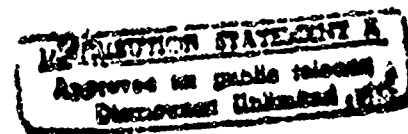
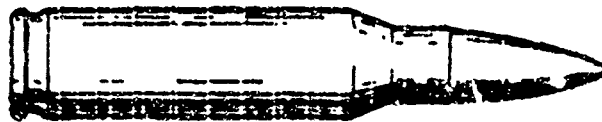


FINAL SUBMISSION

TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA

ENERGY ENGINEERING ANALYSIS



EXECUTIVE SUMMARY

19971016 173

prepared for
U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

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BANDERS & THOMAS, INC.
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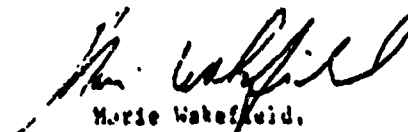
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CONSULTING ENGINEERS, 1 ROBINSON STREET PORTSTOWN PA 19064
NO 224 4810 CABLE SYSTEM TELEFAX 64 6-70

July 5, 1983

U. S. Army Corps of Engineers
Omaha District
601- U. S. Post Office and Court House
Omaha, NE 68102

Attention: ICEED-NC

Reference: Energy Engineering Analysis
Twin Cities Army Ammunition Plant
New Brighton, MN

Subject: Energy Engineering Analysis - Final Submission

Contact No.: DACA-5-83-C-0092

Our Project No.: 05-4660

Gentlemen:

This letter transmits the Final Submission of the Energy Engineering Analysis for the Twin Cities Army Ammunition Plant, New Brighton, Minnesota. The Analysis presents energy conservation projects that will enable the plant to meet energy consumption reduction goals, as specified in the Army Facilities Energy Plan.

The Analysis consists of nine components:

- Executive Summary
- Technical Report
- Appendix I: Master Building List
- Appendix II: Energy Conservation Calculations and Data
- Appendix III: Energy Conservation Measures Summaries
- Appendix III: Energy Conservation Measures
- Project Programming Documents
- Modified Increment I Study
- Increment F Study

All comments have been reviewed and incorporated in the report, as appropriate.

This Energy Engineering Analysis is a valuable data base that can be used for the development of additional projects as Army goals are revised and other energy conservation projects become viable.

STV ENGINEERS Engineers, Architects, Planners, Construction Managers

STV/SANDERS & THOMAS.

U. S. Army Corps of Engineers
Attention: MROED-MC

July 2, 1983
Page 2

The assistance that was provided by plant and COE personnel proved invaluable in completing this assignment. We appreciate their cooperation and hospitality.

Thank you for this opportunity to be of service.

Very truly yours,

STV/SANDERS & THOMAS


David H. Jonik, P.E.
Project Manager

DHJ:mac

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PROJECT ABSTRACT

ENERGY ENGINEERING ANALYSIS
TWIN CITIES ARMY AMMUNITION PLANT

This analysis is undertaken to assist the Twin Cities Army Ammunition Plant (TCAAP) in meeting the goals established by the Army Facilities Energy Plan to reduce energy consumption by 20 percent by FY 85.

Projects selected for implementation as a result of this analysis will enable TCAAP to achieve the FY 85 goal. These projects have been divided into standby and mobilization status. Total energy savings resulting from standby status project implementation will be approximately 130,800 MBTU's at a total estimated cost of \$4.2 million. If mobilization status projects are implemented annual energy savings will be approximately 626,300 MBTU's during periods of full mobilization. The cost of implementing mobilization status projects is estimated at \$12.9 million.

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USE OF THE REPORT

This Energy Engineering Analysis consists of a main report, which describes the existing and anticipated energy use trends, and defines and summarizes specific energy conservation projects recommended to achieve the goals stated in the Army Facilities Energy Plan. Appendices and the Annual Energy Consumption Summary include building information, weather data, cost data, and detailed computer-generated and manual calculations for each individual project.

The Energy Engineering Analysis will enable ammunition plant personnel to identify energy conservation measures and meet Army energy reduction goals.

The report includes:

- Energy consumption by fuel type;
- energy consumption trends;
- ECAM projects;
- Increment F and G Project;
- other potential projects;
- quick-fix management form; and
- descriptions of analyzed buildings.

In addition, the Analysis is a detailed data base consisting of:

- An analysis of building energy use;
- Energy Conservation Measures applied to each analyzed building to be improved; and
- a set of marked-up prints from the survey indicating the conditions when surveyed.

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EXECUTIVE SUMMARY

1.2 PROJECT REQUIREMENT

This engineering analysis is undertaken in order to develop a systematic program of projects that will lead to energy consumption reductions at the Twin Cities Army Ammunition Plant (TCAAP) without compromising the mission of the plant, and in compliance with all applicable environmental and Occupational Safety and Health Administration regulations. Reduced energy consumption is a stated goal of the Army Facilities Energy Plan.

The projects included in this analysis are grouped into five increments: A - Energy Conservation and Management Program (ECAM) Projects for Buildings and Processes, B - ECAM Projects for Utilities and Energy Distribution Systems, Modified E - Central Boiler System Projects, F - Energy Saving Modifications within the Facilities Engineer's Control, and G - Minor Construction, Maintenance, and Repair Projects not ECAM Qualified.

2.1 PLANT DESCRIPTION

TCAAP is located in New Brighton, Minnesota, approximately five miles north of the Twin Cities of Minneapolis and St. Paul. See Figure 1: Twin Cities Army Ammunition Plant Location Map. The plant covers about 2,370 acres and consists of 262 enclosed buildings with a total floor area of about 4.4 million square feet. Figure 2: Twin Cities Army Ammunition Plant Site Map, shows the main features of the plant.

The Federal Cartridge Corporation and the Donovan Construction Company are the operating contractors designated to carry out the plant's mission, which is to produce the following ammunition:

- 5.56mm cartridges
- 7.62mm cartridges
- 155mm shells
- Tracers
- Primers

TCAAP is currently on standby status.

3.1 ARMY FACILITIES ENERGY PLAN

The Army Facilities Energy Plan sets short and long range energy goals for the Army and provides policy and planning guidance for the development of detailed facility energy plans. The Army's energy goals in effect at the time of our scope of work, compared to present goals, are as shown in Table 1: Comparison of Army Facilities Energy Plan Goals.

