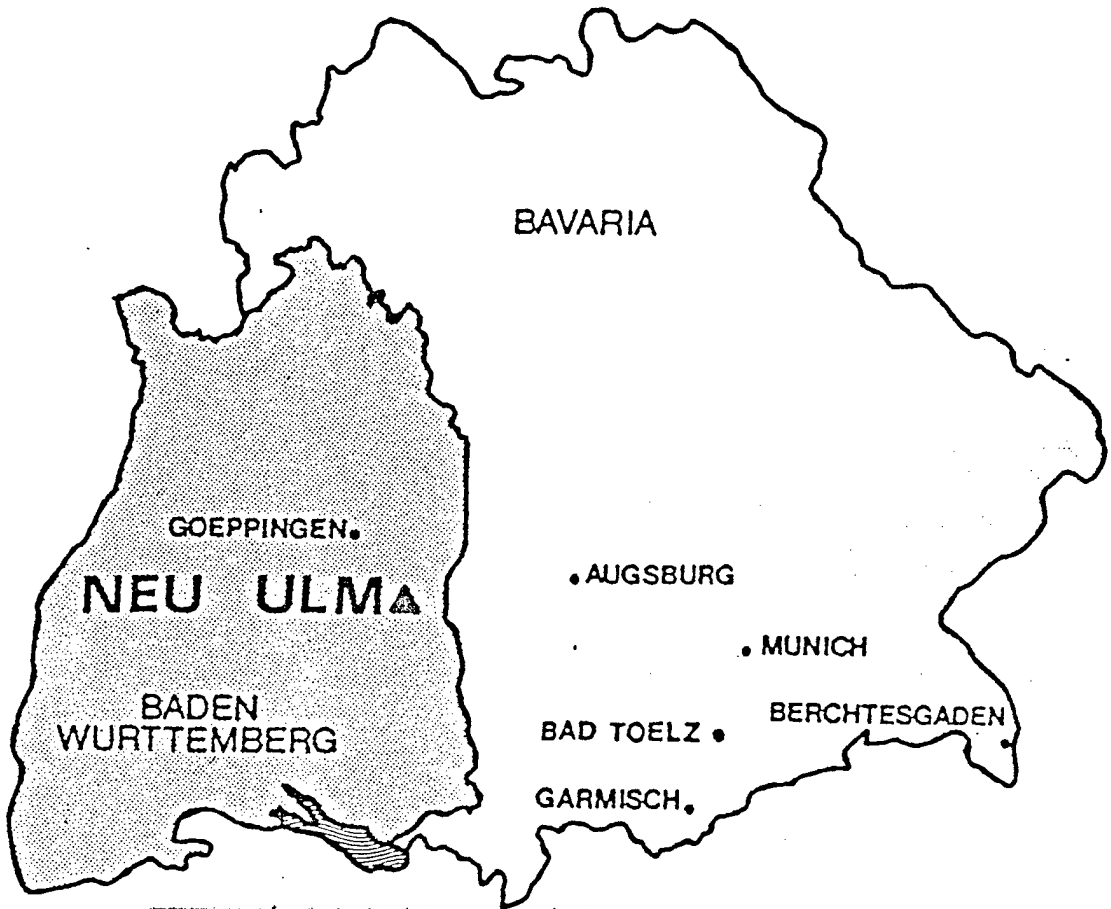


# EEAP

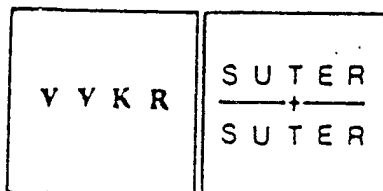
## PHASE III EXECUTIVE SUMMARY



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18 April 1986



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### EXECUTIVE SUMMARY

#### I. PROJECT INTRODUCTION:

This document is the end result of the Energy Engineering Analysis Program (EEAP) at Neu Ulm Military Community in West Germany. This EEAP was authorized by the U.S. Department of the Army, European Division, Corps of Engineers, headquartered in Frankfurt, West Germany, under contract No. DACA-90-83-6-0023. The ultimate goal of this effort is the reduction of energy consumption in compliance with the objectives set forth in the U.S. Army Facilities Energy Plan.

The scope of services for this study defines the project in three phases of work. Phase I involves data collection for all buildings at Neu Ulm. The data collection phase includes utility data, determination and inspection of model buildings, assignment and review of similar buildings, and review of operating procedures. Phase II utilizes and relies heavily upon the information collected in Phase I. In this phase, energy conservation recommendations are developed to estimate related energy savings, as well as implementation costs for specific recommendations. Phase III of this project screened all energy conservation projects and provided programming documents for those projects which the community is requesting funding. By definition, any programmed project has a savings to investment ratio greater than one in compliance with the revised Energy Conservation Investment Program (ECIP) criteria dated June 1985. The end result of the three phases of work is one package, requesting funding for two projects designed to reduce energy consumption at Neu Ulm Military Community. In addition, the first two phases of work compiled details of buildings and possible energy related modifications that can be used for future renovation activities.

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II. PHASE I:

Phase I of the EEAP consists of "data gathering and inspection of the facilities in the field." During this phase, several GY areas were reviewed at this military community. Complete details of the data collection including energy use data, and all building survey data can be found in the Phase I Data Report.

A. Buildings Surveyed:

At Neu Ulm Military Community, the following GY areas were included under the contractual requirement for the EEAP:

GY 696 Wiley Barracks: which consists primarily of troop housing, and support, recreation and community and facilities, and equipment and maintenance shops.

GY 236 Ford Housing: which consists of six family housing buildings, all multi-storied apartment buildings.

GY 419 Nelson Barracks: which consists of troop housing and support, equipment maintenance areas and open storage areas.

GY 221 Vorfeld Family Housing: which consists of family housing, troop housing, school buildings, and commissary.

GY 439 Officers Club: which consist of administrative offices, shops, warehouses, and central storage areas.

GY 602 Neu Ulm Supply Center: which consists of administrative offices, shops, warehouses, and central storage areas.

The other GY areas included in the Neu Ulm Master Planning area that were not a part of this Scope of Work are:

GY 027 Schwaighofen Airfield

GY 624 Bubesheim Training Area

GY 051 Merklingen Ammo Dump

GY 626 Burlafingen Training Area

GY 363 Bollingen Training Area

GY 643 Kleinkoetz Training Area

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GY 364 Guenzburg Training Area	GY 646 Leibi Training Area
GY 365 Maehringen Training Area	GY 657 Strass Training Area
GY 366 Reisenburg Training Area	GY 659 Thalfingen Training Area
GY 551 Ludwigsfeld Training Area	GY 923 Guenzburg Communication Facility
GY 618 Gerlenhofen Training Area	GY A49 Leipzig Gas Station
GY A44 Von Steuben Missile Training Area	GY 962 Tactical Defense Station

These areas were excluded from the Scope of Services by EUD Project Manager due to the nature and type of buildings located in these GY areas.

