US Army Corps
of Engineers

Europe Division

ENERGY ENGINEERING ANALYSIS PROGRAM

Wuerzburg Military Community

Executive Summary

Final Report

STANLEY CONSULTANTS

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.
Distribution A. Approved for public release.

Marie Wakefield,
Librarian Engineering

STANLEY CONSULTANTS, INC.

June 13, 1984

U. S. Army Engineer Division, Europe
Leubeckerstrasse 31, Annex B
6000 Frankfurt/Main
Germany

Attention: EUDED-MS

Gentlemen:

Re: Contract DACA 90-81--C-0094
Energy Engineering Analysis Program (EEAP)
Aschaffenburg, Schweinfurt, and Wuerzburg
Military Communities, Germany
Final Submittal

We are pleased to present the final submittal of increments A, B, E, F, and G of the subject EEAP. The report includes our analysis of the energy conservation opportunities (ECO's) and their development into projects. For each project, a life cycle cost analysis in accordance with the current SIR criteria has been developed for each individual ECO. The life cycle cost analyses include all changes requested by the communities at the recent presentations of the draft reports.

Sincerely,

STANLEY CONSULTANTS, INC.

Vernon L. McAllister, P.E.
Project Manager

VLM:lb:8472

1.0 EXECUTIVE SUMMARY

1.1 SCOPE OF SERVICES

This final report is submitted in accordance with the Schedule of Title I Services for Contract DACA 90-81-C-0094 Energy Engineering Analysis Program FY 81 OMA, EEAP 007, Aschaffenburg, Wuerzburg, and Schweinfurt Military Communities, and as amended by Addenda Nos. 1, 2, and 3 to Appendix A and the Resume of Negotiations.

1.2 PURPOSE

The purpose of the Energy Engineering Analysis Program (EEAP) is to develop a comprehensive plan for the use of energy and to identify energy conservation projects at each of the military communities.

1.3 PREVIOUS STUDIES

The architect-engineer firm of Daniel, Mann, Johnson, and Mendenhall (DMJM) had previously studied the consolidation of heating plants and several other energy conservation opportunities (ECOs) at these communities. Their findings are developed in their final report dated June 7, 1982. Subsequent to this work, Stanley Consultants (SCI) was given the task of developing ECOs in kasernes not included in the DMJM Scope of Services.

The SCI study began with the field data collection effort of November and December 1981. The results were included in the Preliminary Report dated January 14, 1982. From this data ECOs were identified and analyzed for economic feasiblity in the Interim Report, dated October 1, 1982. After a presentation of the report at the community, the packaging of projects was developed for the Prefinal Report dated March 17, 1983. Comments on this submittal were received and incorporated into the Final Report dated August 10, 1983. The Final Report also included programming documents.

The contract for this work has now been modified to develop the DMJM and SCI ECOs for all of the kasernes and to provide a heating plant consolidation study for the main area of the Aschaffenburg Military Community and Conn Barracks in the Schweinfurt Military Community. These studies complement the heating plant consolidation

studies developed by DMJM and already programmed. The first submittal of the work included in this contract modification was the Field Data Report, dated April 10, 1984. ECOs identified in the data collection were developed as detailed in the Draft Report, dated April 30, 1984. During the presentation of the Draft Report in May, 1984, the packaging of ECOs into projects was developed. This arrangement of projects is included in the Final Report.

1.4 FIELD DATA COLLECTION

During November and December 1983, a field data collection was made at the three communities. At Wuerzburg, Stanley Consultants was required to provide walk-through audits of 173 buildings. Time and staff allowed that 140 of the more comprehensive total audits and 271 of the walk-through audits were possible. All energy-consuming buildings in this community were surveyed.

1.5 DEVELOPMENT OF PROJECTS

All ECOs were evaluated for this community in accordance with the Energy Conservation Investment Program (ECIP) criteria. The current criteria has the following significant requirements:

- Construction cost must be greater than $200,000.
- Discounted Savings-to-Investment Ratio (SIR) must be greater than 1.0.
- Economic life of the improvement must not be evaluated for more than 15 years.
- Seventy-five percent of the project savings must be from energy (Btu) savings.