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FIGURE 1
TWIN CITIES ARMY AMMUNITION PLANT
LOCATION MAP

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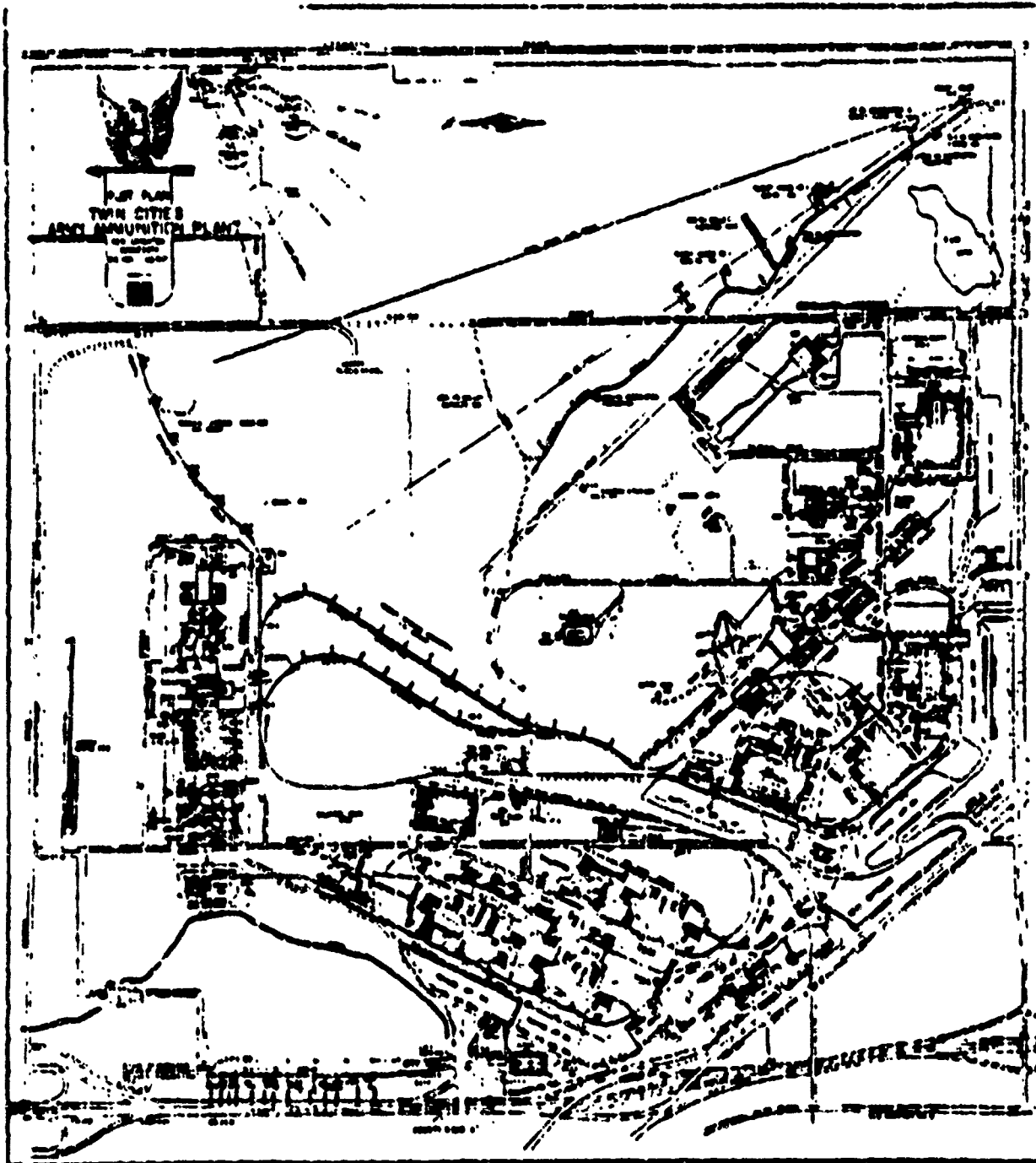


FIGURE 2
TWIN CITIES ARMY AMMUNITION PLANT
SITE MAP



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**TABLE 1
COMPARISON OF ARMY FACILITIES ENERGY PLAN GOALS**

	<u>1 OCT 1978</u>	<u>26 DEC 1981</u>
Reduce total consumption by:	25% by FY 85 80% by FY 2000	20% by FY 85 40% by FY 2000
Energy from coal & RDF	10% by FY 85	N.M.
Solar energy	1% by FY 85	N.M.
Natural gas	Eliminate use by FY 2000	N.M.
Petroleum fuels	Reduce by 75% by FY 2000	N.M.
Capability for synthetic gases	N.M.	By FY 2000
Heating oil consumption	N.M.	Reduce by 75% by FY 2000

N.M. - Not Mentioned.

The program recommended in this EEA report is consistent with revised Army Facilities Energy Plan goals as stated in the 26 October 1981 version.

4.1 SOURCE ENERGY CONSUMPTION

Table 2: Source Energy Consumption, compares energy consumption at TCAAP from FY 1975, the base year for the study, with consumption during FY 1979. Energy consumption over the period decreased by about 50 percent. This is primarily attributed to the cessation of production as well as energy conservation measures.

**TABLE 2
TCAAP SOURCE ENERGY CONSUMPTION
FY 1975 AND 1979**

<u>Source</u>	<u>FY 1975</u>		<u>FY 1979</u>	
	<u>Cost (\$000)</u>	<u>MBTU's Consumed (000)</u>	<u>Cost (\$000)</u>	<u>MBTU's Consumed (000)</u>
Electricity	\$1,050	647	\$ 696	334
Fuel Oil No. 2	706	326	791	326
Natural Gas	<u>707</u>	<u>693</u>	<u>351</u>	<u>165</u>
Totals	\$2,463	1,666	\$1,838	825

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Current fuel consumption is primarily attributed to building rather than process requirements.