One building surveyed at the Neu Ulm Military Community were designated "Annex A Buildings." This facility was audited in great detail in order to complete a computerized analysis of current energy use, possible energy conservation opportunities and the performance of the existing heating and ventilating equipment. These Annex A Buildings surveyed at Neu Ulm was as follows:

GY 696 Wiley Barracks:  
Bldg. No. 263 Billets 19,600

All other buildings at Neu Ulm were surveyed in Phase I as "walk-through similar buildings." That is, they were surveyed to discern the major differences between them and an Annex A Building to which they were judged similar. Due to the wide variety of building types at Neu Ulm, not all facilities could be made similar to one of the four Annex A Buildings at Neu Ulm. Since this EEAP contract encompasses six military communities, there was a total of 51 Annex A Buildings, 50 of which were located at other communities. These facilities were judged by EUD to be representative of all facilities on all military communities under contract. As a result, some buildings at Neu Ulm were judged similar to Annex A Buildings at another military community in order to provide computer simulation.

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The list of these buildings at other military communities follows:

<u>COMMUNITY</u>	<u>GY</u>	<u>BLDG</u>	<u>BASIC USE</u>
Augsburg	536	9	Dining Hall
Augsburg	536	51	Barracks
Augsburg	572	125	Maint. Shop
Augsburg	280	220	Maint. Shop
Garmisch	571	119	Gym
Augsburg	572	178	Shop
Augsburg	572	134	School
Bad Toelz	283	13	Rigging Detachment
Munich	402	4	Maint. Shop
Augsburg	572	156	Barracks
Garmisch	536	33	Hotel, Apartments
Augsburg	572	123	Barracks
Augsburg	187	743	Family Housing
Garmish	571	114	Office
Augsburg	862	568	Family Housing
Goepplingen	139	148	Maint. Shop
Garmish	301	830	Hotel
Goepplingen	231	714	Family Housing
Augsburg	863	63	PX, Family Housing
Geopplingen	139	210	Family Housing
Augsburg	187	704	Family Housing

During the computer analysis of the energy consumption of each boiler plant, each Annex A Building was reviewed as if it existed at Neu Ulm, whether it did or not. That is, an Annex A Building from the Augsburg Military Community was analyzed with Neu Ulm weather data in order to make the similar building's analysis more accurate. Complete information on all of these buildings can be found in the Phase I Data Report.

At each building, whether reviewed as an Annex A Building or a walk-through similar building, an ECO checklist for the specific building under consideration was completed. This checklist noted over 110 Energy Conservation Opportunities (ECOs) that were reviewed at the facility.

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Each ECO was noted as "Completed" or "Not Completed" and if not completed, as "Feasible" or "Not Feasible." Based on this checklist, all energy conservation calculations were performed after incorporating the Phase I comments from both EUD and the military community. All ECO's noted as "Not Completed," and "Feasible" were reviewed for implementation. This checklist was also verified against the current ECIP Project List and the Master Planning Documents at Neu Ulm so that there would be no duplication of effort for projects already recommended and slated for implementation.

B. Energy Consumption History:

As reviewed in the Phase I Data Report, the Neu Ulm Military Community has steadily reduced its energy consumption since the peak year of FY 1975. By FY 1983, the total reduction has been 9%, thus approaching the mandate established by the Department of the Army to reduce overall energy consumption by 20% from the FY 1975 levels. The energy consumption trends can be seen in the following chart data provided by the VII Corps Headquarters in Stuttgart, West Germany:

Energy Consumption History (MIL BTU)

FY	Electricity	Heating Fuel	Total Fuels
1975	146,044	437,566	583,610
1976	162,945	422,505	585,450
1977	163,908	421,785	585,693
1978	167,956	453,977	621,933
1979	178,686	433,916	612,602
1980	181,609	395,584	577,193
1981	183,129	390,591	573,720
1982	192,456	411,888	604,344
1983	189,463	341,789	531,252

C. Energy Conservation Efforts since FY 1975:

The reduction in the energy consumption at Neu Ulm has been due to a number of factors. Perhaps the most significant has been the establishment of a Community - wide Energy Conservation Program by the

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Director of Engineering and Housing. This program has included an educational effort to inform every individual and each family on the Neu Ulm Community of the importance of energy conservation. This program ultimately affects every aspect of life at Neu Ulm. In addition, there has been an Energy Conservation Awards Program to recognize those individuals and groups leading the energy conservation efforts.

Since FY 1975, substantial energy conservation actions have been put into effect. These include the following measures.

GY 221 Vorfeld Family Housing: All Basement Windows and entrance doord replaced in all family housing buildings. Boiler consolidation converted 10 family housing buildings to a central heating plant. New insulation and roof repair installed in 23 buildings. New double pane windows installed throughout elementary school. All single pane windows replaced with double pane windows on all family housing buildings. Weather protection overhangs installed on all building entrances. Heating supply and return piping insulation replaced.

GY 236 Ford Family Housing: All basement windows and entrance doors replaced. Damaged heating supply and return piping insulation replaced.

GY 419 Nelson Barracks: Indoor/outdoor temperature control devices added to several buildings, automatic temperature control devices for domestic hot water systems installed in all buildings. Boiler plant #302 repaired and renovated. Boiler plant #314 converted from #6 fuwewl oil to #2 fuel oil.

GY 602 Supply Center: Ceilings lowered and insulated in commissary and Building #131. Motor pool garage doors have been replaced.

GY 439 Officer's Club: Heating system replaced. Insulation added to building.

GY 696 Wiley Barracks: Indoor/outdoor temperature control devices installed in troop billet buildings. Automatic temperature control devices for domestic hot water systems installed in all troop billets. Maintenance shop bay doors replaced in four buildings. Insulation of building construction.

See the Phase I Data Report for the current list of all ECIP projects presently ongoing, in design or under contract.

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### III. PHASE II

Phase II of EEAP consisted of "analysis of data (collected in Phase I), performance of feasibility and economic studies and the identification of proposed projects." More specifically, Phase II consisted of 1) verification of computer simulated buildings' energy consumption versus actual utility bills; 2) identification of proposed projects and calculation of savings, costs, and SIRs; and 3) deletion of projects, as requested by Neu Ulm Military Community and required under ECIP criteria.

#### A. Methodology:

The basis of the analysis phase of this EEAP at Neu Ulm is the computerized analysis of the Annex A Building at this military community and at several other communities which were judged similar to other buildings at Neu Ulm. As noted earlier, the calculated energy consumption of each building at Neu Ulm was based on the computer analysis of these facilities.

The computer program utilized for this analysis is entitled C-PARTS (Component Performance Analysis for Real Thermal Systems). This program was developed and copyrighted by VVKR Incorporated of Alexandria, Virginia and is designed to allow an accurate assessment of each energy sensitive element in an existing building. The program utilizes standard American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) heat transfer methodologies and thermal resistance values for building materials from the National Bureau of Standards (NBS) or ASHRAE. Since the program was specifically designed with the analysis of existing buildings in mind, it is based on an hour by hour analysis of a typical day each month, and provides outputs that can easily be compared with the actual utility consumption data of an existing facility.

