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THE HASHEMITE KINGDOM OF JORDAN

RECOMMENDATIONS FOR AN INDUSTRIAL ENERGY EFFICIENCY PROGRAM

Draft Final Report

Prepared for:

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Amman, Jordan

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A brief mission to Jordan was conducted from January 9 through 17, 1988, in the course of which many individuals provided useful information and gave their opinions on the barriers to improving energy efficiency in Jordanian industry. Their help is much appreciated.

The full cooperation of the Industrial Energy Department of the Ministry of Energy and Mineral Resources is also acknowledged. With the assistance of Eng. Jamal Shweikeh and the support of Director Rashad Aburas, much was accomplished in a short time.

Funding for this study was provided by the AID S&T/EY's Energy Conservation Services Program (ECSP). Technical guidance was provided by Mr. Alberto Sabadell, ECSP Project Officer at S&T/EY, and Mr. Robert Archer and Dr. Robert Ichord of the Asia Near East (ANE/TR) Bureau.

EXECUTIVE SUMMARY

Jordan imports nearly all of the energy it uses, with the industrial and power generating sectors accounting for over 40 percent of the country's energy consumption. To determine the potential for energy conservation, audits of large enterprises were carried out in 1985-1986 as part of a World Bank Project, and the Industrial Energy Department of the Ministry of Energy and Mineral Resources (MEMR) has begun a program of audits of medium and small enterprises. Results from the audits performed to date suggest that 4-5 percent of national oil consumption could be saved in the industrial sector, equivalent to about 150,000 tonnes of fuel oil or about U.S. $20 million per year.

The promotion of energy efficiency throughout the industrial sector can therefore result in significant benefits to Jordan. The MEMR requested technical assistance through the U.S. Agency for International Development (USAID) mission in Amman to develop and implement an industrial energy conservation plan. With the support of the Office of Energy within USAID's Bureau for Science and Technology (S&T/EY), funding for a diagnostic study was provided under the Energy Conservation Services Program (ECSP). A brief mission was therefore undertaken by Mr. B. G. Tunnah of RCG/Hagler, Bailly from January 9 to 17, 1988, with the following objectives:

(1) To review activities to date and assess the potential for energy savings in Jordanian industry

(2) To identify the main barriers to energy efficiency that must be addressed by the MEMR

(3) To develop recommendations for an energy conservation plan

(4) To identify priorities for ECSP involvement, including possible budgets for technical assistance.

Discussions were held with representatives of the government, banks, private-sector industrial enterprises, Chambers of Trade and Industry, the University of Jordan and USAID. The main problems to be addressed are believed to be the following:

(1) Lack of awareness of the potential benefits of energy efficiency

(2) Inability to define energy-related problems at the plant level in engineering and cost terms

(3) Inability to evaluate technical options and to present the financial case for investment

(4) Difficulties with implementation of conservation projects

(5) Lack of private-sector consultancy support

(6) Lack of energy accounting in enterprises

(7) Lack of funds for conservation investments

An energy efficiency program must therefore address these issues. A long-term program is recommended based on the elements of pricing (already the subject of an ongoing project),[1] information, advice and technical assistance, incentives and, to a significantly lesser extent, regulations.

A program for improving energy efficiency through Jordanian industry fits well in the context of the USAID Mission policy, whose objectives include[2] improving productivity and increasing private-sector involvement in the support of manufacturing industries. The program described in this report recognizes the potential for substantial private-sector involvement in energy conservation, and emphasizes the short-term need to improve the capabilities of local firms to assist industry in the more efficient use of energy resources. The program also recognizes the role of the existing Industrial Energy Department (IED) of the MEMR as a catalyst to stimulate energy efficiency -- working primarily through private sector firms -- by coordinating training programs and commissioning local firms to conduct audits, prepare promotional materials, and provide specific productivity improvement services such as a combustion testing service for industry. The present role of the IED/MEMR, which entails undertaking audits for factories and helping implement efficiency measures, would be modified under the proposed program to promote general energy awareness and support the development of a strong local capability to serve Jordanian industry. The IED/MEMR will continue to be deeply involved in energy efficiency through the monitoring of energy consumption trends and through the promotion of government policies supportive of the rational use of energy.

An action plan in support of an energy conservation program is detailed in this report. The activities are divided into five tasks:

Task 1: Carry out capability and needs assessments, primarily an appraisal of private-sector capabilities

Task 2: Conduct promotional activities, including development of promotional materials and "awareness" seminars for plant owners, with a major role played by local firms

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1 This project is being undertaken by the Meta Systems Division of RCG/Hagler, Bailly with AID funding.

2 Jordan Action Plan, March 1988 (USAID Mission, Amman)

Task 3: Carry out training, especially of engineers from private-sector consulting firms

Task 4: Provide information, advice, and technical assistances, including a pilot program of combustion testing services, primarily through private sector firms

Task 5: Study incentives and regulations, including a series of special studies contracted to local firms and university departments.

Detailed proposals for each activity are given in the main text. Promotional materials are listed, for example, and a number of training courses are proposed for a wide range of audiences. A series of special projects is proposed to study possible incentives and regulations.

A time table is proposed for the remainder of 1988, during which technical assistance would be provided through the ECSP. A corresponding budget estimate is provided.

The results of the proposed program should be:

(1) A significant transfer of knowledge and experience about industrial energy efficiency to the private sector in Jordan, through the local consulting engineering firms and the industrial enterprises themselves

(2) A better understanding of the benefits and further potential for energy savings, providing a basis for considering future funding of a longer term and broader energy demand management activity

(3) Enhancement of the capability of the IED/MEMR to promote energy awareness, to monitor energy efficiency, and to develop policy initiatives that will stimulate further gains in productivity.

We believe that the proposed program will serve as a testing ground for assistance to the growing private sector in Jordan, and that the lessons learned in 1988 could provide a solid groundwork for expanded activities in 1989 and beyond. The energy-related service industry should be an ideal subsector to demonstrate the benefits that can be achieved through cooperation between the AID Mission, the government, and private-sector entrepreneurs. The potential benefits to Jordan from increasing industrial energy efficiency are significant, and we believe that the proposed program will be able to capitalize on the evident enthusiasm for energy efficiency that exists in many enterprises and institutions.

1 BACKGROUND

Jordan is at present almost entirely dependent on imported energy, mainly in the form of crude oil and petroleum products. Although world oil prices have fallen in recent years, the share of oil imports remains around 10 percent of total imports. The industrial and power generating sectors account for over 40 percent of national energy consumption of commercial fuels. Industrial energy use is therefore an important area for promoting improvements in efficiency.

Various activities relating to energy efficiency have been undertaken in recent years. Of particular relevance was a series of energy audits carried out in industrial plants with the assistance of Bechtel as part of a World Bank project in 1985-1986. These audits covered 14 large plants that represented the 10 largest subsectors of energy use -- petroleum refining, fertilizers, steel, cement, phosphates, potash extraction, glass, ceramics, bricks, and power generation. The energy conservation measures recommended as a result of the audits would reduce Joran's oil consumption by 3 percent and have an average payback of 5 of less than 3 years. In general, the Bechtel study concluded that the large plants were reasonably efficient in energy terms and that most operated with specific energy consumptions close to international standards.

While Jordan's industrial sector is dominated by a few major companies in the subsectors indicated, there are a large number of small and medium-sized enterprises in other subsectors. There are almost 1,500 enterprises employing 5 to 25 employees, mostly in the food manufacturing, mining and quarrying, furniture and wood products, mineral products, machinery, and clothing subsectors (see Exhibit 1).

The energy efficiency of small- and medium-sized enterprises has not been studied to any great extent to date, although the Industrial Energy Department of the Ministry of Energy and Mineral Resources (IED/MEMR) has made a start by conducting audits in 19 establishments. The potential for savings indicated in the IED/MEMR audits ranges from 7 percent to 30 percent, as shown in Exhibit 2. Paybacks under 1 year are the rule, not the exception. The measures proposed as a result of the audits include:

(1) Improved operating and maintenance techniques

(2) Better housekeeping

(3) Better energy monitoring and management

(4) Heat recovery from flue gases and process streams

(5) Improved process control and combustion control

(6) Heavy fuel oil preheating

Exhibit 1

Distribution of Enterprises, 1984

Industry Type	0-5 Employees	5-25 Employees	25+ Employees	Total
Mining and quarrying	28	130	3	161
Food manufacturing	412	279	35	726
Beverages	0	5	11	16
Cigarettes and tobacco	0	3	1	4
Textiles	72	37	9	117
Clothing	611	107	10	728
Leather & leather products	25	4	2	31
Footwear	75	22	4	101
Furniture & wood products	967	121	12	1,100
Paper & paper products	1	9	6	16
Printing & publishing	43	49	8	100
Chemicals & chemical products	5	32	24	61
Petroleum refining	0	0	1	1
Rubber & rubber products	4	0	0	4
Plastic & plastic products	4	28	22	54
Non-metallic mineral products	600	223	25	648
Basic metal products	7	14	9	30
Non-electrical machinery	1,045	188	27	1,260
Electrical machinery	4	6	2	12
Transport equipment	0	3	1	4
Miscellaneous	7	0	0	7
Energy electrical products	0	0	3	3
Industrial services	2,937	209	3	3,149
TOTAL	**6,847**	**1,469**	**217**	**8,533**

Source: Industrial Census 1984, Department of Statistics, Amman.

Exhibit 2

Summary of Potential Energy Savings
In Small- & Medium- Sized Industries

	Plant	(JD)	(JD/YR)	% Saving	Period (YR)
1.	General Plastics Industry	3,000	4,000	20.0%	<1
2.	Arab Pharm Manu. Co:				
	A. Salalem factory	3,000	4,000	20.0%	<1
	B. Buheria factory	15,000	10,000	11.0%	1.5
3.	United Indust. Batteries factory	7,000	10,000	9.0%	<1
4.	Jordan Pipes Manufact.	20,000	25,000	30.0%	<1
5.	Jordan Sewing & Netting Ind.	20,000	25,000	11%.0	<1
6.	Moh'mad Asaad Polystyrene factory	10,000	24,000	30.0%	<1
7.	Modern Flour Mills & Macaroni Factories	3,000	8,000	7.0%	<1
8.	Yeast Manuf. Indust.	4,000	11,000	15.0%	<1
9.	Rafia Ind. (Plastic Bags)	450	2,600	7.0%	<1
10.	Jordan Rock Wool	3,500	12,600	25.0%	<1
11.	Jordan Ice & Aerated Water Co.	2,500	19,800	9.0%	<1
12.	ICA	6,000	23,000	17.5%	<1
13.	National Indust. (paper)	5,000	26,000	12.0%	<1
14.	Jordan Wood Manu. & Production Co.	76,000	116,000	34.0%	<1
		102,450	205,000	15.0%	<1

In addition, audits were performed at the Arab Center for Pharmaceuticals and Chemicals, Universal Chemical Industries, Steel Mesh Industrial Co., Jordan Siper Paint Co., and Jordan Carbon Co; no conservation measures were identified. The Jordan Wood Manufacturing and Production Co. is now shut down; data for this plant are not included in totals.

