



SYR/97/001

15 November 1998

Dear Mr. Philby,

Subject: **SYR/97/001 - SYR/96/G31 - SYR/97/E02**

Supply-Side Efficiency and Energy Conservation and Planning

We are pleased to enclose herewith, for your information and records, copy of the above project document duly signed by H.E. Dr. Abdul Rahim Subei, Minister of State for Planning Affairs, on behalf of the Government, H.E. Mr. Muneeb Saem El-Daher, Minister of Electricity, on behalf of the Executing Agency and Mr. Fawaz Fokeladeh, Assistant Administrator and Regional Director RBAS, on behalf of UNDP.

With best regards.

Yours sincerely,


Taoufik Ben Amara
Resident Representative

Mr. Philby

Mr. Khaled Philby
Chief,
Country Operations Division
RBAS, UNDP, New York

Cc: Mr. Dale Leach
Finance Officer
RBAS, UNDP, New York
(with copy of encl.)

**PROJECT OF THE SYRIAN ARAB REPUBLIC
UNITED NATIONS DEVELOPMENT PROGRAMME
GLOBAL ENVIRONMENT FACILITY**

PROJECT DOCUMENT

Number & Title: SYR/96/G31/A/1G/99
SYR/97/001
SYR/97/E02
Syria: Supply-Side Efficiency and Energy Conservation and Planning

Estimated start date: November 1998
Estimated end date: November 2002
Executing agency: Government of Syria/Ministry of Electricity
Government Cooperating agency: Ministry of Electricity
Implementing Agency: Ministry of Electricity
Project Site: Damascus and Banias, Syria
Beneficiary Countries: Syria

Summary of UNDP and cost-sharing inputs \$

(as per the attached budget)

UNDP:	
TRAC (1&2)	\$505,000
GEF	\$4,070,000
Other: OPEC Fund	\$180,000
Total:	\$4,755,000

Classification Information:

ACC sector and subsection:	035 Energy
DCAS sector and Subsector:	Energy
Government sector and Subsector:	Energy
Primary areas of focus/sub-focus:	
Secondary areas of focus/subfocus:	
Primary type of intervention:	
Secondary type of intervention:	
Primary target beneficiaries:	

Government inputs: (local Currency)
(in kind) 37,700,000
(in cash) _____

Brief Description: The goal of this project is to reduce greenhouse gas emissions in Syria by improving demand-side energy efficiency through the creation of a multi-purpose Syrian Energy Services Center (SECS) and National Energy Efficiency Program (NEEP), and by improving supply-side efficiency through the demonstration of Efficiency Management Systems and Maintenance Management Systems (EMS/MMS) in the Banias Power Plant.

The SECS will provide energy efficiency services to public and private sector industries and businesses with a goal of eventually becoming an independent, commercially viable corporation. The NEEP will provide a broad range of supporting activities including information dissemination, awareness programs, national efficiency research and program design, and policy analysis.

On the supply side, the EMS/MMS program will create a central capability to provide technical assistance to all power plants in Syria to establish efficiency and maintenance management systems. The demonstration project will achieve immediate GHG reductions and will also serve as a training experience for the Ministry of Electricity staff involved so that this technology can be replicated in other plants.

Overall, the project will create the institutional capacity within the Ministry of Electricity to improve energy efficiency both within its own operations as well as among its consumers, on a sustainable basis.