In this manner, the C-PARTS analysis can be checked against a known factor, the utility consumption of the facility for accuracy. Any significant deviations between the C-PARTS output and the actual consumption point to a problem in the C-PARTS data input or analysis. As a result, the final C-PARTS outputs have been verified against real data rather than a simple estimate of energy consumption.

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As reviewed earlier, the vast majority of buildings analyzed are walk-through similar buildings. Each of these facilities was made similar to an Annex A building, located either at this community or another. For each walk-through building, a variation checklist was provided to note the differences between that building and the Annex A building to which it was judged similar. For example, two buildings may be similar in respect to the basic construction and use, but one has 25% greater window area and 30% greater floor area than the other. These approximate variations have been noted for each walk-through building in respect to its associated Annex A building. All heat transfer coefficients, U-values, are assumed equal to those for the Annex A Building, unless noted otherwise.

After these analyses have been complete, each of the walk-through similar buildings at this community is analyzed by C-PARTS in relation to its associated Annex A building. The variations noted above are taken into account in the analysis process to derive an accurate estimation of the energy use at each individual walk-through facility.

#### B. Boiler Plant Verification Analyses:

The next procedure in the C-PARTS Analysis at this military community is the verification of the computed energy consumption against the actual energy consumption for the test year. There is no specific energy consumption data for each building. Rather, there is energy consumption data for central boiler plants, which provide heat to a number of buildings, and for electrical substations, which provide power to a number of buildings.

After the energy consumption data has been calculated for all of the Annex A buildings and the walk-through similar buildings, the facilities are all grouped according to the central plants and substations or lowest metered source servicing them. The totals of these facility groupings are then verified against the historical energy consumption data.

There are several factors that can cause deviations between the ASHRAE computed loads of C-PARTS and actual consumption data. The major factors are as follows:

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1. Distribution line losses and steam leaks,
2. Lack of heating system controls that cause building occupants to open windows for comfort and thus increase infiltration losses,
3. Doors that are left open for excessive time periods especially in repair and maintenance facilities,
4. Low boiler efficiencies due to equipment age, poor or non-existent controls, and low maintenance factors.
5. Non-scheduled or irregular use of a facility.

Whenever possible, corrections for these factors were introduced, based on additional data that was collected during the Phase I survey. This data includes the ambient air conditions on the day of the survey, the number of windows and doors found open, comments on leaking pipes, doors found open, poor heating system controls, the measurement of the boiler flue gas readings, building plans and blueprints and photographs of building conditions. With this additional information, and the ability of the C-PARTS program to rapidly re-evaluate the building loads, adjustments were made to account for the infiltration and other losses to verify the computer analysis with the actual energy consumption within reasonable limits.

#### C. Energy Conservation Opportunities:

The Energy Conservation Opportunities (ECOs) studies at this community was based on the Annex B requirements of the Scope of Services dated 20 January 1983. The ECO's noted in Annex B were those required by the Army for analysis. In addition to these, however, several additional ECO's were voluntarily added to the analysis procedure to provide a complete review of all feasible energy savings measures at this community. These additional ECO's also include some requested by various reviewing agencies after Phase I Data Report was submitted. Others requested were judged outside the requirements of this contract.

The ECO's proposed for review and analysis are divided into eight major groupings according to their building system. These groups are as follows:

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ABBREVIATION

- |                         |     |
|-------------------------|-----|
| 1) Building Envelope    | (B) |
| 2) Cooling              | (C) |
| 3) Heating              | (H) |
| 4) Lighting             | (L) |
| 5) Special Equipment    | (S) |
| 6) Temperature Controls | (T) |
| 7) Ventilation          | (V) |
| 8) Domestic Hot Water   | (W) |

Within these groupings, all ECO's under each Increment of study have been reviewed and analyzed. The analysis of each ECO was performed either by the C-PARTS program or by manual calculations, based on data derived from the C-PARTS analysis and Boiler Plant Verification Analysis.

Generally, the Building Envelope ECO's and Temperature Control ECO's were analyzed by re-running the C-PARTS load analysis for a specific building with revised inputs reflecting the ECO. For example, by analyzing the building first as existing, and then with additional roof insulation and comparing the two outputs, the energy savings associated with the roof insulation can be determined. These computer analyses were conducted on a full year's basis to obtain total savings in a year.

The manual calculations were based on data from the C-PARTS analysis of the facility or from the Boiler Plant Verification Analysis. All methods of the calculations were derived from ASHRAE or from several guidebooks provided by the U.S. Department of Energy.

The Master List of all Energy Conservation Opportunities that were reviewed at this community are as follows, though not all of these ECOs were applicable nor calculated.

BUILDING ENVELOPE

- B-1 Insulation added to walls.
- B-2.1 Insulation added to existing roof.
- B-2.2 Insulation added with new roof.

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- B-3 Insulation added to basement ceiling.
- B-4.1 Insulation added to attic floors.
- B-4.2 Insulation added to usable attic.
- B-5.5 Caulk and weatherstrip windows.
- B-7.5 Caulk and weatherstrip doors.
- B-8 Storm windows installed.
- B-9 Storm doors installed.
- B-10 Double pane windows installed.
- B-11 Sun control screens or louvers added to windows.
- B-12 Solar control film added to windows.
- B-13.1 Glass area replaced with Spandrel panel
- B-13.2 Glass area replaced with glass blocks
- B-14 Automatic door closers installed.
- B-15 Doors vestibuled.
- B-16 Thermal barriers installed.
- B-17.1 Double glaze skylights.
- B-17.2 Remove existing skylights.
- B-18 Loading dock doors sealed.
- B-19 Air curtains installed.
- B-20 Thermal/solar control shades installed.

#### COOLING SYSTEMS

- C-1 Economizer systems provide free cooling during winter season.
- C-2 Dual duct or multizone systems converted to single zone systems.
- C-3 Cooling pipe lines and ductwork insulated.
- C-4 Absorption cooling equipment replaced.
- C-5 Cooling equipment is serviced, cleaned and adjusted regularly.

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- C-6 Cooling of unoccupied areas is prevented.
- C-7 Variable air volume systems installed.
- C-8 Filters cleaned and inspected regularly.
- C-9 Temperature of chilled water raised.
- C-10 Solar assisted cooling equipment installed.
- C-11 Reheat coils removed.
- C-12 Heat recovered from refrigerant gas.

#### HEATING SYSTEMS

- H-1 Combustion air to boiler preheated.
- H-2 Fuel oil to boiler preheated.
- H-3 Steam condensate returned to boilers.
- H-4 Flue gas dampers installed.
- H-5 Automatic ignition pilot lights installed.
- H-6 Flue gas analysis and adjustment performed regularly.
- H-7 Combustion is monitored and adjusted regularly.
- H-8 Heating equipment converted from natural gas to oil or coal.
- H-9 Steam, condensate and hot water piping insulated.
- H-9.5 Insulate valves and fittings.
- H-10 Unnecessary humidification removed.
- H-11 Oxygen trim controls installed on boilers.
- H-12 Heat recovery systems installed.
- H-13 Solar energy heating system installed.
- H-14 Reheat coils removed.
- H-15 Temperature of hot water used for heating lowered.
- H-16 Connected to district heating.