Source: Industrial Energy Department, MEMR, January 1988.

(7) Substitution of heavy fuel oil for diesel fuel

(8) Improved lighting systems

(9) Improved thermal insulation

(10) Minor process modifications.

The potential savings through broad application of these types of measures in small- and medium-sized enterprises throughout the industrial sector are estimated to be in the region of 4-5 percent of national oil consumption, amounting to 150,000 tonnes fuel oil per year and valued at about U.S.$20 million per year.

In view of these significant potential benefits to Jordan, the MEMR requested technical assistance through USAID Amman to develop and implement an industrial energy conservation plan. This assistance was to be provided under the Energy Conservation Services Program (ECSP). A brief mission was undertaken by Mr. B. G. Tunnah of RCG/Hagler, Bailly from January 9 to 17, 1988, with the following objectives:

(1) To review activities to date and confirm the potential for energy savings in Jordanian industry

(2) To identify the main barriers to energy efficiency that must be addressed by any conservation program

(3) To develop specific recommendations for such a program

(4) To identify priorities for ECSP involvement and corresponding budgets for technical assistance.

Discussions were held in and around Amman, with the emphasis on the problems of small and medium-sized enterprises and on how these firms might be encouraged to become more energy efficient. The following people were met and all provided useful ideas and opinions that are incorporated in this report:

Rashad Aburas	Director, Industrial Energy Dept., MEMR
Ali Anani	Manager, Renewable Energy Dept., MEMR
Yasin Shahzada	Assistant Director, Amman Chamber of Industry
Rafik Omar	Director, Research and Information, Amman Chamber of Trade
Tayseer Wahbeh	Manager, Technical Dept., Industrial Development Bank
Muqbel Rashid	Head, Technical Division, Industrial Development Bank

Samar Rasas	Amman Chamber of Industry (Industrial Products Exhibition)
Hani Khammash	Technical Assistant to Managing Director, Jordan Cement Industries
Amal Abboushi	Asst. Refinery Manager, Jordan Petroleum Co. Ltd.
Abdel-Karim Alawin	Process Engineer, Jordan Petroleum Co. Ltd.
Abdul Kharim	Process Manager, Jordan Petroleum Co. Ltd.
Hazem Asfour	Plant Manager, Jordan Rock Wool Ind. Co. Ltd.
Munir Zeine	Jordan Ice and Aerated Water Co. Ltd.
Salah Sayed	Chairman, Chemical Engineering Faculty, the University of Jordan
Lyle Weiss	Engineering Dept., USAID Mission, Amman
Farid Salahi	Engineering Dept., USAID Mission, Amman
Mark Kraczkiewicz	Regional Economist, USAID
Richard Rousseau	Project Officer, USAID

In addition to this background, the report consists of five sections. Section 2 examines the main problem areas that are restricting improvements in energy efficiency in the industrial sector, and Section 3 provides specific recommendations for a conservation program to address these problems. The program emphasizes the private sector's potential role in providing services to help industrial enterprises improve their energy efficiency. In Section 4, technical assistance activities are defined for the next 12 months, and corresponding budget estimates provided in Section 5 for various elements of the program.

2 BARRIERS TO ENERGY CONSERVATION

In the manufacturing industry in most countries, a gap exists between the energy that is saved and the potential for savings that appears to be technically possible and financially justified. For example, a study completed about 5 years ago in England[1] examined the actions of various plants and compared them with their potential savings. Very few of the plants had implemented the full variety of possible energy saving measures: half the firms in the sample had achieved less than 50 percent of their potential savings. Of the many possible barriers to implementation of energy efficiency measures, the most important were found to be:

(1) A lack of knowledge of what is technically possible

(2) Poor management attitude to energy conservation and the lack of effective energy reporting systems

(3) Inaccurate or inappropriate capital investment evaluation methods.

In the discussions with representatives of a wide range of Jordanian industrial enterprises and other organizations, these barriers were again evident. A number of other problems, which are perhaps less evident in the developed countries of Europe and the United States but are important in Jordan, were also identified and are described below.

Of course, many industrial enterprises in Jordan (and in many other countries) are suffering from underutilization of plant capacity, lack of sales, and lack of profits. Even in the best managed plants, energy efficiency will deteriorate significantly when throughputs are reduced. At times of low utilization and low profits, it is thus especially important that every effort be made to reduce energy wastage and save money. When sales are down, savings in energy bills translate into a distinct competitive advantage for the factory concerned.

LACK OF AWARENESS OF POTENTIAL BENEFITS

The lack of awareness of the potential benefits was the problem most mentioned during discussions. It appears that senior factory managers and factory owners are frequently unaware of the substantial benefits to profitability that energy efficiency can bring. Energy is a major element of manufacturing costs in many industries, ranging as high as 35 percent for energy-intensive industries such as cement, brick-making and steel,

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1 "Energy Conservation Investment in Industry; An Appraisal of the Opportunities and Barriers", Energy Paper No. 50, U.K. Dept. of Energy, HMSO, London, 1982.

depending on local conditions. For many factories, energy is thus a cost that can be significantly controlled by management.

Improvements in the efficiency with which energy is used in the manufacturing industry can be translated directly into increased profits. Many of the measures that need to be adopted to increase profits cost little or nothing to implement. Furthermore, plants can often save over 30 percent of their energy bill by implementing only those measures with a payback of less than 2 years. During the discussions in Jordan, the example was quoted of one factory whose electricity bill was reduced by almost 50 percent by installing low-cost power factor correction equipment and by monitoring electrical load more carefully during peak periods. For several years, it appears the factory had been paying substantial peak load and power factor penalties without realizing it. It is quite likely that many other factories are failing to adopt even the simplest "housekeeping" measures to cut their energy costs.

To raise the level of awareness of energy conservation as a means to increase profits and thus boost the competitive position of an enterprise, we believe it is essential to start at the top. Factory owners and senior managers must be provided with information on the typical levels of energy expenditure in their subsectors and should be encouraged to check how their factory compares. They also need information on how energy efficiency might be improved at their factory.

Energy management is a relatively new management function and it is most important that the decision makers in Jordanian industry understand that energy can be managed as efficiently as such resources as labor, raw materials, and finance.

INABILITY TO DEFINE PROBLEMS

Partly through lack of awareness of the potential benefits of energy efficiency, there appears to be an inability in small and medium-sized enterprises to define energy-related problems and to identify specific areas where savings can be made. During the in-country visit, we noticed several examples of energy being wasted, situations that would have been identified by anyone carrying out a simple energy audit. Having realized there is an energy-related problem, it is of course essential for a manager or engineer to be able to define the problem in technical, quantified terms; a lack of experienced engineering personnel in the typical small enterprise is apparently a serious barrier to improvements, especially in the absence of outside help.

INABILITY TO EVALUATE TECHNICAL OPTIONS AND PRESENT FINANCIAL CASE

As we have indicated, no-cost/low-cost housekeeping measures are frequently ignored. Where capital investment may be involved, small- and medium-sized enterprises tend to lack the technical skills needed to examine the range of options for improving energy

efficiency and select the most cost-effective solution for a specific situation. Equally important is the financial evaluation of potential conservation investments. If a plant owner cannot be convinced that an investment is financially attractive, he clearly will not invest his money. A comprehensive technical discussion is unlikely to be convincing to an entrepreneur running a small business.

Engineers must be trained to present the case for energy efficiency in financial terms, including an appraisal of any risk factors involved. Too many engineers fail to recognize that energy management is as much about communication as calculation, and too many have insufficient experience in financial matters. To achieve good results, an engineer should have a basic understanding of the financial situation in his company; he must be able to relate his conservation ideas to the contribution they might make to company profits.

Energy efficiency has to be "sold" to senior management and plant owners in terms they can understand. A national program to promote energy conservation must address this problem through training courses that help engineers present the case for conservation in a manner most likely to convince decision makers to invest.

DIFFICULTIES WITH IMPLEMENTATION OF CONSERVATION PROJECTS

When a decision is made to invest in energy efficiency, it becomes the responsibility of someone in the plant, usually an engineer, to carry out the implementation phase. Experience in project implementation appears to be lacking, and there is also a lack of outside consulting engineering capability to help the plants at the implementation stage. We were told by the oil refinery management that they are often approached by small firms for technical assistance to carry out improvements to their utility or process systems. Several examples were quoted of help being given on cooling water and boiler water treatment problems because the small firm had no experienced engineers of its own and was unable to find suitable local consulting firms to assist.

We were also told that manufacturers representatives in Jordan are often not competent to offer proper technical assistance when needed, but rather are merely salesmen. We were told of one case in which a factory wished to insulate its refrigeration system. Insulation for a cold system must obviously be capable of operating effectively at low temperatures at which atmospheric water vapor could condense. Insulation must therefore be resistant to water ingress as well as being effective as a thermal insulator. To date, four local suppliers have claimed to have the right product; four times, the insulation has failed after a few months and the plant is again looking for the proper materials.

LACK OF OUTSIDE CONSULTANCY SUPPORT

Lack of awareness and inability to define and solve problems are made all the more serious because of a noticeable lack of local consulting engineer support in Jordan. We were told on several occasions that a plant manager who believes he has an energy-related problem cannot readily turn to local firms for advice and technical assistance. Apparently, local consulting engineering firms themselves lack experienced engineers capable of diagnosing and rectifying problems related to industrial processing. We were told that many Jordanian consulting firms offering technical and engineering services are quite proficient at handling matters concerning buildings (e.g., central heating systems, electrical wiring, air conditioning, lighting) but that services concerning industry and energy matters on a larger scale are very difficult to obtain.