On behalf of:

Signature

Date

Name/Title



H. E. Dr. Abdul Rahim Subei
Minister of State for Planning Affairs
H. E. Mr. Muneeb Saem El Daher
Minister of Electricity
Mr. Fawaz Fokeladeh
Assistant Administrator &
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Official Exchange Rate at time of last signature of project document is \$1=SP46.00

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ACRONYMS

CO ₂	Carbon dioxide
DSM	Demand Side Management
EMS	Efficiency Management System
ESMAP	Environmental Sector Management Assistance Programme
ESSP	Energy Sector Support Project
EU	European Union
GCEP	General Corporation for Environmental Affairs
GEF	Global Environment Facility
GoS	Government of the Syrian Arab Republic
GHG	Greenhouse Gases
HFO	Heavy Fuel Oil
IRP	Integrated Resource Planning
JICA	Japanese International Cooperation Agency
kW	Kilo Watt
kWh	Kilo Watt Hours
METAP	Mediterranean Environment Technical Assistance Programme
MMS	Maintenance Management System
MoE	Ministry of Electricity
MoEc	Ministry of Economy
PEDEEE	Public Establishment for Distribution and Exploitation of Electric Energy
PEEGT	Public Establishment of Electricity Generation and Transmission
PRIF	Pre-Investment Feasibility
PPER	Project Performance Evaluation Report
SESC	Syrian Energy Services Center
SPC	State Planning Commission, or Syrian Petroleum Company
TPR	Tripartite Review
UN DESA	United Nations Department for Economic and Social Affairs
UNDP	United Nations Development Programme

SECTION A

A. CONTEXT

The Syrian Arab Republic has a developing, mixed-sector economy. Beginning with the nationalization of all large industries in the 1960s, the public sector continued to grow and dominate much of the Syrian economy. However, declining performance of the public sector industries and the power sector in particular in the 1980s led to the need to begin the introduction of private capital investments. Syria has thus embarked on a gradual transition from a public sector dominated economy to one based increasingly on market principles.

This transition is made more difficult by a rapidly increasing population. With an annual growth rate around 3.6%, one of the highest in the world, the current population of approximately 16 million is expected to double by 2025. In addition, 60% of the population is under 20 years of age, thus creating enormous pressure for the economy to create new jobs as this age group enters the work force.

The Syrian economy grew rapidly during the early 1990s when GDP growth averaged 7-8% per year from 1990-93. However, declining oil revenues, falling external aid and rising inflation have reduced economic growth in subsequent years. Nonetheless, the nearly several billion dollars in foreign assistance as a result of the Gulf War enabled the country to invest heavily in new power generation capacity, such that at the present time the power shortages which plagued the country for almost a decade have virtually been eliminated. Still, with electricity demand growing at an annual rate of around 8%, demand will again exceed supply by the year 2004.

Syria is succeeding in gradually liberalizing its economy and attracting both domestic and foreign investment. The legal framework provided by the 1991 Law No. 10 for the Encouragement of Productive Investment has resulted in several billion dollars of private investment in new businesses in the past six years and the creation of thousands of new jobs. Continued economic growth will depend in part on the ability to improve energy efficiency on both the supply and demand sides. On the supply side, for example, only 65% of net electricity generated is actually sold to consumers, the remainder being lost in the distribution system either through technical inefficiencies or billing, collection, metering and theft problems. On the demand side, almost half of final electricity demand is consumed inefficiently in homes and small businesses, and another quarter in the industrial sector. The challenge for Syria in the future will be to match the heavy investments it has made in the supply side with similar investments in efficiency improvements in order to keep supply and demand in balance as the country continues to grow. This will require a new focus on efficiency throughout the economy, following a strategy which allows programs and institutions to evolve gradually toward a more market oriented system.

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1. Description of the Sector

Syria possesses significant indigenous energy resources relative to its own internal demand. Proven oil reserves are estimated at 400 Mtoe, or about 30 times current total national energy consumption. Proven natural gas reserves are equivalent to 200 Mtoe, and hydro-electric resources are estimated at 4,500 GWh annually, equivalent to about 1.2 Mtoe. Although oil supplies appear ample, the export of Syrian crude oil and petroleum products represents an important source of foreign exchange. In 1995, 61%, or 18 Mtoe, of crude oil production was exported, equal to more than \$1 billion in foreign trade income, or over half of Syria's export revenue.¹ Given both internal consumption and the export of oil, proven recoverable oil reserves will last little more than a decade at current rates of extraction of approximately 30 Mtoe/year. Prospects for further large discoveries of oil are very limited and Syria is expected to become a net importer of energy by the middle of the next decade.² Thus, efforts to substitute oil with other energy sources and to improve the efficiency of its use are of critical importance to the national economy.