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- H-17 Turbulators installed in fire tube boilers.
- H-18 Supply and return piping installed.
- H-19 Spot heating installed.
- H-20 Fluidized Bed Combustion System
- H-21 Boiler Maintenance

#### LIGHTING SYSTEMS

- L-1 Lighting fixtures removed.
- L-2 Lamps and/or ballasts removed from fixtures.
- L-3 Task lighting installed.
- L-4 Lower wattage lamps installed.
- L-5 Lamps and fixtures cleaned regularly.
- L-6 Exterior lighting is reduced to minimum.
- L-7 Lighting is off in unoccupied areas.
- L-8 Photocell controls installed.
- L-9 Automatic time clock controls installed.
- L-10 Fixtures relamped on schedule.
- L-11 Natural daylighting is utilized.
- L-12 Incandescent fixtures replaced with fluorescent fixtures.
- L-13 Exterior lighting replaced with low or high pressure sodium fixtures.
- L-14 Mercury vapor fixtures replaced with high pressure sodium.
- L-15 High efficiency ballasts installed.
- L-16 Power reducers installed.

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SPECIAL EQUIPMENT SYSTEMS

- S-1 Time delay switches installed on elevator motors.
- S-2 Motors and motor driven equipment are maintained and adjusted regularly.
- S-3 Time clocks installed to turn off vending machines and drinking fountains overnight and during weekends.
- S-4 Kitchen equipment and laundry equipment maintained and cleaned regularly.
- S-5 Co-generation equipment installed.
- S-6 Laundry waste air/water heat recovered.
- S-7 Kitchen waste air/water heat recovered.
- S-8 Individual metering of family housing installed.
- S-9 Peak demand load controlled.
- S-10 Electrical Load Replacement

TEMPERATURE CONTROL

- T-1 Heating and cooling reduced to unoccupied areas.
- T-2 Time clocks added to heating and cooling systems.
- T-3 Tamperproof thermostats installed.
- T-4 Thermostats set at 78° for cooling, 65° for heating.
- T-5 Thermostats relocated from outside walls and from areas subject to drafts or direct sunlight.
- T-6 Economizer controls added to heating and cooling system.
- T-7 Temperature control system adjusted and recalibrated seasonally.
- T-8 Automatic energy management systems installed.

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- T-9 Zone control implemented.
- T-10 Thermostatic radiator control valves installed.
- T-11 Night setback controls installed.
- T-12 Outside air reset installed.
- T-13 Duty cycling controls installed.
- T-14 Heating monitoring devices installed.

#### VENTILATION SYSTEMS

- V-1 Outside air reduced to minimum levels.
- V-2 Exhaust systems balanced with the outside air intake systems.
- V-3 Time clocks installed to shut down exhaust systems overnight and during weekends.
- V-4 Outside air dampers sealed and adjusted to operate properly.
- V-5 Exhaust hoods are equipped with make-up air systems.
- V-6 Toilet exhaust fans wired to operate only when lights are turned on.
- V-7 Heat recovery systems installed between exhaust air and outside air.
- V-8 Maintenance Shop Exhaust system installed.

#### DOMESTIC HOT WATER SYSTEMS

- W-1 Temperature of domestic hot water reduced.
- W-2 Hot water piping insulated.
- W-3 Storage tanks insulated.
- W-4.1 Eliminate hot water use.

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- W-4.2 Time clocks installed to shut off water heaters overnight and during weekends.
- W-5 Flow restrictors installed in faucets and shower heads.
- W-6 Time clocks installed to shut off circulating water pumps overnight and during weekends.
- W-7 System equipment is serviced, cleaned and adjusted regularly.
- W-8 Solar hot water system installed.
- W-9 Systems decentralized.
- W-10 Hot water production supplemented by heat pump.

D. Projects Requested for Funding:

Of the complete list of ECOs reviewed, 66 were analyzed in detail, with calculations estimating energy savings and implementation costs. Of the 66 ECOs analyzed, 2 are being requested for funding. The remaining 64 ECOs are being dropped due to insufficient SIRs or at the request of Neu Ulm Milcom. A letter dated 7 January 1986 from Neu Ulm Milcom to VVCR outlined those projects for which funding was to be requested. Of those projects, deletions were made based on ECIP criteria. ECIP criteria states that the ESIR and SIR must be greater than one for a project to be eligible for funding. The following is a complete list of projects and associated buildings, where funding is being requested.

<u>Project</u>	<u>Associated Buildings</u>
B-1.0 Double Glazing	GY 419 - Bldgs. 300-304, 307, 309, 310, 317
	GY 602 - Bldgs. 131, 132
	GY 696 - Bldgs. 202-205, 210, 211, 213, 231, 235-238, 240-242, 246, 252-254, 256-259, 261-263, 265, 266
B-19.1 Air Destratification	GY 602 - Bldgs 132
	GY 696 - Bldgs. 206, 212

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IV. PHASE III

Phase III of this study consists of preparing required programming documents, making any required detail changes to the Energy Report, and preparing the Executive Summary. The projects being requested for funding are included in one separate package. A DD 1391 form complete with all backup material was developed for this package.

The package is entitled Building Renovations and addresses two projects. The first project recommended is entitled B-10.0 Double Glazing and provides for replacing all single pane windows in 39 buildings with double pane windows. The second recommended project is entitled B-19.1 Air Destratification and provides for installing industrial ceiling fans in 3 buildings. The following list shows what projects are recommended for which buildings and also shows the results of the life cycle analysis.

TABLE I : BUILDING RENOVATIONS PACKAGE

ECO#	BUILDING #	DISCOUNTED SAVINGS	INVESTMENT COST	SIR	ESIR
B-10.0	7-419-300	61231.	3384.	18.090	18.090
B-10.0	7-419-301	57918.	3213.	18.030	18.030
B-10.0	7-419-302	51079.	2820.	18.120	18.120
B-10.0	7-419-303	101838.	17689.	5.760	5.760
B-10.0	7-419-304	22761.	1264.	18.000	18.000
B-10.0	7-419-307	8151.	1025.	7.950	7.950
B-10.0	7-419-309	3028.	393.	7.700	7.700
B-10.0	7-419-310	3493.	428.	8.170	8.170
B-10.0	7-419-317	1863.	598.	3.110	3.110
B-10.0	7-602-131	53090.	43820.	1.210	1.210
B-10.0	7-602-132	45647.	37651.	1.210	1.210
B-10.0	7-696-202	39850.	2597.	15.340	15.340
B-10.0	7-696-203	39850.	2597.	15.340	15.340
B-10.0	7-696-204	39850.	2597.	15.340	15.340