In fact, we believe that this situation presents an excellent opportunity to enhance the capability of the private sector to help local industry improve energy efficiency. Many of the basic principles, calculation procedures, and design methods used in industrial energy efficiency work are common to those used for buildings-related projects. Special training courses for engineers and exposure to energy efficiency work in industrial plants will address the lack of support to local industry. By improving the ability of consulting engineering firms to provide the relevant services and by stimulating an increased awareness of the potential benefits of energy efficiency in industrial plants, the proposed program can create business opportunities for the private sector and thus generate additional employment for technicians, graduate engineers, and managers.

Unfortunately, there was insufficient time during the mission in January to visit local consulting firms and discuss industrial sector problems with them. The initial stage of the proposed program therefore includes a thorough evaluation of existing capabilities and the requirements for upgrading them.

LACK OF ENERGY ACCOUNTING IN ENTERPRISES

One reason for a lack of awareness of the significance of energy as a production cost may be the failure of bookkeeping in small- and medium-sized enterprises to identify energy consumption as a separate "line item." Energy is viewed as just another cost or overhead that has to be paid at the end of the month. In one meeting in Amman, the suggestion was made that owners are often totally ignorant of the proportion of manufacturing costs represented by energy in their factory. It was also said that owners are often unwilling to give factory employees any information about costs or other financial matters. One of our site visits supported this contention, because the plant manager was unable to produce any cost or consumption data for fuels. The information was kept by the accounting department at the head office in Amman. A plant manager cannot be responsible for controlling energy costs if he is ignorant of what those costs actually are.

Without proper accounting for energy and distribution of cost information to managers in an enterprise, effective energy management is impossible. Much useful work can be done to promote the collection and analysis of routine energy consumption data in plants as a necessary precursor to improvements in energy efficiency.

LACK OF FUNDS FOR CONSERVATION INVESTMENTS

Leaving aside the fact that many conservation measures require little or no capital investment but merely good management of processing activities, there appears to be a problem in finding funds for investment in energy conservation measures. For any given factory, it may well be that the case for investment has not been made convincingly or it may be that the factory does indeed lack financial resources.

As part of the mission in January, a discussion was held with the Industrial Development Bank. The Bank operates an active "Small Scale Industries and Handicrafts Fund," which approved 404 loans totaling JD 1.239 million in 1986 (an average of JD 3,068, or approximately U.S.$9,200). Data in the Bank's 1986 Annual Report show the loans were in a variety of subsectors:

Subsector	No. of Loans	Total JD	JD per Loan
Food Products	86	291,400	3,388
Maintenance (Cars and Others)	66	202,300	3,065
Metal Works	63	199,200	3,162
Garments and Knitting	48	140,700	2,931
Carpentry	49	137,100	2,798
Building Materials	47	122,000	2,596
Printing and Photography	21	74,700	3,557
Leather Products	5	14,500	2,900
Others	19	57,400	3,021
Total	**404**	**1,239,300**	**3,068 (average)**

These data show that the Bank is quite accustomed to providing relatively small loans to enterprises. Although there was no record of an application being made for an energy-related project, such an application would be considered on the same basis as all other loan applications from industrial enterprises.

The typical interest rate for loans from the Industrial Development Bank is about 9 percent, with repayment terms agreed with the borrower, taking into account his ability to repay. In other words, the Bank is willing to consider loan applications for energy conservation projects, and repayment loans could, in principle, be made from the energy savings generated by the project. The Bank conducts its own appraisal of the project. Where an enterprise wishes to study an energy-related investment in some

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detail, the Bank's "Technical Assistance Fund" is available to lend money for studies for a service charge of 2 percent of the amount borrowed.

We therefore believe that difficulties in obtaining funds for worthwhile energy efficiency projects may be exaggerated. We believe the problem of funding should be investigated further, taking into account the actual experience of enterprises, but we are not convinced that a good project, with little risk and with a short payback period (as is the case for the majority of energy efficiency projects), will be unable to obtain financial assistance on acceptable terms from the Industrial Development Bank or other private banks in Jordan. The need for a special government-supported loan guarantee arrangement (which was raised during discussions with plants) must be looked into carefully, as we have no evidence at this time that such a scheme is a prerequisite to project implementation.

3 A PROGRAM FOR INDUSTRIAL ENERGY EFFICIENCY

An energy efficiency program must address the major issues of awareness (especially at top management levels), technical skills to identify and resolve energy-related problems, proper financial evaluation of potential investments, and above all the lack of a vigorous private sector that can provide services to local enterprises seeking to improve energy efficiency.

We propose a program that develops private-sector capabilities in the area of energy efficiency services and, at the same time, helps the IED/MEMR strengthen its role in coordinating and monitoring energy efficiency activities and proposing energy policy initiatives. The program is structured to support the Mission private sector program as expressed in its Action Plan (March 1988), which includes:

- Strengthening business management and industrial engineering training institutions

- Expanding or establishing private-sector organizations and associations supportive of growth in the manufacturing and services industries, broadening the standards and certification functions of these associations, and strengthening their ability to initiate policy dialogue with the government on issues pertinent to the development of their respective industries

- Strengthening business service industries to provide technical assistance to improve local manufacturing, developing a local market for such services, partly through the formation of model service firms, and exploring potential regional markets for the export of these services.

The proposed program for industrial energy efficiency consists of five tasks:

Task 1: Carry out Capability and Needs Assessments

Appraise existing private-sector capabilities (e.g., consulting engineering firms, equipment suppliers, university departments); identify key organizations and appropriate channels for program implementation; define training and resource needs; conduct review of IED/MEMR staffing and training and resource needs.

Task 2: Conduct Promotional Activities

Develop and distribute promotional materials to raise energy awareness; conduct seminars for plant owners and senior managers; carry out demonstration projects in selected plants.

Task 3: Carry Out Training

Train private-sector engineers to conduct audits, feasibility studies, and project evaluations, and to develop and implement energy efficiency programs in plants; provide specialized training for plant operators and supervisors; cooperate with the University of Jordan in conducting "further education courses"; provide appropriate training for IED/MEMR staff; provide support to the Jordan Institute of Management on energy-related matters.

Task 4: Provide Information, Advice, and Technical Assistance

Establish an energy information center (including library) to make available to a wide audience reports, books, and video films on industrial energy efficiency; provide lists of local consulting engineering firms and equipment suppliers, with information on their capabilities and specialties; provide assistance to industrial enterprises to obtain energy audit services and advice on program implementation from suitable private sector firms or organizations; establish a comprehensive data base at the MEMR to monitor energy consumption trends and provide supporting information for energy policy initiatives.

Task 5: Study Incentives and Regulations

Study possible incentives to promote energy efficiency and possible regulatory actions (e.g., to enforce efficiency standards).

In general, the work will be accomplished by the maximum use of private-sector firms, with coordination and quality control by the IED/MEMR and specific technical expertise contributed by U.S. experts provide by ECSP.

It is appropriate at this point to mention the topic of energy pricing. Rational energy pricing is the basis for energy conservation policy. We believe that prices for energy products that reflect the long term cost of supply are important as a signal to consumers. In general, Jordanian energy prices are roughly at world market levels. In any case, a major project is being undertaken by the Meta Systems Division of RCG/Hagler, Bailly with USAID funding. A macroeconomic model is being developed for projecting sectoral activities and energy demands. The pricing of both electricity

and petroleum products is being investigated and recommendations developed for restructuring electricity tariffs and controlling petroleum product prices. Optimization of refinery operations is also under study. For this reason, the subject of energy pricing does not feature in the proposed energy efficiency program.

TASK 1: CARRY OUT CAPABILITY AND NEEDS ASSESSMENTS

The first part of the program will consist of an appraisal of the capabilities of the Jordanian private-sector with respect to services for improving industrial energy efficiency. Lists of consulting engineering firms, experienced staff from university departments and research institutes, and suppliers of energy-related equipment (such as insulation, heat exchangers, and combustion instrumentation) will be assembled, and selected firms and individuals will be interviewed. A joint effort is proposed, with one technical expert from RCG/Hagler, Bailly working in conjunction with one or two engineers from the IED/MEMR. During the visit to Jordan in January 1988, it was suggested that the IED/MEMR make a start on assembling lists of firms and individuals. As part of the appraisal, it will be necessary to collect brochures and qualifications statements from firms, and to obtain lists of previous jobs related to energy efficiency in the industrial or other sectors. Details of the training and experience of key personnel should be obtained during interviews; files of resumes should be compiled.

Based on the information gathered, the level of support available to industrial enterprises will be assessed. The availability of services, or lack of them, can be checked through interviews with selected plants and professional associations. It will then be possible to develop detailed recommendations for training programs and assistance with equipment purchases (e.g., audit instruments, microcomputers). Qualified organizations and individuals will be identified to participate in subsequent elements of the program.

Bearing in mind the coordinating and monitoring role proposed for the IED/MEMR, a similar assessment of staff capabilities and physical resources should be made at the MEMR. Recommendations for assistance to the IED/MEMR should then be developed.

As part of Task 1, we also propose to evaluate the potential market for energy-related services in Jordan. The initial visit and interviews in January indicated there is little demand by industrial enterprises for such services at the present time. Through a series of interviews, it would be possible to assess the extent to which the promotional and other activities of this program could translate into business opportunities for private consulting engineering firms. The value that potential customers place on energy-related services, and thus the price they might be willing to pay, will be a key to success in achieving energy savings in the long term. It will, of course, be interesting to compare the attitudes of plant owners and managers at the beginning of the program

and after several months, to measure the extent to which the promotional activities and services provided to selected firms have resulted in increased awareness and interest in energy matters.

Finally, a check of the availability of pilot plants and testing facilities should be made. For example, facilities for combustion testing are available at the University of Jordan. Cooperation with the faculty of chemical engineering could be possible in several areas, such as specialized training for boiler and furnace operators. It would also be helpful to be able to use existing equipment for such tasks as fuel testing (e.g., calorimeters) and the testing of heavy fuel oil burners. This aspect of the "capability assessment" would be reported as part of the overall study of private-sector capabilities.