5.1 PROJECT EXECUTION

This energy engineering analysis was conducted in four phases:

- . Field surveys and data gathering
- . Analysis of projects
- . Review and verification
- . Preparation of Project Programming Documents

5.1.1 Field Surveys and Data Gathering

The field surveys included buildings and process surveys. The building surveys were conducted in four areas:

- . Architectural - to evaluate such items as wall and roof types, and levels of insulation
- . Mechanical - to evaluate heating, ventilating, and air conditioning
- . Electrical - to evaluate lighting and building electrical systems
- . Distribution - to evaluate plant utility systems

The process surveys addressed the process systems located at the plant including production of 5.56 and 7.62mm cartridges, 19mm shells, tracers, and primers, as well as the various recovery systems in operation.

The distribution surveys covered all plant utility systems including electrical, steam, natural gas, water, sewage, and compressed air.

The survey phase enabled the identification of energy conservation opportunities and the applicability of energy conservation measures to TCAAP.

5.1.2 Analysis of Projects

After the data gathering phase it was possible to identify potential projects for analysis. These projects were analyzed for applicability to TCAAP and their potential to save energy in relation to their implementation cost.

Energy conservation measures were computer analyzed to develop energy savings and implementation costs. In addition, SAP, BCR and ECR values were computed. These latter three values, however, are no longer needed to determine project priorities. Instead, priorities are determined by Savings Investment Ratio

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(SIR) using the methodology presented in the Energy Conservation Investment Program (ECIP) Guidance, dated 22 September 1982. Projects recommended for implementation in this report on the basis of ECR generally meet SIR criteria.

The Sanders & Thomas SIR Program is similar to the program presented in the ECIP Guidance, with the following exception:

The discount factor is calculated directly from the C tables by determining the compounded single payment discount factors for each year, then finding their sum over the economic life of the project. This method makes it possible to consider different modes of operation (i.e. mobilization and peacetime) as might be the case for Army ammunition plants.

5.1.3 Review and Verification

TCAAP personnel assisted in the selection of those projects which should be implemented and developed project priorities. All projects were reviewed and verified at the plant in consultation with TCAAP personnel.

5.1.4 Preparation of Project Programming Documents

A DD Form 1391, Detailed Justification, and Project Development Brochure has been prepared for each selected ECAM project.

6.1 ENERGY CONSERVATION OPPORTUNITIES

The following energy conservation opportunities were investigated and found to be viable:

- . Insulation
- . Storm windows
- . Caulking
- . Consolidation of Building 105
- . Weatherstripping
- . Install shower flow restrictors
- . Reduce ventilation requirements
- . Prevent air stratification
- . Load dock seals
- . Reduce lighting levels
- . Replace incandescent fixtures
- . Install fluorescent fixtures
- . Install high-efficiency fixtures
- . Revise boiler controls
- . Viscosity controls
- . Install economizers
- . Install new burners
- . Reduce street lighting
- . Insulate steam lines return condensate
- . Steam distribution system pressure decrease

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The following conservation opportunities were studied but found not viable because of low ECR or lack of conservation opportunity at the plant:

- . Replace kitchen lighting fixtures
- . Improve power factor
- . High-efficiency motor replacement
- . FM radio controls
- . Decentralize domestic hot water heaters
- . Reclaim heat from hot refrigerant gas
- . Install chiller controls
- . Replace chillers
- . Solar films
- . Blowdown heat recovery
- . Construct vestibules
- . Replace existing transformers with new units having lower characteristic impedances
- . Cogeneration projects
- . Steam distribution system leak repair
- . Steam distribution condensate recovery
- . Off-peak operation of well pumps
- . Capacitors on well pump motors
- . Off-peak operation of sewage pumps
- . Combustion air preheaters for boiler stacks
- . Revise ventilation and heating for the gun rooms in Building 308
- . Draw furnace combustion air preheating
- . Heat recovery from Coit washers and dryers
- . Rotary forge air heater
- . Salem furnace exhaust gases used for Salem dryer
- . Insulate condensate return lines
- . Ducted heat destratification
- . Insulation projects for building 139-A, 139-B, 139-C, 139-D, 141-A, 141-B, 144-A through H, 149-A through O
- . Air washer-humidifier for Building 135
- . Use process heat to heat buildings and shutdown comfort heat steam
- . Seal abandoned electric motor houses
- . Install timers on HVAC equipment
- . Reduce ceiling height
- . Change constant volume AHU to variable air volume AHU
- . Install blowdown fans in heated high bay areas
- . Use economizer cycle
- . Use enthalpy controlled economizer cycle
- . Reset controls for hot and cold decks on dual ducts, multizone, and terminal reheat units.

7.1 OTHER PROJECTS CONSIDERED

7.1.1 Compressor Cooling Water Systems for Buildings 101, 102, 501 and 503

These projects conserve water by recirculating air compressor cooling water through a closed-loop cooling tower arrangement.

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These are not energy conservation projects. With the addition of the cooling tower and associated equipment, the amount of energy consumed will be the same or slightly more than that used to originally pump the cooling water. However, with the exception of Building 102 (to be leased), the significant savings incurred by not treating the cooling water at the sewage treatment plants make these feasible and highly recommended projects.

8.1 PROJECTS SUMMARY

8.1.1 Introduction

ECAM, increment G, and other projects are separately listed according to descending ECR. A summary of project categories completes this section in Table 9: Summary of Projects.

8.1.2 Selected ECAM Projects

ECAM Projects selected by TCAAP personnel at the Review and Verification Meeting are presented in Table 3: Selected ECAM Projects. Projects are separated by fiscal year and by standby or mobilization status and listed in order of descending ECR. Plant priorities may vary from the prioritized ECR's. The plant will decide which projects are to be implemented based on the actual present requirements.

8.1.3 Viable Projects Not Selected for Implementation by TCAAP

Table 4: Viable Projects Not Selected for Implementation by TCAAP, includes those projects not selected for implementation by TCAAP personnel. These projects were not selected because anticipated procedural changes at the plant would make these projects unnecessary and other projects have accomplished the same purpose. Projects are separated by fiscal year and by standby or mobilization status and listed in order of descending ECR.

8.1.4 Energy Conservation Measures Not Meeting ECAM Criteria

Those portions of ECM Nos. 2 through 8 not included in selected ECAM projects or Increment G projects are listed in Table 5: Energy Conservation Measures Not Meeting ECAM Criteria. Annual KBTU savings, CHE, TIC, and ECR data are included for the unselected portion of each ECM. A complete itemization of individual building projects from which future implementation selection could be made appears in Appendix III of the EEA dated May 26, 1982.