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ECO#	BUILDING #	DISCOUNTED SAVINGS	INVESTMENT COST	SIR	ESIR
B-10.0	7-696-205	39850.	2597.	15.340	15.340
B-10.0	7-696-210	5398.	1470.	3.670	3.670
B-10.0	7-696-211	1458.	341.	4.270	4.270
B-10.0	7-696-213	9338.	2154.	4.340	4.340
B-10.0	7-696-231	659.	222.	2.960	2.960
B-10.0	7-696-235	60401.	23482.	2.570	2.570
B-10.0	7-696-236	24044.	12323.	1.950	1.950
B-10.0	7-696-237	70314.	36078.	1.950	1.950
B-10.0	7-696-238	9683.	3231.	3.000	3.000
B-10.0	7-696-240	14952.	1435.	10.420	10.420
B-10.0	7-696-241	4808.	2717.	1.770	1.770
B-10.0	7-696-242	14952.	1435.	10.420	10.420
B-10.0	7-696-246	17323.	9828.	1.760	1.760
B-10.0	7-696-252	14952.	1435.	10.420	10.420
B-10.0	7-696-253	14952.	1435.	10.420	10.420
B-10.0	7-696-254	14952.	1435.	10.420	10.420
B-10.0	7-696-256	14952.	1435.	10.420	10.420
B-10.0	7-696-257	4808.	2717.	1.770	1.770
B-10.0	7-696-258	14952.	1435.	10.420	10.420
B-10.0	7-696-259	17323.	9828.	1.760	1.760
B-10.0	7-696-261	14952.	1435.	10.420	10.420
B-10.0	7-696-262	14952.	1435.	10.420	10.420
B-10.0	7-696-263	14952.	1435.	10.420	10.420
B-10.0	7-696-265	23296.	11930.	1.950	1.950
B-10.0	7-696-266	26395.	13536.	1.950	1.950
B-19.1	7-602-132	58164.	3793.	15.330	15.330
B-19.1	7-696-206	53633.	2529.	21.210	21.210
B-19.1	7-696-212	6433.	421.	15.260	15.260
TOTAL		1112497.	273623.	4.066	4.066

DEFINITION OF ECO # CODES

B-10.0 DOUBLE GLAZING  
 B-19.1 AIR DESTRATIFICATION

Date: April 18, 1986  
Program: MCA, ECIP  
Project Year: FY 1989

Location: Neu Ulm Milcom  
Project Title: Building Renovations  
Project Number:

V. CONCLUSIONS:

It is recommended that the package previously outlined be implemented. Each task included in this package will improve the buildings' energy consumption efficiencies in a cost effective manner, which is in compliance with the Army's "Energy Conservation Investment Program." Implementation of this package will allow Neu Ulm Military Community to meet their energy conservation goals. It is projected that implementation of this project will reduce energy use by 2.8% when compared to the 1983 reported energy consumption.

The following table outlines the savings and costs attributable to this package:

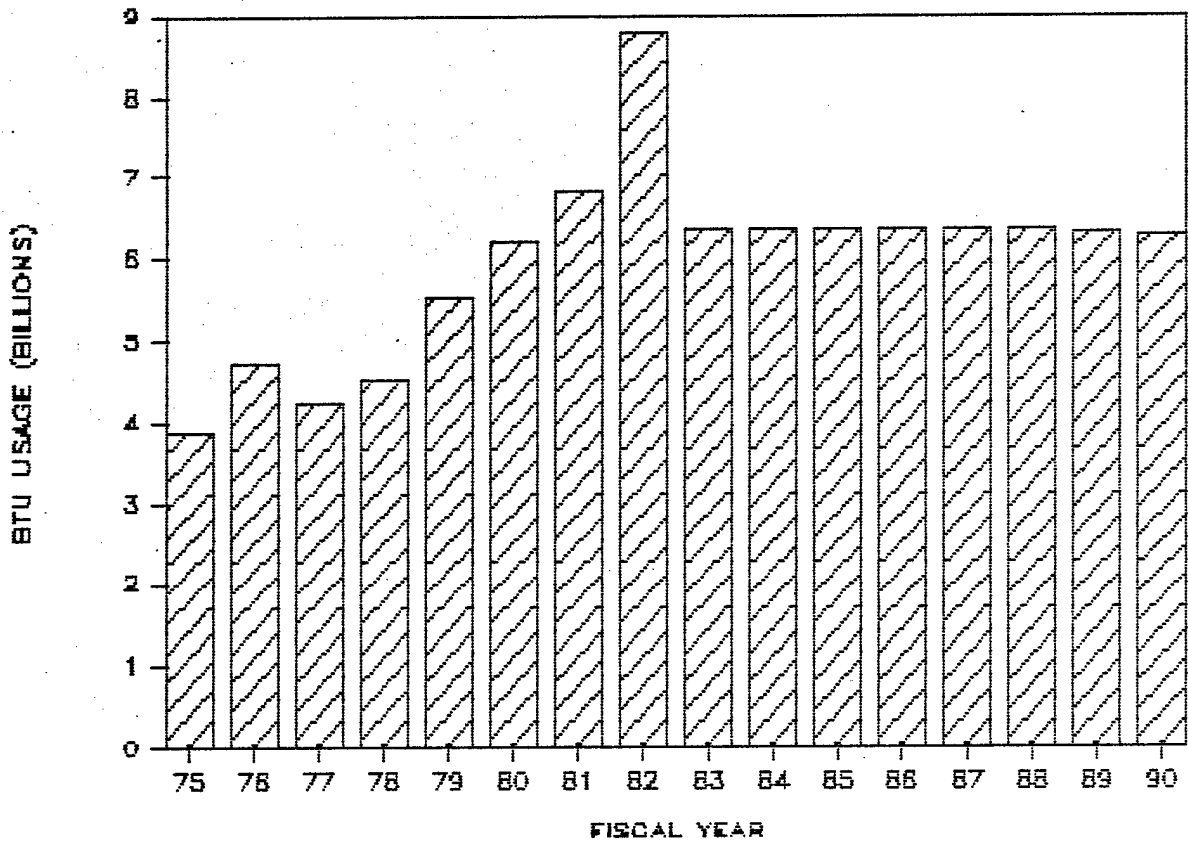
SUMMARY TABLE

	Annual Savings \$	Discounted Savings \$	Total Cost \$	SIR
Package #1	71,503	1,112,497	273,623	4.066

The following graphs predict the energy consumption and costs if the package is funded. For the first six graphs, showing projected energy consumption for Neu Ulm, it can be seen that actual fuel consumption was used for fiscal years 1975 through 1983. However, for years 1983-1988 straight line projections are shown utilizing 1983 data. 1983 data was used because this is the last year for which detailed utility data was collected in our Phase I Data Report. The energy savings fiscal years 1989 and 1990 as would be anticipated if construction begins in 1989. Actual fuel costs are used for years 1983-1985. However, fuel cost projections for years 1986-1990 were difficult to affix. For example, the fuel costs for electricity went down from 1983 to 1984 and then again for 1984 to 1985. It is our opinion that this trend could not continue. Therefore, we used the 1985 costs to project the energy costs through 1990. The same situation occurred with coal prices. However, 1986-1990 the 1985 coal price/ton was used while inflating the shipping costs 5%/year. The #2 oil costs went down from 1983 to 1984 and increased from 1984 to 1985. Therefore, the costs used for years the bar graphs that savings in energy use and, therefore, energy costs can be realized from the implementation of the projects recommended by this study.