TASK 2: CONDUCT PROMOTIONAL ACTIVITIES

It will be important to make available a broad range of promotional materials to raise the level of energy awareness of plant owners, managers, and engineers. There is always a tendency for enterprises in one industrial subsector to think that their problems are different from those of enterprises in other subsectors. In fact, many of the problems are common to numerous subsectors, and the techniques for identifying problems, evaluating options, and developing solutions to energy problems are essentially the same for all industries. For example, poor boiler operation occurs in all industries and the remedies are generally the same in all plants. Only in terms of process details are there likely to be differences, and relatively little contribution to energy saving is made on the process side in most plants. Wide dissemination of promotional materials that stress the common aspects of energy efficiency improvement and deemphasize the differences between subsectors will help raise energy awareness and should serve to encourage managers and owners of enterprises to learn from the successes of others.

The value of appointing energy managers in medium-sized and large enterprises should also be publicized. Energy managers form a useful contact point in channeling advice and information, and may be the subject of training programs at a subsequent stage of the program.

Specific activities proposed for Task 2 include:

(1) Conduct short seminars for plant owners and senior managers in selected factories where money-saving ideas can be demonstrated in-situ. Three half-day seminars, each for up to 15 people, should be conducted in a 1-week period, with all arrangements and initiatives being the responsibility of the IED/MEMR and with technical support for the seminar content provided through the ECSP. Seminars could be repeated in various locations around the country.

(2) Prepare a series of technical guidebooks, adapted to Jordanian conditions, from documents already published overseas (see Exhibit 3). This work should be contracted to a suitable local firm (identified in Task 1), whose work would be supervised by the IED/MEMR.

(3) Prepare a booklet, written in general terms, on the opportunities for energy conservation in industrial plants, similar to that already published by the MEMR for buildings (see Exhibit 4). Again, this work would be supervised by the IED/MEMR, but contracted out to a local firm.

(4) Publish at least five articles with practical advice on energy efficiency improvement in journals such as the monthly publication of the Amman Chamber of Industry (see Exhibit 5) and the MEMR's Energy Conservation. Preparation of these articles should be shared among local firms, university staff, and the IED/MEMR.

(5) Publish a regular report on energy conservation trends, based on data collected each month by the IED/MEMR. This report will be issued from the MEMR itself and will include guidelines on data monitoring, a discussion of the analysis of data, and remarks on the interpretation of the results.

(6) Prepare a report on the relationship of energy costs to total manufacturing costs for a broad range of industries. This report could be published as a small booklet and distributed to members of the Chamber of Industry, selected government departments, banks involved with lending to industrial enterprises, the University of Jordan engineering faculties, utility companies, and the Chamber of Trade.

The survey work required to collect basic data could be done by a local firm or by graduate students of the university under the general direction of, for example, Mr. Rafik Omar of the Chamber of Trade, who would also participate in data analysis. The study results could be linked to the competitive advantage of export-oriented Jordanian industries. The final report will be published under the auspices of the IED/MEMR.

(7) Set up two demonstration projects in Jordanian factories.[1] These demonstrations will illustrate the procedures used for energy audits, monitoring and targeting, cost-benefit analyses, and feasibility studies, and will include implementation of one or more no cost/low cost measures. The demonstrations will thus illustrate, from start to finish, the typical techniques and procedures for improving energy efficiency.

[1] The bottling plant for Pepsi Cola has been offered as one such site.

Exhibit 3

EXAMPLE OF TECHNICAL GUIDEBOOK

Fuel Efficiency Booklets

The Fuel Efficiency Booklets contain essential technical material presented in an unbiased way to help plan for maximum energy efficiency. Laid out for easy reference, the booklets cover many of the most common energy problem areas. Titles currently available are

1. Energy Audits
2. Utilisation of Steam for Process and Heating
3. Economic use of fixed space heaters
4. Compressed air and energy use
5. Steam costs and fuel savings
6. Recovery of heat from condensate, flash steam and vapour
7. Degree days
8. The economic thickness of insulation for hot pipes
9. Economic use of electricity
10. Controls and energy savings
12. Energy management and good lighting practices
13. The recovery of waste heat from industrial processes
14. Economic use of oil-fired boiler plant
15. Economic use of gas-fired boiler plant
16. Economic thickness of insulation for existing industrial buildings
17. Economic use of coal-fired boiler plant
18. Boiler blowdown

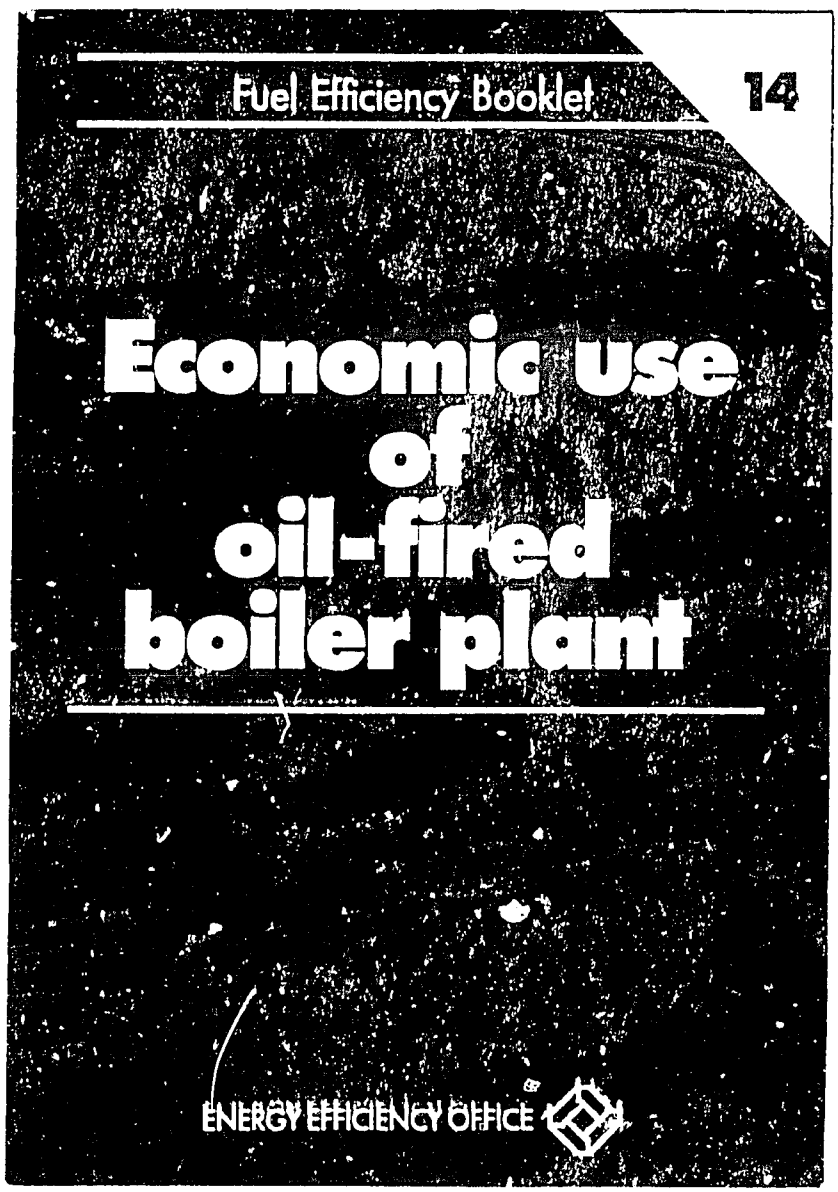
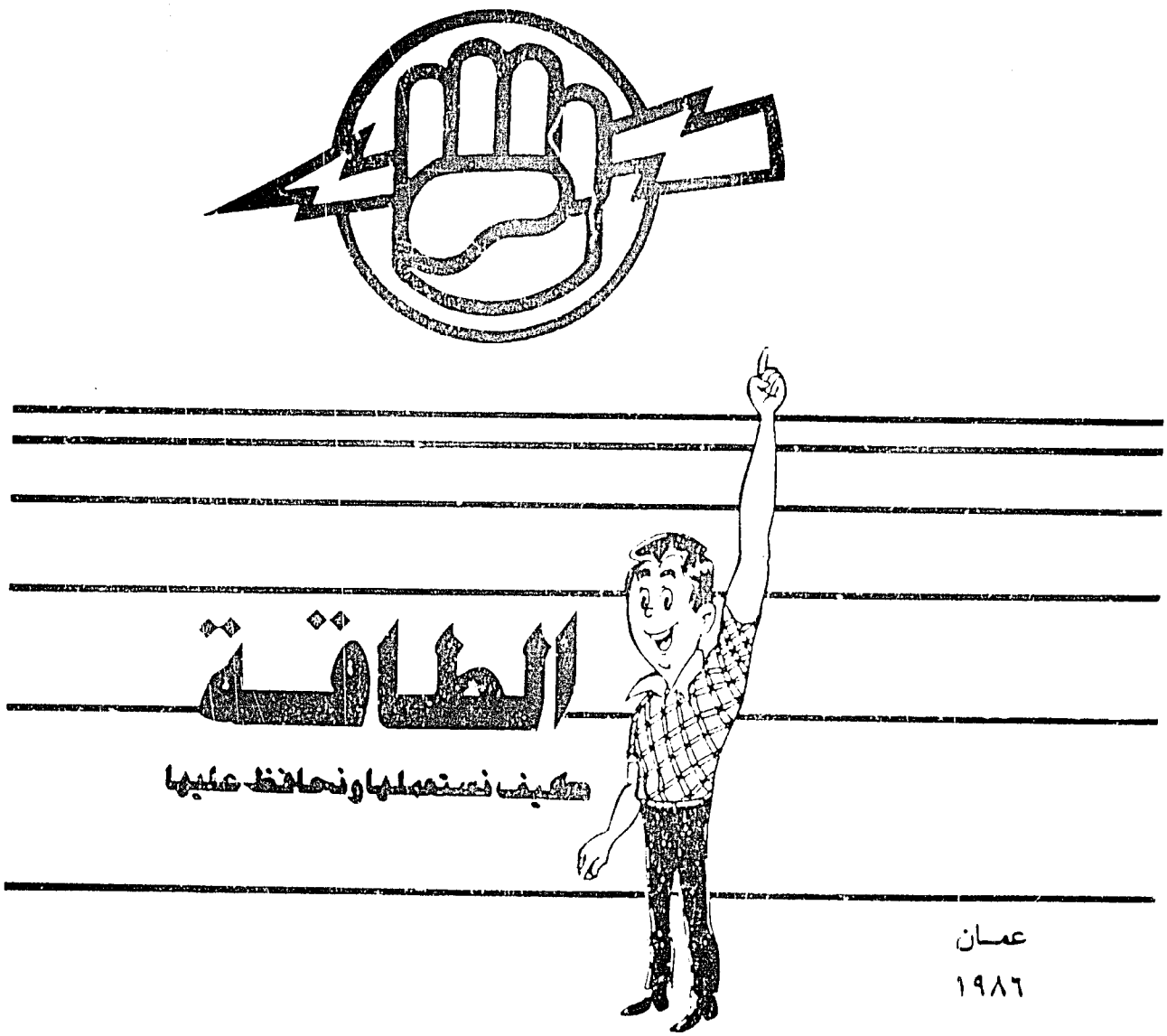