A separate Programming Document (Form DD 1391) and ECIP analysis was developed for each viable Project for this community. These items are bound separately in the Programming Documents volume. By referring to the appropriate section of the final report volume a detailed description and analysis, including building listing for each ECO, can be obtained.

During the presentation of the draft report at the community in May 1984, the packaging of these projects was reviewed with the community. The 1391s have been developed for projects meeting ECIP

criteria. For those ECOs not meeting the ECIP criteria, a 1391 first page and ECIP analysis are provided to the community for development with alternate funding opportunities.

1.6 ENERGY CONSERVATION OPPORTUNITIES

Increments A, B, E, and G

1.6.1 Introduction - The results of the analysis and the development into projects is summarized for each of the following ECOs.

1.6.2 Zone Multi-Use Facilities - This ECO would provide internal zoning of the heating systems in buildings. It has been included in the project to provide heating controls and low-pressure sodium lighting.

1.6.3 Reschedule Utilization - This ECO would reschedule the operation of buildings to provide energy savings. There were no facilities at Wuerzburg that would readily allow a change in the schedule of operations.

1.6.4 Consolidate Services to New Building - This ECO would consolidate service functions that are presently provided in a number of small, energy intensive buildings into new, larger multiple use facilities of energy efficient design. The projects that are developed include motor repair shops, AAFES cafeterias, and administration buildings with a total project cost of $29,241,900. However, since the SIR is only 0.0, the projects fall into the Increment G category.

1.6.5 Exhaust Air Heat Recovery - This ECO would install exhaust air heat recovery units. The project would have a cost of $399,200. Since the SIR is 0.6, it falls into Increment G.

1.6.6 Destratify Air - This ECO would install ceiling fans to recover warm air at the ceiling and re-direct it to the floor. It has been included in the project to provide heating controls and low-pressure sodium lighting.

1.6.7 Refrigerant Gas Heat Recovery - This ECO would recover heat from the refrigeration compressor units. No projects were developed from this ECO.

1.6.8 Heat Pump for Domestic Hot Water - This ECO would use a heat pump to heat domestic hot water. The heat pumps would be

located in the boiler rooms of buildings. No feasible project was developed.

1.6.9 Decentralize Domestic Hot Water - In many facilities, a large domestic hot water system has been provided to serve a small number of hot water loads. This ECO would install local instantaneous hot water heaters at the point of usage. This ECO was found to have a negative energy savings.

1.6.10 Insulate Domestic Hot Water Storage Tanks - This ECO would add insulating jackets to domestic hot water storage tanks. In many cases, the jackets have already been installed. Since this is relatively inexpensive, the installation of jackets should be a maintenance and repair item.

1.6.11 Install Shower Flow Restrictors - This ECO would provide restricted flow shower heads for all showers. This ECO has been included in the OMA shower flow restrictor project with an SIR of 12.0 and a project cost of $42,100, and the MFH shower flow restrictor project which has an SIR of 12.3 and a project cost of $91,300.

1.6.12 Relamp with More Efficient Lamps - This ECO would replace standard 40-watt fluorescent lamps with 35-watt energy saving fluorescent lamps and replace 40-, 60-, and 75-watt incandescent lamps with 9-, 18-, and 25-watt folded tube fluorescent lamps. This replacement should be done on a self-help basis when the present lamps fail.

1.6.13 Control Light Levels Automatically - This ECO would automatically control the light level in interior spaces. No opportunities were found that were significantly more efficient than the manual switching already being used.

1.6.14 Utilize Photocontrols on Exterior Lighting - This ECO would install photocontrols on all exterior lights not already controlled. The installation of photocontrols is justified where the probability that the lights being left on in the daytime is at least 60 percent or where the circuit load is at least 500 watts.

1.6.15 Use Spot Heating Instead of Unit Heaters - This ECO would replace unit heaters with infrared heaters positioned over the work

stations. No applications were found where this ECO would work well at Wuerzburg.

1.6.16 Thermostatic Radiator Valves - This ECO would replace manual radiator valves with thermostatic radiator valves. This ECO is included in the OMA project to provide heating controls and low-pressure sodium lighting. It has an SIR of 23.6. It has also been included in the MFH project to provide thermostatic control valves where it has an SIR of 39.1.