8.1.5 Steam/Power Plant Modernization (Modified Increment E)

An analysis of various methods of improving the steam/power plants showed that the preferred approach was to convert Boiler Plant 515 to fire coal, expanding its capacity to meet mobilization requirements.

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8.1.6 Increment F Projects

Increment F projects for Building 535 will save approximately 950 MBTU's per year and will produce a first year savings of about \$4,000. These projects are listed in Table 6: Potential Energy Conservation Projects Developed for Building 535 (Standby Status).

Recommendations were made concerning the advantages of using gas versus electric annealers viable projects to more accurately control temperatures in Buildings 101, 108, 112, 135, 501, and 503 are presented in Table 7. The most economical method of heating and controlling the temperature in Building 501 was reviewed. These analyses showed that the existing gas annealers should be retained; that projects for improved temperature control will save 7,800 MBTU's per year and \$42,000 in energy costs in the first year after implementation; and that recommendations for Building 501 will save 185 MBTU's per year or \$1,800 the first year after implementation.

8.1.7 Increment G Minor Construction, Maintenance and Repair Projects

Table 8: Increment G Minor Construction, Maintenance and Repair Projects, lists qualifying projects by descending ECR.

8.1.8 Projected Energy Trends

Figure 3: Standby Status - Projected Energy Consumption, shows the projected trend in energy consumption over the period FY 1975 to FY 2000. During FY 1985, when the energy projects will be implemented, energy use will be reduced by approximately 93,000 MBTU's per year. Building energy usage per square foot will be reduced from 399 to 123 MBTU's per gross square foot per year from FY 1975 through FY 1985.

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**TABLE 3
SELECTED LEAD PROJECTS**

Project No.	Project Title	Annual M&E Savings (\$000)	Annual Cost Savings (\$000)	Benefits (\$000)	CR (000)	ICR (000)	ICR	ECR
FT 80 Mobilization Station								
11-1	Energy Monitoring and Control System	204,500	2,330	30,959	2,750	2,899	10.7	10.8
5-16	Buildings 101, 201, 301, High Bay Fans for Heat Distribution	111,000	706	10,220	1,305	1,416	10.0	10.9
9-5	Recover Heat from Solene Hot Water Boilers, Buildings 503 and 501	7,650	66	914	300	310	10.7	73.3
5-11	Replace Lighting Fixtures in Building 150	20,900	99	1,792	410	432	4.2	64.4
5-21	Insulate Condensate Return Lines, Buildings 501 and 503	10,500	63	1,259	161	170	7.4	65.0
5-12	Replace Lighting Fixtures in Selected Buildings	71,700	252	6,539	1,200	1,429	3.2	52.5
9-3	Recover Heat from Solene Furnaces in Buildings 101 and 503	67,400	200	5,600	1,330	1,400	4.1	35.0
9-6	Wasting Furnace Heat Recovery, Building 501	11,500	60	1,307	300	400	3.4	29.6
5-70	Weatherstrip and Caulk Windows and Doors, Install Storm Windows in Front and Miscellaneous Buildings	3,000	31	617	127	134	4.6	23.7
5-2	Install Wall and Roof Insulation in Primer and Miscellaneous Buildings	10,000	109	2,995	625	654	4.6	23.5
9-7	Waste Furnace Furnace, Heat Recovery, Building 501	20,650	171	3,473	1,625	1,710	2.0	17.6
9-4	Recover Heat from Solene Furnace in Building 503	2,000	17	370	160	160	2.0	17.5
5-3	Install Insulated Panels over Windows in Primer and Miscellaneous Buildings	10,600	100	2,167	610	644	3.5	17.3
Subtotal		507,770	4,330	70,275	11,000	11,500		

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Table 3 (continued)

7-6	<u>EV in Standby Status</u> Install Package Boilers in Buildings 115 and 315	150	3,014	997	67%	4.0	4.0	0.3-4
8-5	Replace Insulation on 110 P516 Steam Distribution System	407	4,104	3,075	3,164	7.5	2.5	10.3
	Subtotal	557	11,068	3,062	3,793			
9-1	<u>EV in Mobilization Status</u> Install Wall and Roof Insulation to Primer and Miscellaneous Buildings	56	1,130	721	235	3.9	6.0	22.0
6-6	Replace Incandescence/Mercury Vapor Fixtures with High-Pressure Sodium Fixtures	42	704	501	608	10.0	1.2	15.0
	Subtotal	98	1,834	1,222	843			

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**TABLE 4
WORK PROJECTS NOT SELECTED FOR IMPLEMENTATION BY ICAP**

Project No.	Project Title	Annual Savings	DOC (\$/yr)	ICC (\$/sqft)	SAP	BCR	IRR
11. Air Rehabilitation Studies							
5-15*	Building 101, ducted heat destratification	7,750	176	106	4.1	3.9	49.2
5-16*	Building 503, ducted heat destratification	5,400	300	316	9.3	1.7	18.8
	Subtotal	12,650	476	507			
17. Air Standby Status							
7-4	Install Economizers in Building 515	20,100	976	1,048	4.2	4.5	28.2
7-3	Install Economizers in Building 115	15,750	731	770	5.5	3.4	21.5
7-5	Replace Burners and Install Combustion Controls in Boiler Plant 515	21,200	1,202	1,265	6.7	2.8	17.7
	Subtotal	65,050	2,909	3,083			

*Project nos. 5-16 and 7-5 are not included in Table 3: Summary of Projects, due to the selection of project no. 5-16: Install high efficiency fans in Buildings 101, 501, 503 - Rehabilitation Studies.

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**TABLE 5
ENERGY CONSERVATION MEASURES NOT MEETING ECAM CRITERIA***

ECM No.	Annual MFTU Savings	1 Y MA CUE (\$000)	1 Y MA IIC (\$000)	ECR
2	30,400	3,079	3,291	9.9
3	11,000	352	371	31.2
4	3,300	587	618	5.6
5	6,600	340	358	19.4
6	2,000	300	199	5.3
7	3,800	560	591	6.8
8	0	0	0	N/A

*These portions of ECM Nos. 2 through 8, not included in selected ECAM projects or Increment 6 projects, are summarized in this table.