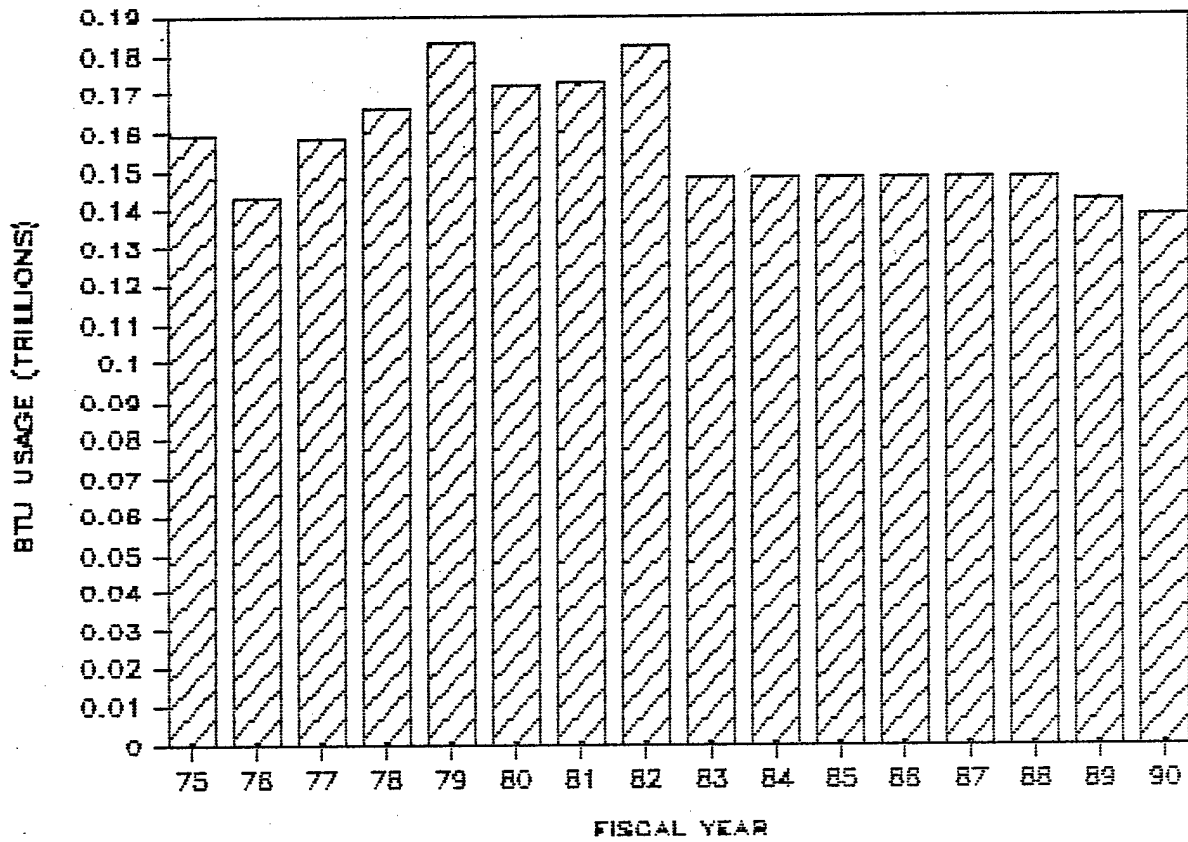
# PROJECTED NATURAL GAS USE

NEU ULM MILCOM



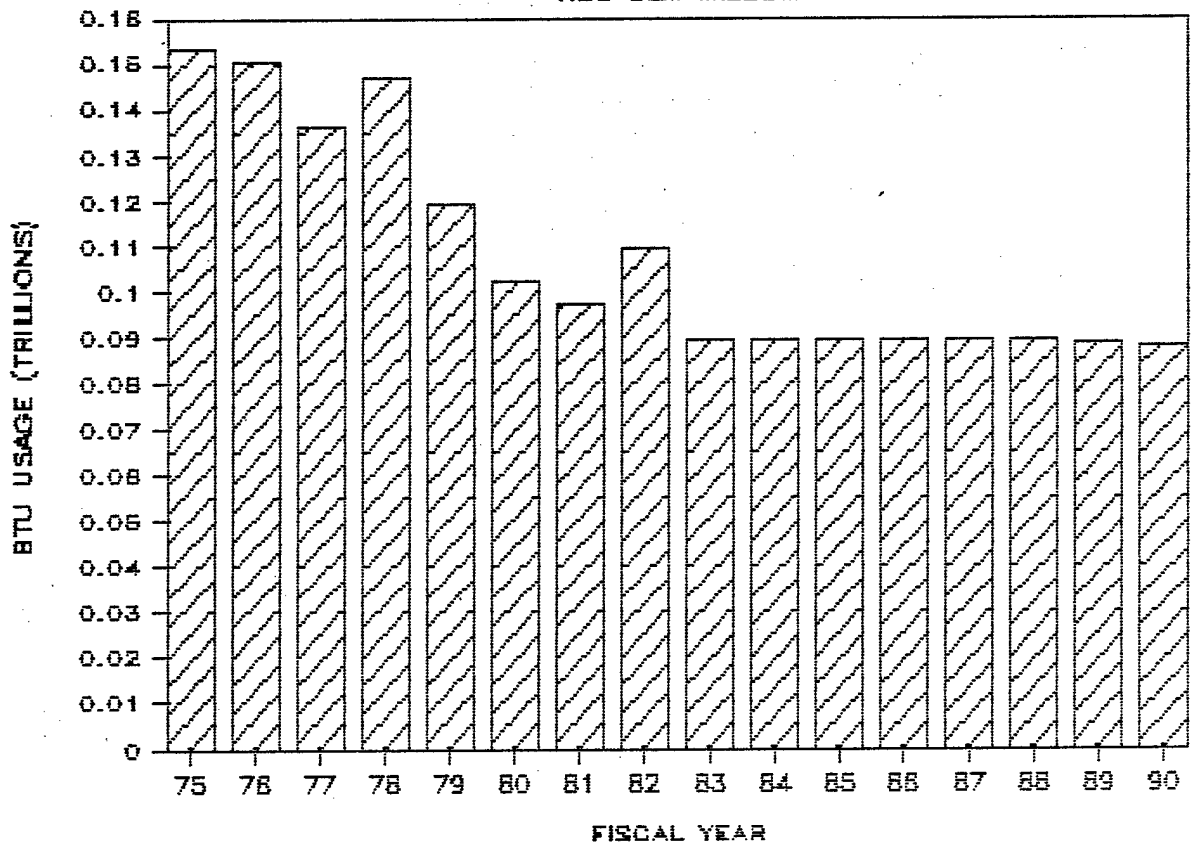
# PROJECTED BITUMINOUS COAL USE

NEU ULM MILCOM



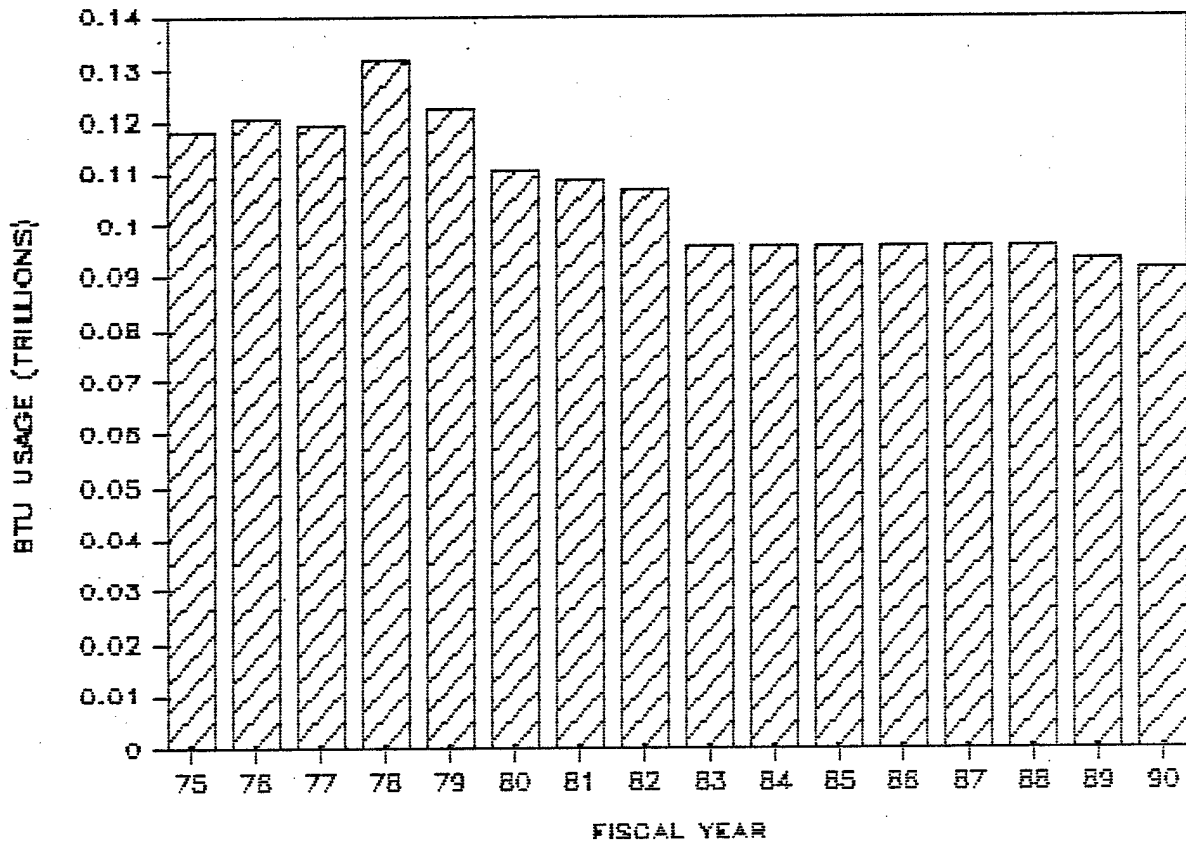
# PROJECTED ANTHRACITE COAL USE

NEU ULM MILCOM