Exhibit 4

BOOKLET PUBLISHED BY MEMR

سلسلة
« الطاقة والمواطن »
« ١ »

وزارة الطاقة والثروة المعدنية



عمان
١٩٨٦

Exhibit 5

MONTHLY PUBLICATION OF THE AMMAN CHAMBER OF INDUSTRY

رسالة الصناعة

شهرية دورية تصدر عن غرفة صناعة عمان

الاقتصاد والمعارض

في هذا العدد:

رقم الصفحة

- كلمة العدد - اليوبيل الفضي للغرفة - بقلم السيد عصام بدير ٣
- اعضاء اللجان الاستشارية القطاعية ٤
- الاجتماع الستون - كلمة السيد معن هنيان رئيس لجنة الاعلام والمعارض ٦

نشاطات غرفة صناعة عمان

- مجلس الادارة يلتقي مع وزير الصناعة والتجارة ٨
- رئيس واعضاء الغرفة يجتمعون مع معالي الوزير السوداني ٩
- اخبار متفرقة ١٠

ما يهم الصناعة محلياً

- تجربة الاردن في مجال الصناعات الهندسية ١٤
  دراسة اعداد م. عماد الشماع والدكتور محمد سلامة
- العلاقات العامة في الصناعة مقال بقلم وصفي عبده ٢٠
- الصناعات الهندسية الاردنية - موضوع الغلاف ٢٢
- راي الصحافة ٢٤
- الشركة الاردنية العالمية لانتاج افران الغاز والغسالات - استطلاع وصفي عبده ٢٨
- الجديد في الصناعة الاردنية ٣١

اسواق التصدير

- الصادرات الاردنية خلال الثلث الاول من عام ١٩٧٧ ٣٤
- نشاطات مؤسسة المراكز التجارية الاردنية ٣٧
- محضر اجتماع اللجنة العليا المصرية الاردنية المشتركة ٣٨
- الاتفاق التجاري بين الاردن والسودان ٤٢
- قرارات مصرية بانشاء سوق مصرفية حرة ٤٣
- البروتوكول التجاري بين الاردن والسودان ٤٧
- تعليمات استيراد وانتاج المواد الكيماوية في العراق ٥٠

متفرقات

- المؤتمر العربي الثاني لصناعة المعلبات الغذائية ٥٣
- عروض تصدير - منتجات اردنية جاهزة للتصدير ٥٦
- فرص تعاون تجاري ومشاريع مشتركة ٥٨
- معارض دولية ٦٢
- القاموس الصناعي ٦٤

رسالة الصناعة

تصدرها :-
غرفة صناعة عمان

بإشراف :-
لجنة الاعلام والمعارض

رئيس التحرير :-
محمد صالح جابر

مدير التحرير :-
ياسين شاهزاده

سكرتير التحرير :-
وصفي محمد عبده

للاعلان في مجلة
رسالة الصناعة
يرجى مراجعة
غرفة صناعة عمان
تلفون ٦٤٤٥٦٩
٦٤٤٧٤٧
ص.ب ١٨٠٠ عمان - الاردن

ترحب غرفة صناعة عمان، بأية مقترحات او ملاحظات حول موضوعات هذه المجلة، كما يسرها ان تدعو كافة الصناعيين الى تزويدنا بالمعلومات عن نشاطاتهم الانتاجية والتسويقية والتي يعتقدون انها صالحة للنشر.
هذا وترحب الغرفة بأية مقالات او دراسات في مجالات الانتاج والتسويق والاقتصاد.

الآراء والمقترحات الواردة في هذه المجلة تعبر عن راي اصحابها ولا تعبر بالضرورة عن راي غرفة صناعة عمان

المراسلات :-
رسالة الصناعة
غرفة صناعة عمان
ص.ب ١٨٠٠
عمان - الاردن

The demonstration factories will also serve as case studies for the seminars for plant owners (activity 1) and as training sites for various courses planned for

later in 1988. The procedures used and results obtained will be reported in detail and the report made available to industry. On request, the IED/MEMR will arrange short plant inspection visits by interested parties.

Setting up the demonstration projects will be the responsibility of the IED/MEMR; technical assistance will be provided by RCG/Hagler, Bailly, and the work will also be aided by up to two engineers from local consulting engineering firms.

(8) Conduct at least one 2-day exhibition of energy-related equipment and materials during 1988, at which local manufacturers and importers can display their products. There will also be several short presentations each day at which manufacturers and importers can give technical information to potential customers. The IED/MEMR can also present case histories of energy efficiency achievements. Private consulting firms would be invited to participate, as would the banks. The organization of the exhibition and technical presentations will be contracted to a suitable local firm, with overall supervision by the IED/MEMR.

Finally, consideration should be given to introducing a national awards scheme for achievements in energy management. Awards provide an incentive for individuals, and their achievements can serve as models for others.

With respect to mailing lists, the names of firms, interested individuals, addresses, and telephone numbers should be maintained by the IED/MEMR and kept up to date by regular consultation with the Amman Chamber of Industry and Chamber of Trade, as well as through contacts with universities. Cooperation to publicize the benefits of energy efficiency should be sought with organizations such as the Chamber of Industry and the Jordan Institute of Management, both of which have extensive contacts with industrial enterprises at the highest management levels (for example, see Appendix A).

TASK 3: CARRY OUT TRAINING

In addition to the promotional activities, many of which have an element of training, specific training courses should be conducted under the sponsorship of the IED/MEMR. The details of the course curricula and the corresponding participants

will be confirmed on completion of Task 1. However, it is envisaged that the following courses will be run in 1988:

(1) A 2-week course on the principles of energy efficiency improvement in industry. This will form a general introduction to industrial conservation and will address the following topics, at least:

- energy audits, monitoring, and targeting
- report writing
- principles of combustion; furnace and boiler efficiencies
- gas and oil burners; fuel handling
- combustion control systems
- principles of heat transfer; calculation of heat losses; heat recovery
- insulation
- steam generation and distribution
- drying and evaporation
- lighting equipment and controls
- energy audit instruments; plant instrumentation
- evaluation of electrical systems; power factor correction; energy saving for motors; load leveling; maximum demand controllers
- cogeneration systems
- typical conservation measures in selected industries
- the role of the energy manager
- project evaluation procedures
- the use of microcomputers
- government policies for energy conservation.

One or two experienced foreign experts will give lectures and there will also be participation by "guest lecturers" for the University of Jordan, local enterprises, banks, and the MEMR. The first course will be conducted by IED/MEMR; subsequent courses could be contracted out to local firms.

Within the course material, case studies and examples of energy efficiency achievements from Jordanian industry will be included wherever possible. Participants will be required to carry out calculation exercises in the classroom, to conduct several assignments during two fieldwork sessions under the general supervision of the lecturers, and to prepare a report and presentation on their findings and recommendations.

Up to 30 participants will be invited, including plant engineers, consulting firm staff, staff from loan approval departments of banks, and staff from the MEMR. Each participant will be given a comprehensive course manual. The emphasis throughout the course will be on practical work in industrial enterprises.

Depending on demand, this course could be repeated at the end of 1988 or early in 1989.

(2) A course on energy audit procedures of 1 to 2 weeks. This course will be carried out almost entirely in local factories, with up to 10 participants being trained in the practical techniques of auditing using portable instruments. One or two foreign lecturers will be used. Participants will be invited primarily from private consulting firms that have an interest in offering audit services to local industry.

(3) A 3-day course on energy efficient operation of boilers and steam distribution systems. Two days of this course will be conducted in the classroom and one day in a local factory where practical work on a boiler and steam system will be carried out by participants. A typical course manual for plant operators and supervisors is shown in Appendix B. Up to 20 participants from local enterprises and consulting firms will be invited. If possible, use will be made of the combustion and fuels testing facilities at the University of Jordan.

(4) A 2-day workshop on industrial energy efficiency for final year undergraduate engineers at the University of Jordan, Department of Chemical Engineering. This workshop will draw on the factory demonstration projects mentioned previously and will emphasize the practical side of energy conservation work. Up to 30 students will be accommodated at one session of the course. If demand is sufficient, several workshops could be run to accommodate students from other faculties.

The first workshop will be conducted by lecturers from the IED/MEMR and one foreign expert. Subsequent workshops could include lecturers from local consulting firms who have gained experience in audit work in Jordanian plants.

(5) 2- or 3-day further education courses in cooperation with the Faculty of Chemical Engineering at the University of Jordan. The faculty is proposing to conduct a series of short courses for practicing engineers and it we recommend that the IED/MEMR cooperate fully to provide lecturers and case history materials. Exact details of the courses will have to be developed with the University. As experience is gained with audit work and the implementation of conservation programs in local factories, representatives of consulting engineering firms would also be encouraged to participate under contract to the MEMR.

TASK 4: PROVIDE INFORMATION, ADVICE, AND TECHNICAL ASSISTANCE

This task will include the establishment of an energy information center to provide information to a wide audience on industrial energy efficiency. The center should be

conveniently located and operated by an organization such as the Amman Chamber of Industry or the Jordan Institute of Management, whose members can be encouraged to make use of the facilities provided. The information center should have available a full selection of reports and technical data related to energy efficiency in a broad range of industries; these reports should be obtained from the United States and other developed countries.

The energy information center should, of course, be familiar with the services offered by local banks, the Jordan Institute of Management, local consulting engineering firms, and equipment suppliers. Industrial enterprises can thus use the center to locate consulting services when needed and to identify possible sources of funds for energy conservation investments.

In addition to technical information, a data base of energy consumption information should be established at the IED/MEMR. Technical assistance through the ECSP should be provided to set up this data base, building on the regular data already being provided from local industry (see Exhibit 6). Comprehensive information on energy use and production rates should be gathered routinely and analyzed to check on specific energy consumptions; any variations or trends in energy intensity should be noted and the results of the analyses by the IED/MEMR sent to the factory concerned, with comments and suggestions where appropriate. Every quarter, the data should be aggregated by industrial subsector and a national report published. We recommend that at least 50 factories participate in the data base program.