1.6.17 New Air Handling Unit Controls - This ECO is most applicable to controlling air conditioning systems. Controls for hot air systems are included in the night setback ECO.

1.6.18 Night Setback - This ECO would install night setback controls to limit the operation of heating systems in the nighttime hours. This ECO has been included in the OMA project to provide heating controls and low-pressure sodium lighting with an SIR of 9.2.

1.6.19 Weather Stripping - This ECO would install weather stripping on existing doors and windows. This ECO is included in the OMA building infiltration modifications package with an SIR of 2.8, and in the MFH project to provide weather stripping with an SIR of 2.4.

1.6.20 Replace Windows - This ECO would replace the existing, leaky, single-pane windows with tight double-pane windows. The community elected not to pursue a project for this ECO.

1.6.21 Translucent Panels to Replace Highbay Windows - This ECO would replace highbay single-glazed window systems with an energy efficient translucent panel system. It has been included in the OMA building infiltration modifications package with an SIR of 2.2.

1.6.22 Modify Skylights - This ECO would replace inefficient skylights with new skylights constructed of double-pane windows and low heat loss frames. It was found that all skylights were relatively new and already of low heat loss design.

1.6.23 Block Windows - This ECO would replace unnecessary windows with insulated block walls. No significant project could be developed for this ECO. The ECO for translucent insulating panels is

related to this ECO. It has the advantage of allowing light to pass through the window.

1.6.24 Replace Doors - This ECO would replace equipment shop personnel doors and equipment doors with well insulated doors. It has been included in the OMA project to replace doors and has an SIR of 0.3 and a project cost of $408,100.

1.6.25 Install Vestibules - This ECO would install vestibules on entrance doors to buildings in order to establish an air lock at the building entrance. A typical vestibule would cost $670. The SIR for this ECO is 0.5 dropping it into Increment F.

1.6.26 Install Air Curtains - This ECO would install air curtains to reduce excessive heat loss from shop doors. This ECO has an SIR of 0.4. No project has been developed for this ECO.

1.6.27 Install Loading Dock Seals - This ECO would install loading dock seals at truck loading docks. It is included in the project for building infiltration modifications and has an SIR of 10.3

1.6.28 Outside Air Reset - This ECO would install outside air reset controls on steam and hot water building heating systems. The controls change the temperature. Since the energy savings are negligible, this project falls into ECIP Increment G. No project has been developed for this ECO.

1.6.29 Attic and Roof Insulation - This ECO would provide additional insulation in roofs and ceilings. Five projects with SIRs of from 0.7 to 1.5 were developed for this ECO. These projects break this ECO into packages for specific GYs.

1.6.30 Exhaust Fan Control - This ECO would interlock the shower room exhaust fan with the light switch in the barracks shower rooms. This work can easily be done by DEH personnel as an Increment F ECO.

1.6.31 Replace Building Heating System - This ECO would replace existing steam heating systems in buildings with hot water systems and new controls. Eight projects to replace building heating systems were developed for this ECO. The project SIRs range from 0.4 to 2.0. These projects break the ECO into packages for specific GYs.

1.6.32 Energy Monitoring and Control Systems (EMCS) - This ECO would provide an automatic control system that controls operation of hot water temperature reset and sheds clothes dryer electric loads.

A project to provide an EMCS for hot water reset had an SIR of 0.1 dropping it into ECIP Increment G. The project cost was $324,900.

A project to provide electric clothes dryer load shedding had an SIR of 0.0, dropping it into ECIP Increment G. The project had a cost of $1,823,700.

1.6.33 Low-Pressure Sodium Roadway and Area Lighting - This ECO would replace existing mercury vapor exterior lighting used for roadways and area illumination with low-pressure sodium fixtures. This is included in the project to provide heating controls and low-pressure sodium lighting with an SIR of 1.7.

1.6.34 Individual Electrical Metering of Military Family Housing - This ECO would replace master metering of Military Family Housing units with individual metering of each unit. With an SIR of 6.0, this project qualifies for ECIP Increment B funding. It has a cost of $454,200.

1.6.35 Process Changes to the Wuerzburg Laundry - This ECO would install heat recovery equipment to reclaim laundry discharge water heat and dryer flue heat.