Although there is little use of renewable energy at the present time in Syria, there is considerable potential for both solar and wind energy. Photovoltaic systems could be used to serve remote areas where 4% of Syria's population remains unserved with electricity and grid extension is too costly. Solar water heaters would be cost effective if their development were subsidized to the same extent as conventional energy. Power generation from wind is also possible in the south and central regions. A potential of 7 Mtoe also exists from tar sands and 65 Mtoe from oil shale but would not be economical until the price of oil reached USD 30 per barrel.³

Total energy consumption in 1996 was 13.5 Mtoe, with 32% of this energy being used for power generation, 20% in the transport sector, 22% by the household, commercial and public sector, 22% by the industrial sector and 4% by the agriculture sector. Within the power sector, 15.8% of electricity generated is lost due to technical inefficiencies in the transmission and distribution system, 45.9% is consumed by the residential sector, 24.4% by industry, 4.2% by the commercial sector, 4.8% by agriculture, and 1.8% was exported to Lebanon. Electricity demand has been growing at close to 8% annually since 1990 and is expected to continue at this rate for the foreseeable future.⁴

Energy intensity grew at a rate of 2.2% from 1982-92, reflecting growth in energy consumption without equivalent growth in economic output. Syria's energy intensity is now 25-35% greater than that of Jordan or Turkey, but less than that of Egypt, indicating substantial potential for

¹ UNDP Proposal for Review, *Syria: Supply-side Efficiency and Energy Conservation and Planning*, 1997

² Electricité de France, *Generation and Transmission Master Plan, Global Summary*, June 1997, p. 5

³ Electricité de France, *Generation and Transmission Master Plan, Global Summary*, June 1997, p. 6

⁴ Syrian Arab Republic, Ministry of Electricity, *Annual Statistical Report Year 1995*

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efficiency improvements. Both energy and electricity use per capita are about 10% lower in Syria than in Jordan or Turkey.⁵

Syria has dramatically shifted its electricity production from heavy fuel oil to natural gas in the past decade, from no generation from natural gas in 1987 to 41% in 1995.⁶ Use of this gas, which was previously flared at the oil field, has permitted the heavy fuel oil to be exported. All generation plants are now capable of burning natural gas except the Banias power station, which lacks a gas pipeline, although plans are also to convert it to dual fuel. The Banias plant generated about 20% of the electricity produced by the PEEGT in 1995. Current plans are to shift most electricity production to natural gas. Overall, natural gas provides about 25% of Syria's total energy needs.

Energy prices are heavily subsidized, thus giving incorrect price signals to the economy relative to the efficient use of energy. The average price of electricity is 1.6 US cents/kwh, versus a long run marginal cost at the transmission level of 5.3 US cents/kwh. There is no demand charge to large industrial customers and although there is a penalty for low power factor, it is not well enforced. The power factor fluctuates considerably and could be as low as 0.6. The effect of below market prices is further aggravated by the electricity metering, billing and collection system, where non-technical losses are actually increasing, from around 19% in 1993 to 23% in 1997.⁷

2. Host Country Strategy

Syria's overall economic strategy is to proceed smoothly from a centrally planned economy to a more market-oriented economy without incurring social disruption. This economic liberalization was initiated in 1991 with Law No. 10, which permits the establishment of private enterprises (including independent power) upon approval by the Syrian government.