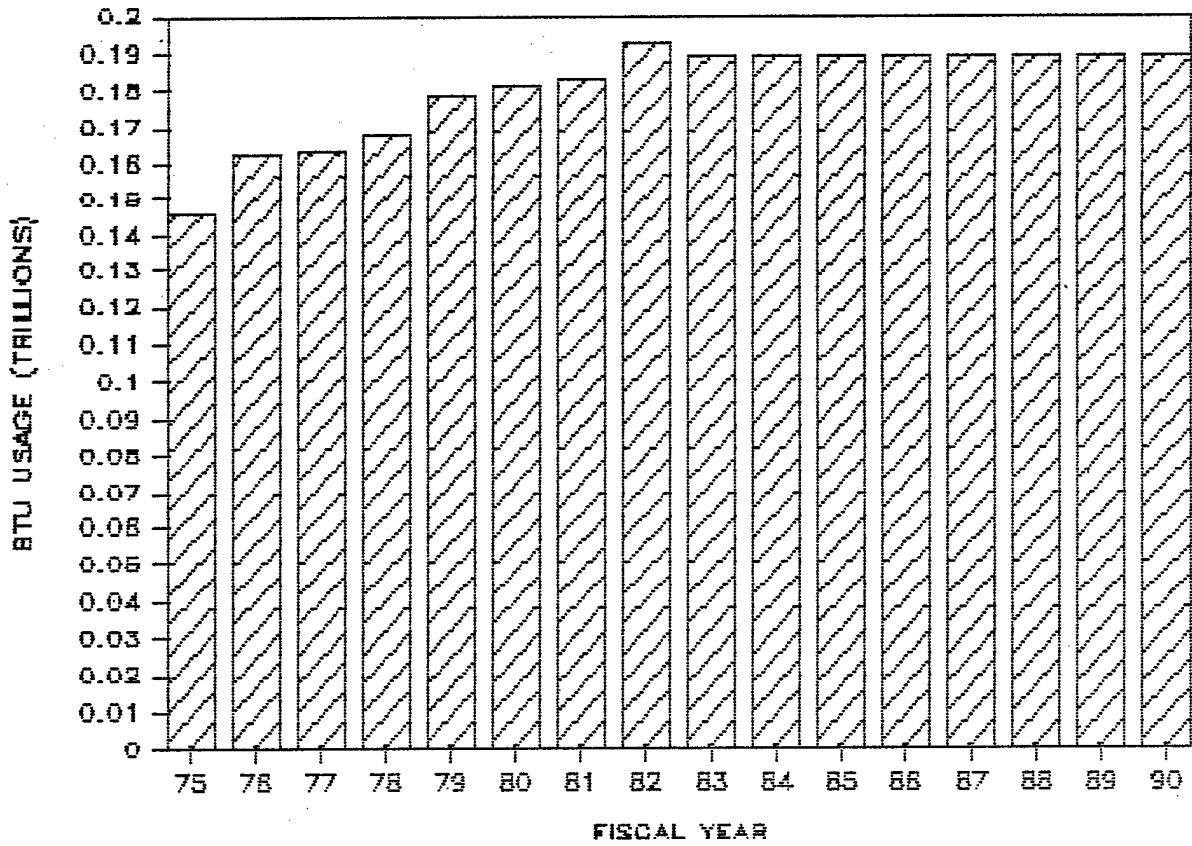
# PROJECTED FUEL OIL USE

NEU ULM MILCOM



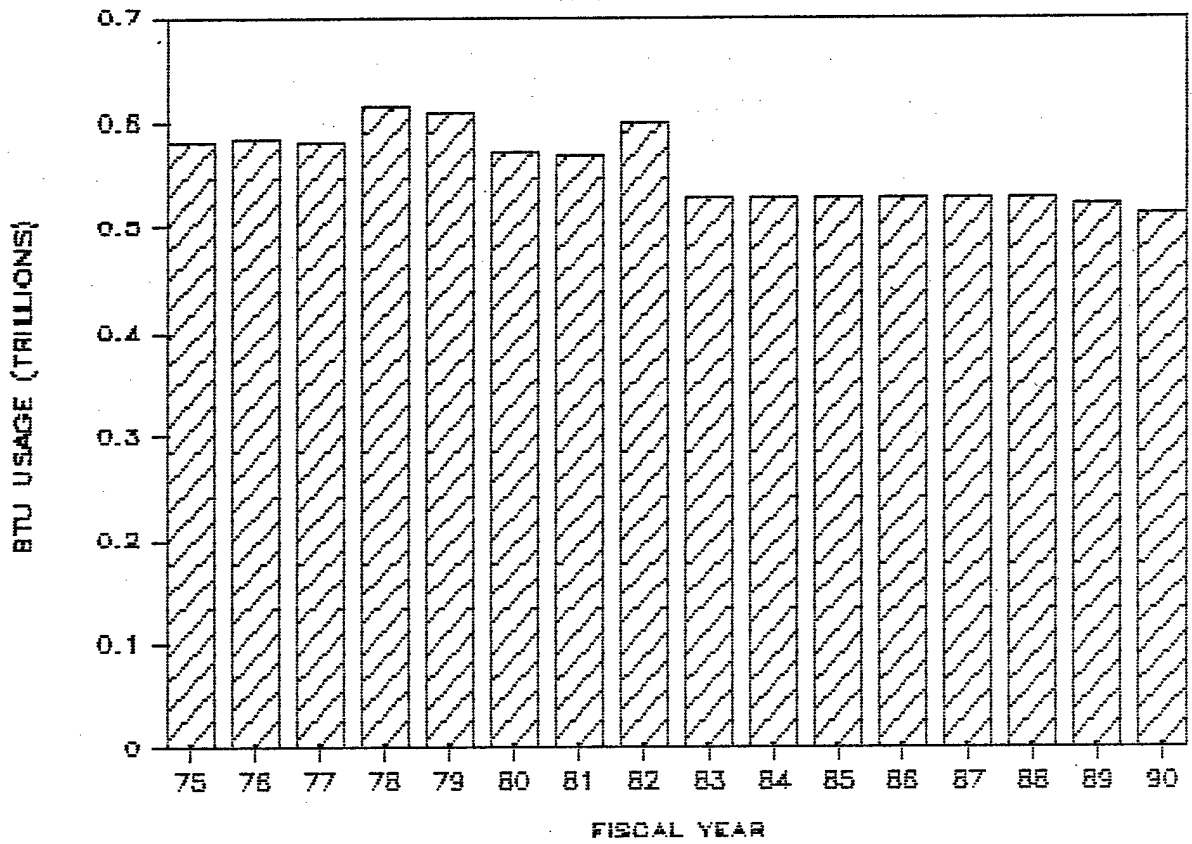
# PROJECTED ELECTRIC USE

NEU ULM MILCOM



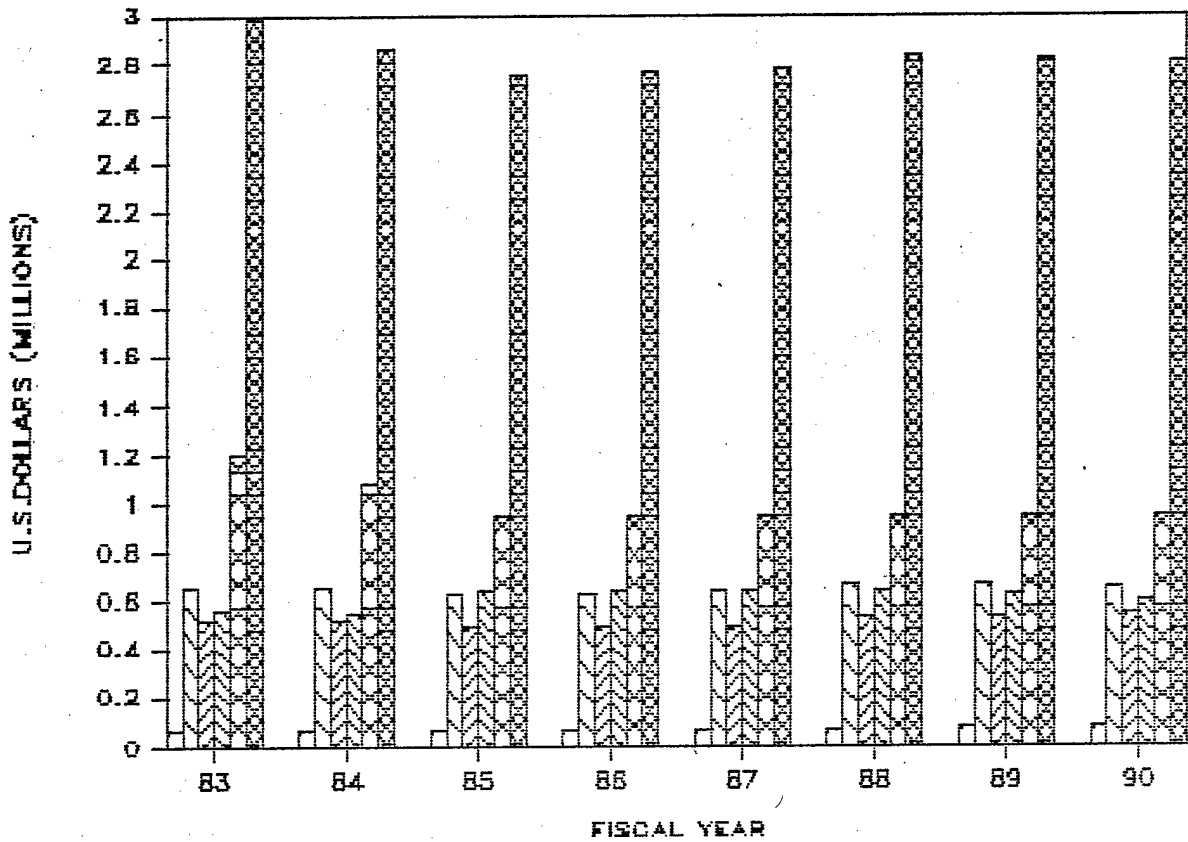
# PROJECTED TOTAL ENERGY USE







NEU ULM MILCOM



# PROJECTED TOTAL ENERGY COSTS

NEU ULM MILCOM



-  NATURAL GAS
-  BITUMINOUS COAL
-  ANTHRACITE COAL
-  FUEL OIL
-  ELECTICITY
-  TOTAL ALL FUELS

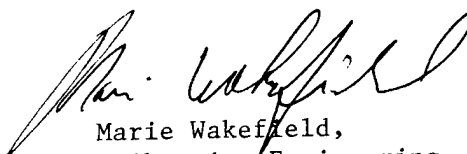


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