Energy audits have been performed in some Jordanian factories, but the demand for audit services should increase as a result of the promotional elements of the proposed program. To encourage plant owners and managers to undertake audits, we propose that two or more consulting engineering firms be contracted for at least five comprehensive energy audits in 1988. The information developed in the course of audits, such as the magnitude of savings obtainable from specific energy conservation measures and their typical payback periods, will be entered in the IED/MEMR data base and used for the development of promotional literature. The audits will be conducted under the overall supervision of the IED/MEMR, with technical assistance provided under the ECSP. Audits will be free of charge to the factories in 1988. The policy for charging a proportion or all of the cost in future years should be established in consultation with the MEMR, the Chamber of Industry, and the USAID Mission, as we propose that local consulting firms continue to be contracted limited number of audits in 1989 as a means of stimulating the development of this type of service to industry.

Finally, we propose that a combustion testing service be established for industry, operated by local consulting firms. At the request of the plant manager, portable instruments will be taken to factories and the operation of boilers and furnaces checked rapidly. Simple adjustments will be carried out on the spot and a brief report of

Exhibit 6

MONTHLY ENERGY AND PRODUCTION DATA FORM

الطاقه الصافيه / التخطيط

الوزارة : شركة الفوسفات/ وحدة الاسمده

الشهر : تشرين ثاني ١٩٨٧

مصادر الوقود المشتراه (طن)		الوقود المستهلك لتوليد الكهرباء (طن)	الوقود المستهلك للتسخين (طن)	الوقود المستهلك للصناعه (طن)	الوقود المستهلك اجمالي الوقود المستهلك (طن)	المفقود من نهاية اليوم (طن)	الطاقه الكهربائيه م.و.س		العمل الاقصى م.و	الانتاج الصناعي	
										النوع	الكمية
زيت وقود	٩٨٢٦	٢٨٥٢	—	١٥٢٣	٤٣٧٥	١٠٥٩٩	المولده	١٣٠٩٥	٢١ر٩ يوم ١٠/٢٩ الساعه الثامنه مساءً	سماد	٤٨٠٠٠
سولار	٣٩٧	١٠	٥٨	٢٨٧	٣٥٥	٢٤٨	المشتراه	٠ر٦		حامض الفوسفوريك	١١٥٠٠
										حامض الكبريتيك	٥١٥٨٦
							المستهلكه داخل المحطات	١٢٨٠٤		حامض الفلوسيليسيك	٨٧٠
اخرى	—	—	—	—	—	—	اجمالي الطاقه المستهلكه	١٣٠٩٦			

PRODUCTION FIGURES ← ENERGY DATA →

اسم معبأ الاستمارة : هني عبد الهادي

توقيعه :

رقم الهاتف : ٣١٤١٥٥/ الموقع ـ العقبه

findings, plus recommendations for improvement, given to management. Proper combustion control is often neglected, because many factories lack the necessary instruments to check operating parameters. This service should therefore help factories save fuel through simple regular examinations, conducted approximately once a month. Initially, the service will be offered free of charge, but we recommend that a nominal charge be introduced after 6 months or so, to help offset the costs of equipment and transport. The combustion testing service will be established as a pilot project by contracting with two selected local consulting firms; training and equipment will be provided under the proposed program to firms selected after completion of Task 1. Overall quality control will be maintained by the IED/MEMR, which would be responsible for publicizing the availability of the service and the results obtained.

TASK 5: STUDY INCENTIVES AND REGULATIONS

To encourage consumers to seek ways of improving energy efficiency, some incentives may be necessary, at least in the first 2 or 3 years. One incentive that we believe is essential has already been described -- the provision of energy audits to factories. These audits should be free of charge for at least the first year, although it is desirable that a charge be introduced later. We believe industry will be reluctant to pay anything until it can be convinced of the potential benefits. The introduction of a charge will be part of the continuing process of bringing in the private-sector consulting firms to meet the demand for audits.

Other incentives that should be studied, in cooperation with the relevant government departments, include:

(1) Relief of customs duties for imported equipment or materials that are to be installed in energy efficiency projects (and that are not available from local manufacturers)

(2) More favorable tax treatment for energy efficiency investments, e.g., accelerated depreciation

(3) Low interest loans and loan guarantees for capital investments leading to improved energy efficiency.

We propose that these topics be studied through contracts to local consulting firms and university departments.

With respect to regulations, there are a few possibilities that should be considered but we do not believe in general that regulation by government agencies has much to offer as a means of assuring high energy efficiency in the industrial sector. We believe that, having set the prices for energy products at a rational level to take into account the long-term cost of supply, information and advice (and the availability of technical

support services) are most effective because the responsibility for efficiency is then left to the individual.

The ingenuity of plant owners, managers, engineers, and operators can be channelled to the goal of cost-effective energy conservation, as long as they can be convinced that they are acting in their own best interests. Imposition of minimum levels of energy efficiency by government is rarely successful in the industrial sector. Enforcement of regulations is a major problem, and the tendency is to force plants to a minimum level of efficiency and no further; the incentive to improve beyond a regulatory minimum is absent.

However, there are some areas where the regulatory approach should be investigated. For example, the reporting of energy consumption and production data could be made compulsory. This could be done through a mandatory report to the IED/MEMR, which would analyze the data and collect comparable figures for similar industries as already suggested, and it could also be done by requiring enterprises to report certain energy-related figures in their annual reports. We have already recommended that the present system whereby plants report each month to the MEMR be extended to cover a more representative selection of plants and subsectors, preferably on a voluntary basis, but by regulation if absolutely necessary.

Regulations could also be introduced in the factory licensing procedures to ensure that the energy efficiency of a new plant is considered carefully by both owners and designers. Simple questions should be included in license application forms, such as:

(1) What is the cost of energy as a percentage of total operating costs for the proposed factory? (A list of typical values could be given to the appropriate department of the Ministry of Industry for comparison purposes, see Task 3, item 6.)

(2) Have energy efficiency improvements been considered in the design for the factory/processing plant, and have any such improvements offering paybacks under 2 years been rejected?

No mandatory sanctions need be taken against companies with high energy costs or companies that have rejected energy efficiency investments with short paybacks, but the attention of plant owners should be drawn to the opportunities that may exist to make worthwhile improvements and thereby increase profits.

In conjunction with data reporting, regulations could be introduced to require all firms with boilers or furnaces to have their efficiency checked regularly (every 6 months, for instance) in the same way that safety inspections are usually carried out. The checking of combustion efficiency has already been discussed and a combustion testing service is to be established. The minimum level of efficiency would not be specified by the regulations. Rather, the test would serve to alert plant personnel to energy waste.

Ideas for regulations that would enhance energy efficiency without adding unwanted bureaucratic controls should be investigated carefully by the IED/MEMR before being formulated as proposed legislation through the MEMR.

With these points in mind, local consulting firms and university departments should be contracted to carry out the following types of special studies as part of task 5:

- Customs Duties and Import Licensing Procedures

  This study should examine the current situation with respect to the procedures and costs involved in importing equipment and materials for energy efficiency projects, where such items are not available locally. Difficulties in obtaining items from overseas should be highlighted, the impact on energy efficiency in Jordanian industry evaluated, and recommendations for improvements made. It is possible that a system of customs duty exemptions for specified categories of equipment could have a significant effect on energy-related investments.

- Licensing Procedures for New Factories

  This study should examine the existing application and approval procedures and suggest ways in which energy efficiency could be encouraged for new factories or for major extensions to existing plants. The objective should be to promote energy efficiency without introducing burdensome bureaucratic controls and delays into the licensing procedure.

- The Efficiency of Rewound Motors

  Rewinding electric motors is often an inexpensive alternative to replacement. Unfortunately, there is rarely any check of quality standards applied in the rewinding process, with the result that rewound motors are often much less efficient than they could be, and certainly much less efficient than new motors. The situation in Jordan should be investigated and the extent of rewound motor use established. Measurements of motor efficiency should be made on a test rig, which could be installed at the University of Jordan. Findings should be reported and recommendations made for ensuring that the quality of rewinding work is acceptable, possibly through the introduction of compulsory motor testing and quality certification.

- Taxation and Energy Efficiency Investments

  This study should examine the present taxation system, particularly as it applies to small- and medium-sized enterprises that are considering investments in energy efficiency projects. The effect of incentives such as accelerated depreciation on the willingness of these enterprises to invest should be investigated.

- Funding Mechanisms for Energy Conservation Projects

  Following on from the previous item, the need for additional assistance to enterprises to help them obtain funds for capital investments should be examined. Suggestions were made during the initial visit in January that some firms will only invest in energy conservation if exceptionally favorable terms are offered. These would include loans at subsidized interest rates and loan guarantees to protect an enterprise should a project have a poorer payback than anticipated (and thus the ability to repay a loan would be impaired). Financial barriers to energy conservation projects should therefore be examined in detail and appropriate recommendations made. We are not yet convinced that additional incentives are needed. We believe that much of the apparent reluctance to invest is actually a combination of lack of awareness of potential benefits and the inability of enterprises to diagnose problems and define solutions. Investments are not made because projects with attractive paybacks have simply not been developed, especially in smaller enterprises.

- Increasing Efficiency in the Consumption of Electricity by Demand Management

  The electricity pricing component of the ongoing Energy Planning and Pricing Study for MEMR has identified opportunities for demand management at larger consumers in the commercial and industrial sectors. These include the use of interruptible tariffs and load control. This study should undertake a survey of this customer segment to better identify and define the target population for demand management, as well as the most effective strategies and the likely potential (in MW) for peak shaving. The study should also identify the hardware and software needs for conducting a demonstration program with selected customers, and design such a program. The next phase of this study would involve evaluating the demonstration program results and, based on the findings, developing a national demand management program.

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4 SUGGESTED TIME TABLE

The five tasks described in Section 3 represent a considerable work load for the IED/MEMR, for local consulting engineering firms, and for university departments. It is clear that effective overall supervision of the program by the IED, assisted through the ECSP, will be critical to its success.

A suggested time table is presented as Exhibit 7 covering a period of approximately 1 year. Many of the activities will take place over a long period of time and will continue after the first year.