A combined project of the discharge water recovery and the heat recovery wheel has a cost of $519,700 and a SIR of 3.7 qualifying it for Increment A funding.

1.6.36 Use of Purchased Steam at Wuerzburg - A project is currently under construction to use steam from the new city-owned refuse plant in the Faulenberg Kaserne.

1.7 LISTING OF PROJECTS

Each of the ECIP Increments A, B, and G projects has been listed in order of its SIR. Increment A and B projects are eligible for ECIP funding. Increment G projects are those which, because of an SIR less than 1.0, do not meet the Increments A or B criteria.

Increments A and B Projects

Description	Increment	SIR	Project Cost ($1,000)
Thermostatic Valves - MFH	A	39.1	26.0
Shower Flow Restrictors	A	12.3	91.3
Heating Controls and LPS Lighting	A	9.6	1,360.9
Individual Electric Meters for MFH Units	B	6.0	454.2
Laundry Heat Reclaim	A	3.7	519.7
Building Infiltration Modifications	A	2.8	370.9
Weatherstripping - MFH	A	2.4	72.6
Replace Building Heating Systems - Larson	A	2.0	2,667.9
Replace Building Heating Systems - Leighton	A	1.6	1,996.3
Replace Building Heating Systems - Faulenberg	A	1.6	1,586.6
Roof and Attic Insulation	A	1.5	2,615.8
Replace Building Heating Systems - Giebelstadt	A	1.4	1,760.3
Roof and Attic Insulation - Marshall Heights, Larson, and Harvey	A	1.4	1,490.4
Replace Building Heating Systems - Emery and Hindenburg	A	1.3	1,808.8
Replace Building Heating Systesm - Marshall Heights and Harvey	A	1.2	2,505.4
Replace Building Heating Systems - Peden	A	1.1	1,906.3
Roof and Attic Insulation - Leighton	A	1.0	661.2

Increment G Projects

Description	Increment	SIR	Project Cost ($1,000)
Shower Flow Restrictors	G	12.2	133.4
Shower Flow Restrictors - OMA	G	12.0	42.1
Roof and Attic Insulation - Marshall Heights	G	0.9	182.1
Roof and Attic Insulation - OMA	G	0.7	226.0
Exhaust Air Heat Recovery	G	0.6	399.2

Increment G Projects (Continued)

Description	Increment	SIR	Project Cost ($1,000)
Replace Building Heating Systems - Peden and Harvey MFH	G	0.4	1,404.6
Replace Doors	G	0.3	408.1
Energy Monitoring and Control Systems (EMCS) - Hot Water Reset	G	0.1	324.9
Energy Monitoring and Control Systems (EMCS) - Load Shedding	G	0.0	1,823.7
Consolidate Services to New Buildings	G	0.0	29,241.9

1.8 INCREMENT F ECOS

1.8.1 Description - Increment F has ECOs that are implemented by minor projects or operational changes suitable for development by the DEH. These are contained in Section 7.0 of the report.

1.8.2 Fan Louvers (7.2) - During the field data collection, it was found that many wall-mounted exhaust fans had been installed without self-closing back draft dampers. These fans should be retrofitted with these dampers.

1.8.3 Control Exhaust Fan From Light Switch (7.3) - In many of the barracks shower rooms, the exhaust fans were running during the daytime even though no one was using the shower facilities. These fans should be interlocked with the lighting wall switches, so that they do not run continuously.

1.8.4 Weather Strip Shop Doors (7.4) - Many of the horizontally folding shop doors were installed without weather stripping. A program should be developed to weather strip these doors.

1.8.5 Insulate Hot Water Pipe Fittings (7.5) - Exposed piping is installed in basement and equipment areas that do not need to be heated. This piping should be insulated.

1.8.6 Install Fireplace Doors (7.6) - The retrofitting of glass doors on fireplaces prevents the exhausting of heated room air through the flue.

1.8.7 Door Thresholds (7.7) - Nonweather resistant or inferior door thresholds were found on many doors. These should be replaced with thresholds designed to curtail air infiltration.

1.8.8 Heating Plant Insulation (7.8) - The heating plants should have insulation installed on steam header valves, boiler steam drum ends, condensate return tanks, steam and condensate piping, and steam-to-hot water heat exchangers.