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TABLE 6

POTENTIAL ENERGY CONSERVATION PROJECTS DEVELOPED FOR BUILDING NO. 935 (STANDBY STATUS)

<u>Project No.</u>	<u>Project Title</u>	<u>Annual MBTU Savings</u>	<u>Total Investment (\$)</u>	<u>First Year Dollar Savings (\$)</u>	<u>Total Discounted Savings (\$)</u>	<u>SIR</u>
4-5	Remove Lamps and Fixtures	430	1,000	2,160	12,930	13.00
4-1	Install Insulated Panels Over Windows	420	8,240	2,290	28,000	3.40
4-2	Weatherstrip Doors	80	3,540	420	5,130	1.45
4-4	Caulk Windows	20	1,250	110	1,400	1.11

TABLE 7

POTENTIAL ENERGY CONSERVATION PROJECTS FOR TEMPERATURE CONTROL (STANDBY STATUS)

<u>Project No.</u>	<u>Project Title</u>	<u>Annual MBTU Savings</u>	<u>Total Investment (\$)</u>	<u>First Year Dollar Savings (\$)</u>	<u>Total Discounted Savings (\$)</u>	<u>SIR</u>
<u>Temperature Control:</u>						
5-1	Building 101	2,380	37,200	12,900	158,100	4.24
5-5	Building 901	2,300	37,200	12,500	153,200	4.11
5-6	Building 903	1,910	56,800	10,400	126,900	2.24
5-3	Building 112	410	14,200	2,200	27,100	1.9:
5-4	Building 135	450	17,700	2,400	29,900	1.69
5-2	Building 108	320	12,400	1,700	20,900	1.69
TOTAL		7,770	175,500	42,100	516,100	2.94

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**TABLE 2
MINIMUM 6 WEEKS CONSTRUCTION, DELAYED, AND REPAIR PROJECTS**

Project No.	Project Title	Annual New Savings (\$1000)	Annual Cost Savings (\$1000)	IBC Savings (\$1000)	ICR	ICR	ICR
11.00 Standby Status							
5-27	Replace lighting fixtures in Buildings 115 and 116	3,000	10.6	61	52.2	2.6	1,000
8-4	Consolidation, Building 105	570	3.0	15	42.8	6.1	500
9-9	Install Self-Combustion Microstatic Valves on Radiation	700	2.8	6.9	32.5	3.0	400
9-19	Small Building Insulation Project (Buildings 115-A (w/ 6" fiber insulation) Building 115-B (with floor insulation) Building 104 Buildings 129, 129A and B Buildings 128A and B Building 118A (with floor insulation) Building 118B (with floor insulation) Subtotal)	700	6.2	9.7	54.8	2.0	70
		5,270	20.9	170			
11.00 Mobilization Status							
5-13	Reduce the number of lamps	370	1.2	6.7	47.0	0.6	50
9-6	Recover Bolt and Parts Used from Solen Furnaces, Buildings 103 and 104	1,000	4.0	71	11.1	1.5	2,500
12-9	Loosen Back Door Seals, Building 100	800	4.8	12	72.7	2.3	80
9-10	Recover Bolt and Parts Used from Working Furnaces, Building 101	6,000	20	60	72.3	2.3	2,400
12-1	Repair Compressed Air Leaks, Building 101	100	0.4	2.6	62.4	0.5	80
12-1	Repair Compressed Air Leaks, Building 101	200	0.5	3.5	62.1	0.5	110
12-4	Repair Compressed Air Leaks, Building 103	700	0.5	7.5	62.1	0.5	100
12-2	Repair Compressed Air Leaks, Building 115	30	0.01	0.6	50.0	1.0	20

This subproject is a duplication of a portion of the following subproject, Buildings 115A-B (with floor insulation), and is not included in the subtotal.

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Table 6 (Continued)

9-11	Metl Recovery from Oil Sprays, Building 101	1,700	9.9	21	50.1	1.0	1,000
9-9	Recover Belt and Parts from Hardening Furnace, Building 501	3,100	10	66	69.5	3.0	2,000
9-6	Install Insulated Window Panels in Microbanes Building	900	9.2	29	39.7	2.5	900
9-10	Install Self-Contained Thermostatic Valves on Radiation	310	3.8	23	16.9	5.8	1,200
12-6	Exhaustrip and Caps, Building 100	310	2.3	19	16.9	0.0	400
9-3	Compressor Cooling Water System, Building 901	N/A	5	65	N/A	0.1	900
9-2	Compressor Cooling Water System, Building 501	N/A	200	75	N/A	0.2	500
9-3	Compressor Cooling Water System, Building 101	N/A	170	75	N/A	0.3	500
	Subtotal	29,200	60.3	660			
91 db Slamby Study							
7-2	Viscosity Controller for Boiler Plant 315	10,000	05	20	205	0.4	1,000
7-7	Steam Distribution Pressure Decrease	12,000	100	50	200	9.5	2,200
7-1	Viscosity Controller for Boiler Plant 115	1,000	9	25	31.5	3.0	1,000
	Subtotal	23,000	203	125			

**TABLE 9
SUMMARY OF PROJECTS**

<u>ITEM</u>	<u>Annual MU (U Savings)</u>	<u>TIC (\$'000)</u>
Selected ECAM Projects (Mobilization Status)	592,220	11,580
Viable Projects Not Selected (Mobilization Status)	17,650	507
Increment G Projects (Standby Status)	5,220	120
Increment B Projects (Mobilization Status)	<u>20,290</u>	<u>660</u>
TOTAL	635,380	12,667
<u>FF 85</u>		
Selected ECAM Projects (Standby Status)	92,700	3,793
Selected ECAM Projects (Mobilization Status)	13,760	841
Viable Projects Not Selected (Standby Status)	65,050	3,003
Increment G Projects (Standby Status)	<u>24,160</u>	<u>126</u>
TOTAL	195,670	7,963
Modified Increment E Projects (\$1982)	----	59,000
Increment F Projects* (Standby Status) (\$1983)	8,120	150

*Implementation of funded Increment F projects will be scheduled by the Facilities Engineer.