Exhibit 7

PROPOSED TIME SCHEDULE

ITEM/TASK	'88 July	August	September	October	November	December	'89 January	February	March	April	May	June	July	August
TASK 1 CAPABILITIES & NEEDS ASSESSMENT														
Private sector assessment	********	**********	**********											
IED/MEMR assessment			********											
Market for energy services	Initial planning meeting in July (10 days)			**********	**********									
TASK 2 PROMOTIONAL ACTIVITIES														
Seminars for owners			(3) ***			***			**					
Technical guidebooks					**********	**********								
General booklet						********								
Journal articles				***		***			***			***		
Report on energy conservation			*	*	*	*	*	*	*		*	*	*	*
Energy costs study						**********								
Demonstrations					** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** **									
Equipment exhibition					* * * * ** * * * ** * * * * ***									
National awards								* * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * *					
Mailing lists, etc.			** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** **											
TASK 3 TRAINING														
Energy Efficiency			* * * *	* * * * *****				* * * * * ******						
Energy Auditing				* * * * *****			* * * * * * *****			* * *****		* * *****		
Boilers/steam systems								* * * ***		* * ***		* * ***		
Workshop for undergraduates											* * * * *****			
"Further education"			* * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ** * * * ->											
TASK 4 INFORMATION, ADVICE, TECH. ASSIST.														
Energy information center		** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ** ->												
Data base			** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ** ->											
Audits							** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ** ->							
Combustion testing							** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ** ->							
TASK 5 INCENTIVES, REGULATIONS														
Special studies					** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ***** ** ** ->									

5 COST ESTIMATES

Based on the proposed program, we have estimated the level of activity and produced two cost estimates. We assumed that at least two staff members from the IED/MEMR would be available to work on the program on a full-time basis.

The first six months' activities, through 1988, will include all of Task 1. Local consulting engineering firms will have been evaluated and suitable firms (or individuals from university departments, for example) selected to start work on promotional activities, such as the preparation of guidebooks and journal articles and the organization of the equipment exhibition. By December 31, a total of six seminars will have been conducted for plant owners. A solid start will have been made with the energy efficiency demonstrations.

By December 31, the training program will also have been fully developed. The first basic course for engineers will have been completed, as well the first course specializing in energy auditing techniques. Plans will therefore be well advanced for the audit work and combustion testing service to be carried out as part of Task 4. Work with the IED/MEMR will also have advanced significantly with respect to establishing the energy information center and data base on energy consumption trends. We would also expect to have conducted, through the IED/MEMR and local firms, much of the survey work for two or more of the special studies under Task 5.

The end of 1988 thus represents a milestone for the program, as most of the program elements will have been tested at least once, or work will have been advanced sufficiently for judgments to be made regarding how the remainder of the activities can be completed using the combination of local firms, the IED/MEMR staff, and outside technical assistance. We do not suggest, however, that the program could be split into two self-contained phases of 6 months each; the first 6 months is the "development and testing" phase, on which the activities of the second 6 months are build and brought to a successful conclusion.

The cost estimates are:

	July-Dec. 1988	Jan-June 1989	Totals
Technical Assistance			
Labor at $550 per day	90 days $49,500	85 days $46,750	$96,250
Air travel at $1,800 per trip	5 man trips $ 9,000	3 man trips $ 5,400	$14,000
Per diem at $105 per day	75 days $ 7,875	70 days $ 7,350	$15,225
	Subtotal 66,375	59,500	125,475
Local contractors			
Labor at $200 per day	110 days $22,000	110 days $22,000	$ 44,000
Travel and local per diem	$ 2,000	$ 3,000	$ 5,000
	Subtotal $24,000	$25,000	$ 49,000
Reports, books, films	$ 1,000	$ 1,000	$ 2,000
Telex, Telephone, reproduction and supplies (including some simple testing instruments)	$ 4,000	$ 2,000	$ 6,000
	Subtotal $ 5,000	$ 3,000	$ 8,000
	Totals $95,375	$87,500	$182,875
	Rounded $95,500	$87,500	$183,000

Appendix A

JORDANIAN INDUSTRIES' EXHIBITION

TO ALL VISITORS

We are glad for your visit to the Permanent Jordanian Industries Exhibition , where you will find samples of Jordanian Inudstrial Products of the following Industrial sectors :-

• Leather Products • Therapeutic Products • Plastic & Rubber Products • Chemical Products • Cosmetics & Perfumes • Engineering Products • Furniture , Doors , Windows • Construction Products • Printing , Paper & Stationery • Food & Supply Products • Woven Industries • Packing & Packaging Products • Agricultural Products .

Please , do not hesitate to consult the Exhibition supervisor for any information you might be in need of or you may contact , Amman Chamber Of Industry on the address shown on the front page of this booklet .

Thank you for your visit

Open : 8.00 - 13.30 DAILY

15.30 - 17.30 DAILY EXCEPT SUNDAY & THURSDAY

Close : FRIDAY & National Holydays .

YOUR GUIDE TO

PERMANENT

JORDANIAN INDUSTRIES EXHIBITION

AMMAN CHAMBER OF INDUSTRY

P.O.BOX : 1800 AMMAN - JORDAN

TEL . 643001 - 644569

TLX : 22079 INDUST - JO

NO.	NAME OF COMPANY	TEL	TELEX	P.O.BOX	KIND OF PRODUCTS
[illegible]	SHIRIN LADYS BAGS	707525	—	415062	LADY'S HAND BAGS
[illegible]	ZACHAL INDUSTRIAL CO.	731184	22213	89	SPORTS SHOES
[illegible]	KIMCHIK SHOES	773963	—	510628	SHOES
[illegible]	THE JORDAN TANNING CO. LTD.	651[illegible]	[illegible]23	776	TANNING
[illegible]	INTERNATIONAL LEATHER PRODUCTS CO.	902276 ZARKA	41423	776	SHOES
6.	MUSALLAM SHOES CO.	779106	21792	926374	SHOES
[illegible]	BITAR SUITCASES INDUSTRIES CO.	818210	22000	102255	HAND BAGS , SCHOOL BAGS , SUITCASES
[illegible]	AL- HIKMA PHARMACEUTICALS CO.	811692	22328	182400	PHARMACEUTICAL DRUGS
[illegible]	JORDAN MEDICAL CORPORATION CO. LTD.	668448	22195	20525	DISPOSABLE SYRINGES .
[illegible]	THE ARAB PHARMACEUTICAL MANUFACTURING CO. LTD.	685121	21315	1695	PHARMACEUTICAL DRUGS
11.	ARAB CENTER FOR PHARMACEUTICALS & CHEMICALS .	722470	23728	22 SAHAB	GELATIN CAPSULES
12.	JORDAN OPTICAL MANUFACTURING CO.	817466	21066	141220	OPTICAL FRAME GLASSES
13.	ARAB VETERINARY INDUSTRIAL CO.	628[illegible]	[illegible] 20	150906	VETERINARY DRUGS
14.	RADAH ABDEEN AND BROS CO.	630594	21763	3499	PL. MATS / BRUSHES
15.	GENERAL PLASTIC IND.	894111	23018	17095	PL. PIPES
[illegible]	JORDAN TYRE RETREADING CO. LTD.	892218	21271	15263	TYRES RETREADING
17.	AL- AHLI PLASTIC FACTORY CO.	644705	21829	8175	PLASTIC CONTAINERS

Appendix A (Continued)

JORDANIAN INDUSTRIES' EXHIBITION

NO.	NAME OF COMPANY	TEL.	TELEX	P.O.BOX	KIND OF PRODUCTS
[illegible]	ARAB FOAM FACTORY CO.	091366	21216	1368	FOAM
[illegible]	NATIONAL FOAM FACTORY	625593	23347	64	FOAM
[illegible]	JORDAN RUBBER INDUSTRIES CO.	785157	22339	240	RUBBER SPARE PARTS FOR CARS & MACHINERY
[illegible]	WORLD PLASTIC INDUSTRY	722041	21620	53	ELECTROPIPES AND THERMOPIPES
[illegible]	JORDAN PLASTICS CO.	793144	21717	2394	KITCHEN UTENSILS / FOAM
[illegible]	JORDAN CARBONATE CO.	895930	21930	1059	CALCIUM CARBONATES
24.	JORDAN CHEMICAL INDUSTRIES CO. LTD.	654433	21663	3380	DETERGENTS
25.	MUDIEB M. HADDAD & SONS CO.	985720	41424	1195	COSMETICS AND PERFUMES / POTATO CHIPS
[illegible]	ARAB POTASH CO.	ZARKA		ZARKA	
27.	THE INDUSTRIAL , COMMERCIAL & AGRICULTURAL CO. LTD.	666165	22152	1470	POTASH SALTS
28.	HOUSEHOLDS & TOILETRIES MANFACTURING CO.	981946	41434	6066	COSMETICS , SOAP, SHAMPOO, SHAVING - CREAM, TOOTH PASTE,DETERGENTS, BISCUITS.
[illegible]	JORDAN INDUSTRIES AND MATCH CO,/ JIMCO	ZARKA			
[illegible]	MODERN CHEMICALS CO./ KIMA.	663216	21316	1027	COSMETICS, DETERGENTS .
31.	JORDAN PETROLEUM REFINERY CO. LTD	651241	[illegible]	7970	MATCHES
[illegible]	AL NAJAH SOAP FACTORIES CO.	642919	21966	2225	DETERGENTS , SHAMPOO, SOAPS .
[illegible]	KALIS EXPANDED METAL MANF. CORP.	630151	21246	1079	LUBRICATING OILS.
		894744	—	157	DETERGENTS , SOAPS.
		721699	23629	925486	ANGLE BEADS , CORNER MESH

NO.	NAME OF COUNTRY	TEL.	TELEX	P.O.BOX	KIND OF PRODUCTS
[illegible]	ADNAN SHA'LAN AND PART.	621121	21613	1420	GAS OVENS
[illegible]	HOUSE HOLD APPLIANCES MFG. CO.	781299	23428	926123	REFRIGERATOR'S
[illegible]	ABDIN INDUSTRIAL EST.	813219	21147	141399	METAL SHELVES
37.	NATIONAL CABLE AND WIRS MANUFACTURING CO.	601[illegible]	23[illegible]	927104	E. CABLES & WIRES.
[illegible]	JAMAL SADEDDIN STEEL MANUFACTURING CO.	651206	22421	8540	STEEL WORKS
39.	KHALIFEH INDUSTRIAL CO.	891890	21030	340920	VALVES
40.	ALADDIN INDUSTRIES CO. LTD.	623098	23180	183661	COOKERS , STOVES . LADDERS .
41.	INTERNATIONAL SYSTEMS AND ELECTRONIC DEVELOPMENT CO. / SEDCO .	678115	23907	414	ELECTRONIC SYSTEMS
42.	INDUSTRIES FOR CONSTRUCTUINAL EQUIP CO. LTD	08541038	22331	926055	SCAFFOLDINGS
[illegible]	HUMAID MAJED AL- HUDHUD AND PARTNERS CO.	MADADA			
[illegible]	ARAB ALUMINIUM INDUSTRY CO. LTD.	743085	21345	183024	METAL FOUNDRY (BRASS + METAL BARS)
[illegible]	ARAB SOLAR INDUSTRIES CO.	84717	21[illegible]3	35042	ALUMINIUM PROFILES
46.	MOHAMAD AHMAD AL SHAMI AND PART	663355	21355	2858	SOLAR ENERGY HEATERS
47.	HAMPARSOUM HALAJIAN FACTORY	018002	22401	258	COOKERS
48.	IZMIQNA INDUSTRY AND TRADE CO.	743166	—	510868	METAL FOUNDRY
		776512	—	7205	AUTO SPARE PARTS

Appendix A (Continued)

JORDANIAN INDUSTRIES' EXHIBITION

					P.V.C. DOORS & WINDOWS
[illegible]	INSUSTRON INSULATION INDUSTRIES	891999	22092	340529	INSULATION MATERIALS / FURNITURE
52.	KURDIEH AND HAKIM ALUMINIUM CO.	794[illegible]	23[illegible]	1037	ALUMINIUM WINDOWS & DOORS
53.	JORDAN INDUSTRIAL INVESTMENTS CORP.	722911	27228	927021	GAS OVENS , WASHING MACHINES .
[illegible]	THE JORDAN PIPES MANUFACTURING CO. LTD.	651451	21519	6899	STEEL PIPES
[illegible]	METAL INDUSTRIES CO.	894506	—	4051	RADIATORS / BOILERS
[illegible]	JORDAN ORNAMIN CO.	817233	23427	35147	MILAMIN KITCHEN UTENSILS
[illegible]	THE JORDAN CEMENT FACTORIES CO. LTD.	729901	21239	610	CEMENT
58.	UNITED CHEMICAL CO. LTD.	790802	21408	3458	PAINTS
59.	GHASSAB AL QADI AND CO.	664564	22064	921313	TILES MARBLES AND MARBLE CHIPS
60.	REMALUX PAINTS FACTORY CO.	891933	23930	15362	PAINTS
61.	JORDAN BRICK AND TILE MANUFACTURING CO.	666131	21693	9578	BRICKS , TILES
62.	ARAB COMPANY FOR WHITE CEMENT INDUSTRY	6686[illegible]	24[illegible]1	960403	WHITE CEMENT
[illegible]	JORDAN LIME AND SILICATE BRICK INDUSTRIES .	662340	22157	3040	LIME AND SILICATE BRICKS
[illegible]	JORDAN BITUMINOUS PRODUCTS CENTER .	847121	—	852	BITUMEN COATINGS
[illegible]	JORDAN SIPES PAINTS CO. LTD.	797292	21876	276	PAINTS
66.	JORDAN ROCK WOOL INDUSTRIES CO. LTD.	602139	23197	926932	ROCK WOOL (INSULATION)
67.	JORDAN GLASS INDUSTRY CO. LTD	641882	21412	3079	GLASS SHEETS

NO.	NAME OF COMPANY	TEL.	TELEX	P.O.BOX	KIND OF PRODUCTS
[illegible]	DANISH JORDANIAN DAIRY CO. LTD.	844700	23035	927132	ICE CREAM , DAIRY PRODUCTS
[illegible]	LAZIZA FACTORIES CO.	722991	23733	39 SAHAB	CONFECTIONERY - NUTS
			LAZIZ JU	IND. ESTATES	
70.	ABDUL AZEEM SHARAUDI AND BROS	636700	23[illegible]	6712	CHEWING GUM , CHOCOLATE , SWEETS , TOF
71.	CONFECTIONERY AND CHEWING GUM FACTORY CO.	621456	21602	7957	CHEWING GUM , CHOCOLATES , SWEET.
72.	JORDAN TOBACO AND CIGARETTE CO. LTD	777112	21204	59	CIGARETTES
73.	ARAB INVESTMENT AND INTERNATIONAL TRADE CO.	731191	23216	94	HYGIENIC PAPER
74.	JORDAN BREWERY CO. LTD	625161	21323	312	ALCOHOLIC DRINKS
75.	SA D ABU JABER AND SONS .	625161	21323	312	ALCOHOLIC DRINKS
76.	ARAB FOOD INDUSTRIES CO.	819132	23520	500	POTATO CHIPS , SOUP , BABY FOOD
77.	JORDAN DAIRY CO.	953358 ZARKA	41429	6474	ICE CREAM , DAIRY PRODUCTS
78.	FINE HYGIENIC PAPER CO. LTD.	652688	24134	154	HYGIENIC PAPER.
79.	JORDAN ICE AND AERATED WATER CO.	892014	24266	146	SOFT DRINKS
80.	WOOLLEN INDUSTRIES CO.	892724	21[illegible]4	1728	BLANKETS
81.	JORDAN CLOTHING CO.	625118	21802	457	CLOTHING
82.	RAMA TRICO FACTORY	775724	—	10172	CLOTHING
83.	NAWRAS FACTORY	646280	—	922314	CLOTHING
84.	NATIONAL SEWING AND TRADE WORK SHOP.	639690	—	6173	CLOTHING

Appendix A (Continued)

JORDANIAN INDUSTRIES' EXHIBITION

NO.	NAME OF COMPANY	TEL.	TELEX	P.O.BOX	KIND OF PRODUCTS
[illegible]	KALBOUNEH FASHION	625530	—	—	CLOTHING
[illegible]	JORWAN FACTORY CO.	668239	—	922303	CLOTHING
[illegible]	[illegible] READY CLOTHES FACTORY	621692	24274	7020	CLOTHING
88.	THE JORDAN WORSTED MILLS CO. LTD.	953 ZARKA	21	6060	WORSTED MILLS
89.	UNION WORKSHOP SEWING	630004	—	183051	CLOTHING
[illegible]	AL HAMIDIEH SEWING WORK SHOP	630908	—	150943	CLOTHING
91.	AL ANWAR PLASTIC CO.	893199	—	15115	PLASTIC BAGS
92.	MODERN PLASTIC YARN FACTORY	893454	—	6154	PLASTIC YARN
93.	EST. HISHAM ZABIAN	645223	21575	011727	PLASTICS CONTAINERS
94.	JORDAN ENVELOPES FACTORY	656255	21543	747	ENVELOPES , PAPER , PLASTIC BAGS
95.	AL- SAYYED PRINTING	655849	21500	20070	LABELS
96.	JORDAN PRINTING AND PACKAGING CO. LTD.	796111	21776	6068	BOXES
97.	IZZAT AL- SARAYJI & CO.	639024	—	23407	PLASTIC STRAWS
98.	SULTAN PLAST IND. CO.	954101 ZARKA	41444	15147	PLASTICS CONTAINERS
99.	MOHD ASA'D INDUSTRIAL EST.	679111	—	925066	POLYESTRYN PRODUCTS
100.	TECHNICAL INDUSTRIAL PLASTICS CO.	668419	22051	8864	PLASTIC - DRIP IRRIGATION
101	JORDAN PHOSPHATE MINES CO.	660141	21223	30	PHOSPHATE
102	ARAB MINERAL WATER CO.	623231	21575	2011	MINERAL WATER

NO.	NAME OF COMPANY	TEL.	TELEX	P.O.BOX	KIND OF PRODUCTS
103	JORDAN CERAMIC INDUSTRIES CO. LTD	_621170	21610	1410	CERAMICS
104	ISAM ABU EITA AND CO.	736365	21628	925126	BED COVERS
105	HISHAM B. QALAM (BADIA FACTORY)	982027 ZARKA	41435 ZARKA	5043	CLOTHING
106	DIRANI & PHARAON CO.	817527	23876	211	FURNITURE FOR SCHOOLS - GARDENS RESTAUR

Appendix B

ENERCON-87-47

May 1987

ENERCON
The National Energy Conservation Center
Buland Markaz, 33, Blue Area
Islamabad, Pakistan

Ministry of Planning and Development
Government of Pakistan

FOREWORD

Recognizing the urgency of energy conservation on a national level, the Government of Pakistan has established the National Energy Conservation Centre (ENERCON) in the Ministry of Planning and Development. ENERCON is leading and coordinating Pakistan's National Energy Conservation Programme, through technical assistance services, special policy studies, information and publications, and training courses.

As part of its commitment to fostering the conservation of energy in Pakistan, ENERCON has undertaken the preparation and distribution of a series of technical manuals. This manual on efficient operation of boiler systems is the second in this series.

Targeted to engineers and technicians managing and operating industrial and commercial facilities, these manuals offer a number of unique approaches:

1) a description of equipment and systems from the point of view of energy consumption and energy efficiency

2) tips and detailed ideas on how to improve and maximize energy efficiency of the equipment

3) methodologies and step by step approaches for calculating and implementation energy saving ideas.

We at ENERCON envision this boiler manual to be equally useful to experienced engineers looking to improve their understanding of concepts of energy efficiency, as to engineering students looking at their first real application of basic engineering principles. This manual is offered as a companion to a training workshop on this subject. Nevertheless, as the other manuals in the series, it is also a source of valuable energy information, to be referred to again and again in the future.

Careful management and efficient utilization of energy in all its forms is of crucial importance to the continued development of Pakistan. Engineers and technical managers have a large and responsible role to play in this national effort. With manuals, training courses, and other technical information and assistance, ENERCON is pledged to continue its detailed technical support of concerned engineers and technicians working together on The National Energy Conservation Programme.

Engr. Sadaqat Hasan Mir, Managing Director, ENERCON

May, 1987

Prepared in Collaboration with:

Hagler, Bailly & Company
Buland Markaz, 33, Blue Area
Islamabad, Pakistan

and

E/DI Europe Ltd.
38 Wigmore Street
London WIH 9DF

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