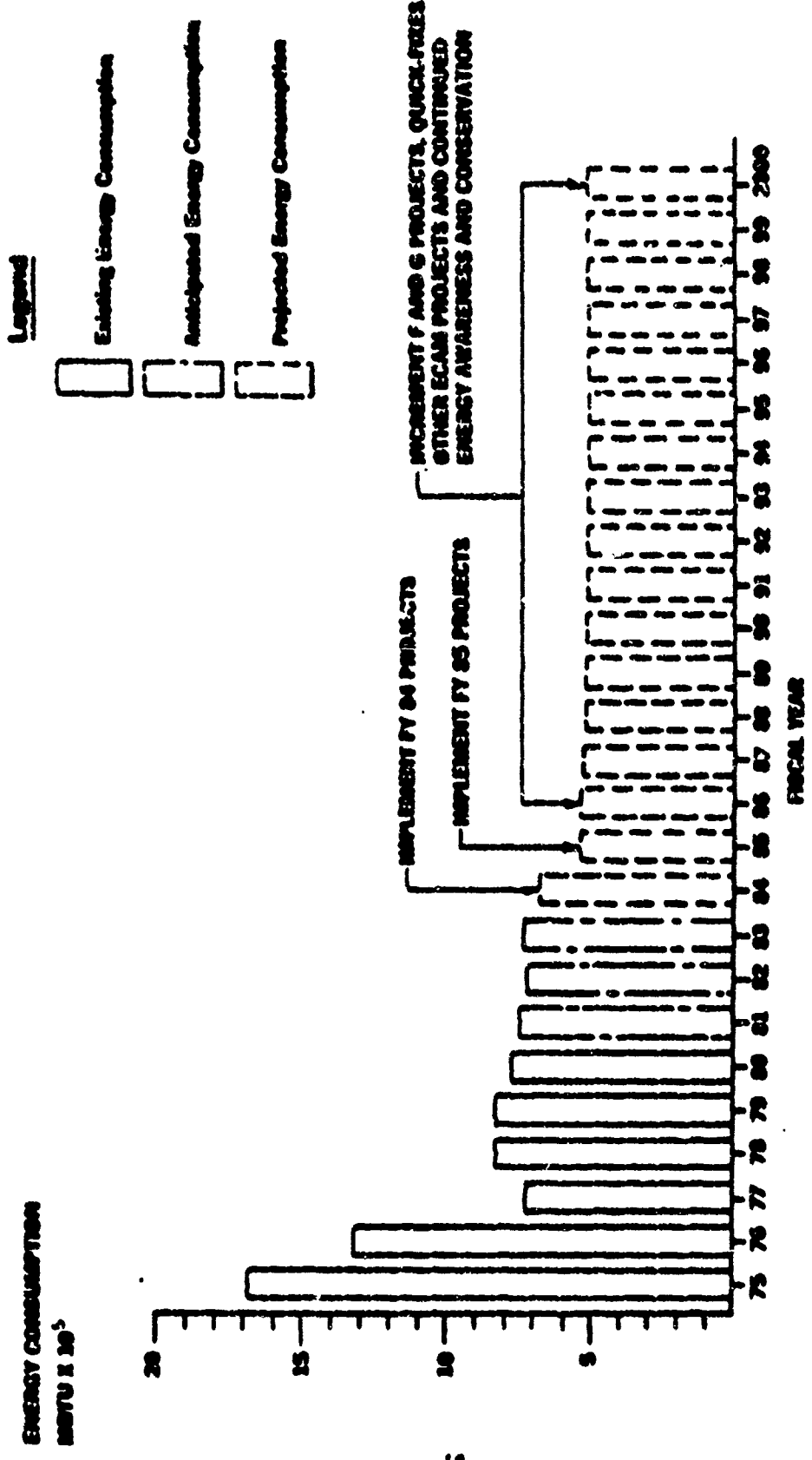
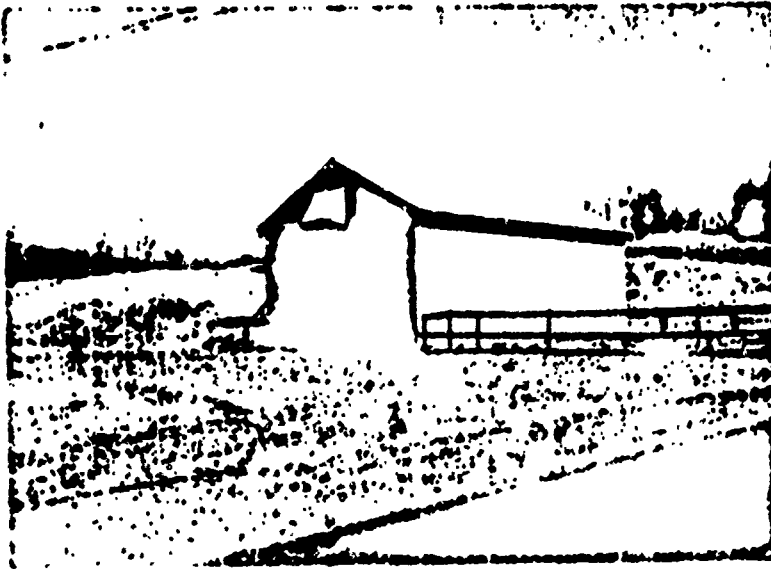


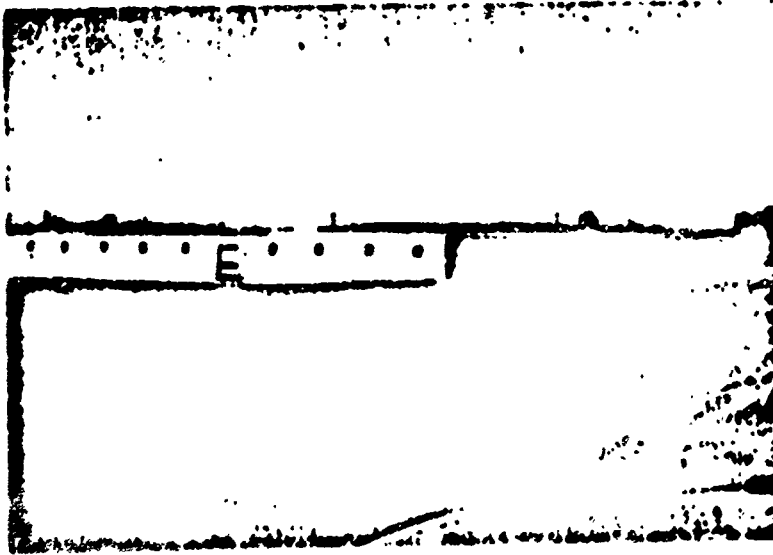
FIGURE 3

STANBY STATUS -- PROJECTED ENERGY CONSUMPTION

SANDERS & THOMAS.



**SMALL BUILDING INSULATION PROJECT
BUILDING 110-B BLACK POWDER STORAGE**

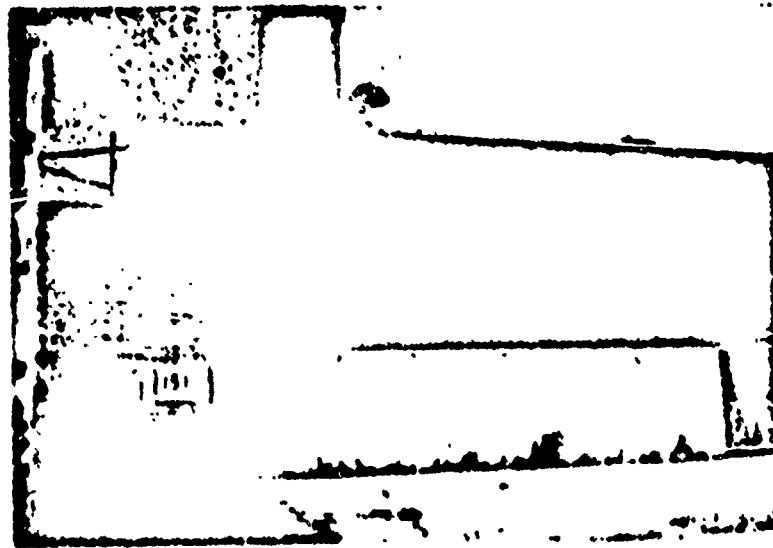


BUILDING 100 INSTALL TRUCK DOCK SEALS

SANDERS & THOMAS.

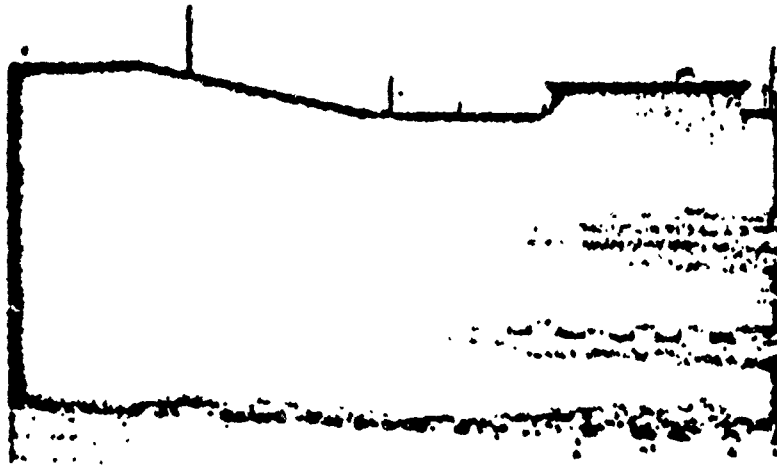


**PROJECT -- REDUCE WINDOW LOSSES AT
BUILDING 101**



**PROJECT -- REDUCE WINDOW LOSSES AT
BUILDING 101**

SANDERS & THOMAS.

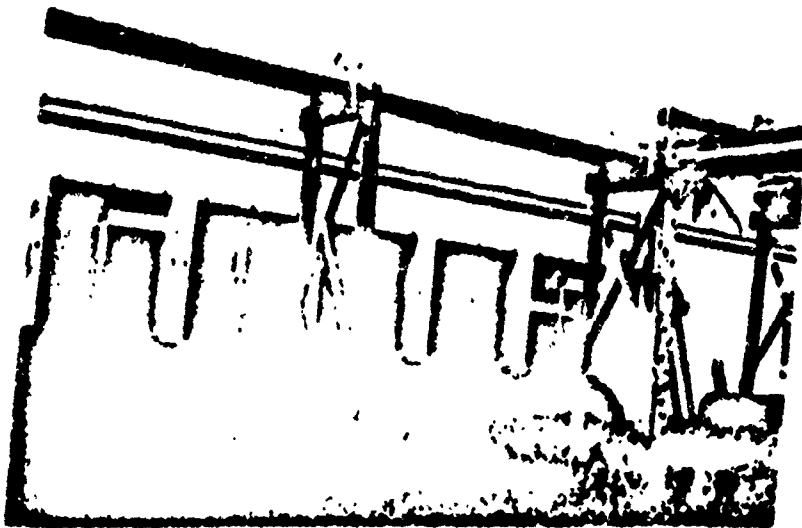


**BUILDING 103 COMPLETED PROJECT COVERING
WINDOWS WITH INSULATED PANELS**

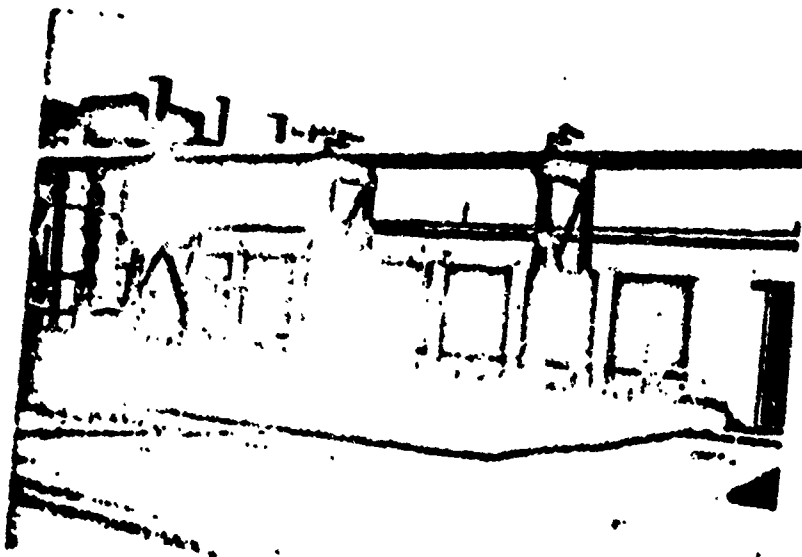


**BUILDING 103 COMPLETED PROJECT COVERING
WINDOWS WITH INSULATED PANELS**

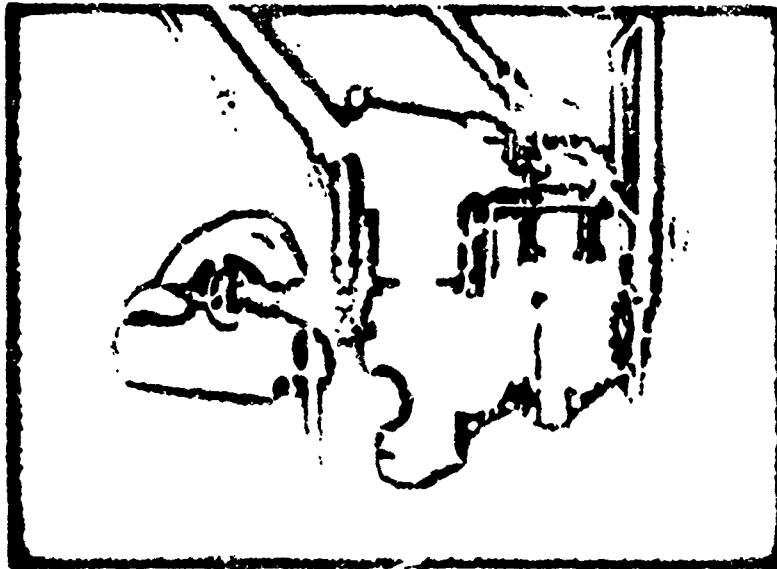
SANDERS & THOMAS.



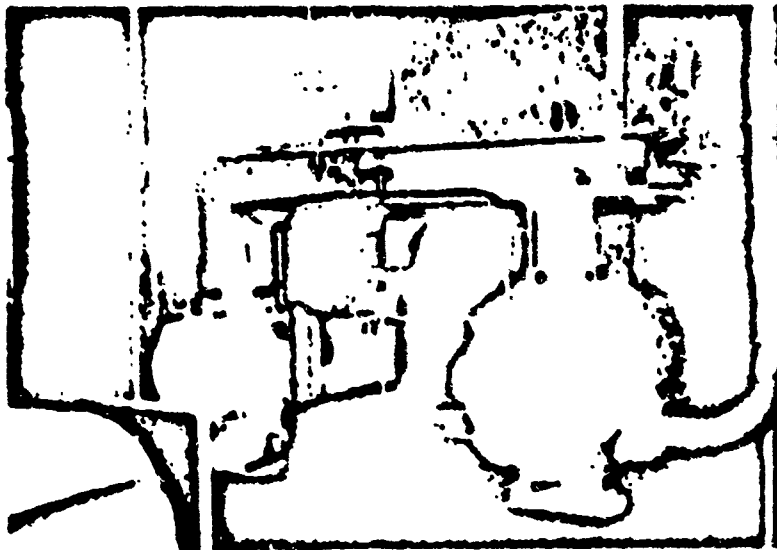
**TYPICAL STEAM DISTRIBUTION SYSTEM INSULATION
NOTE SETTLING OF INSULATION TO THE BOTTOM OF JACKET**



SANDERS & THOMAS.



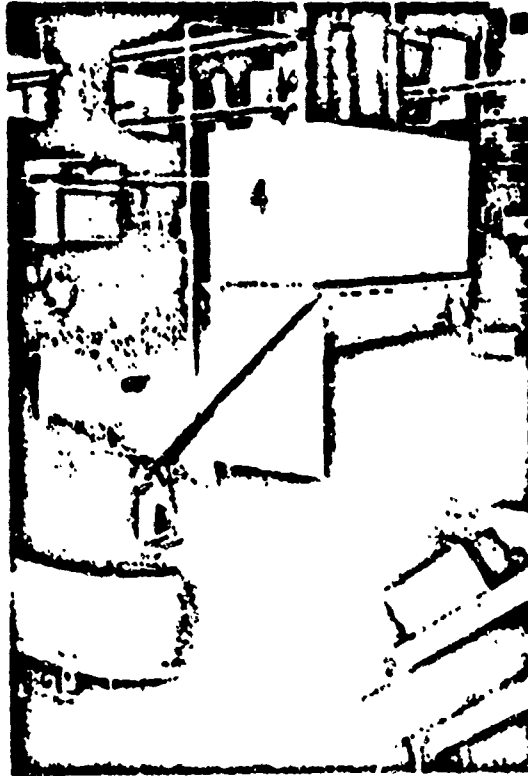
**TYPICAL LARGE AIR COMPRESSORS
POTENTIAL ENERGY SAVINGS THROUGH THE
REDUCTION OF COOLING WATER USAGE**



SANDERS & THOMAS.



**TYPICAL
SALEM FURNACE
PRODUCTION LINE**



**TYPICAL SALEM
DRYER**

SANDERS & THOMAS.



**TYPICAL
SALEM FURNACE
COMBUSTION
AIR BLOWER**



**TYPICAL SALEM FURNACE
DISCHARGE END**

SANDERS & THOMAS.



**ROTARY FURNACE
FLUE GAS EXHAUST**

SANDERS & THOMAS.

DEFINITION OF TERMS

BENEFICIAL OCCUPANCY DATE (BOD)

The date a facility begins to operate.

BENEFIT-TO-COST RATIO (BCR)

The dollar savings realized over the life of the project divided by the non-recurring capital investment (including design). BCR is a measure of project payback. A BCR of 1.0, for example, means that the projects initial capital investment will be recovered over its lifetime.

CURRENT WORKING ESTIMATE (CWE)

The project installation cost escalated to the year the project is programmed for implementation. Installation costs are non-recurring and include all labor and material, contractor costs, bond, contingency, SIOH, and escalation. Design costs are not included and must be added to the CWE to develop the total project cost.

ENERGY-TO-COST RATIO (ECR)

The MBTU's per year saved divided by the non-recurring capital investment (excluding design). ECR is a measure of the amount of energy savings related to the required capital investment. Acceptable ECR's should be lower each year since energy costs escalate faster than capital investment costs.

MOBILIZATION STATUS

Period when the plant is operating at full production level.

SIMPLE AMORTIZATION PERIOD (SAP)

The project capital investment divided by the yearly savings. This yields the period of time required to recover the initial capital investment.

STANDBY STATUS

Inactive buildings or equipment that are maintained in a state of readiness for mobilization.

TOTAL INSTALLED COST (TIC)

The sum of the CWE and the design costs.