In the energy sector, Syria's primary strategy is to substitute gas for oil in order to obtain increased foreign exchange revenues from oil exports and to extend the period it can be self-sufficient in energy. Natural gas reserves will last about 60 years at current rates of production, whereas oil reserves will only last 13 years at current rates. The key target for the gas-to-oil strategy has been the power sector, where gas is expected to account for almost half of fuel consumed in electricity generation. Currently, 80% of all natural gas produced is consumed in electricity generation. Other sectors are also under consideration for conversion to gas, such as home heating, where fuel oil is burned in units with very low efficiencies. However, the growth of gas production is not expected to exceed a maximum level of between 4-5 Mtoe per year, whereas even if only those power plants which currently can burn natural gas all do (2,240 MW),

⁵ Ekono Energy Ltd., *Feasibility Study: Capacity Building for Demand Side Management and Power Plant Efficiency*, 1994

⁶ Syrian Arab Republic, Ministry of Electricity, *Annual Statistical Report Year 1995*, p. 21

⁷ Personal communication, Kieran Smyth, ESB International

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their consumption would exceed 4 Mtoe per year. Thus, Syria may already be reaching the limits of its strategy to rely more heavily on natural gas.

Within the power sector, the dominant strategy has been to eliminate the gap between supply and demand. A program to achieve this was initiated by President Hafez Al Assad in 1993. Since then, an aggressive generation plant construction program has virtually eliminated load shedding and has enabled plant operation to return to normal preventative maintenance schedules which had been abandoned for the period 1990-94 when plants ran until they failed. Following the success of the capacity expansion program, the strategic focus is now turning to improving energy efficiency throughout the supply and demand chain. A critical area is the electricity distribution system, where technical and non-technical losses were 35% but have recently declined to 31%. Other areas of focus are large, public sector industries, where there has been little incentive to address efficiency, the residential sector, which accounts for almost half of final electricity demand, and the Baniyas Power Utility, which currently is operating at 32% efficiency, six percentage points below its desired operating level given the age of the plant.

3. Prior and Ongoing Assistance

In 1986, the UNDP and World Bank conducted a joint energy sector assessment.⁸ The report identified electricity loss reduction in transmission and distribution, along with improvement in power plant efficiency and availability as high priorities. This report was followed later that year by a power sector efficiency project funded by UNDP Syria and the World Bank, and implemented by the UNDP/World Bank Energy Sector Management Assistance Program (ESMAP). The project supplied computer equipment, provided training seminars, and conducted a preinvestment study of power improvement projects.⁹

In 1994, the UNDP/GEF funded a feasibility study for capacity building in the areas of demand-side management and power plant efficiency.¹⁰ It also funded a power plant audit and energy audits of four industrial plants.¹¹ These studies laid the foundation for the current UNDP/GEF project which is intended to establish the institutional capacity for demand-side management in Syria and to promote supply-side efficiency by demonstrating the value of efficiency monitoring and maintenance monitoring systems.

In 1996, the Commission of the European Communities began funding for the Electricity Sector Support Programme (ESSP). This effort has four major components:

⁸ "Syria: Issues and Options in the Energy Sector", May 1986, World Bank Report No. 5822-SYR

⁹ "Electric Power Efficiency Study", September 1988, ESMAP Activity Completion Report No. 089/88

¹⁰ "Feasibility Study: Capacity Building for Demand Side Management and Power Plant Efficiency", November 1994, Ekono Energy Ltd, Ministry of Electricity, Public Establishment of Electricity, Syrian Arab Republic

¹¹ "Energy Audit: Cement Industry, Fertilizer Industry, Steel Industry, Textile Industry", July 1994, Ekono Energy Ltd, Ministry of Electricity, Public Establishment of Electricity, Syrian Arab Republic

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- Development of a Generation and Transmission Master Plan to the year 2010, being done by Electricité de France
- Development of a dispatch center
- Development of transmission and distribution standards
- Development of a management information system.

The Japan International Cooperation Agency (JICA) is funding a training project, including establishment of two training centers, one for transmission and distribution and one for operations.

The UNDP is funding a project in Syria entitled "Strengthening National Capacity for Environmental Affairs in Syria". The project is intended to strengthen the institutional and technical capabilities of the General Commission for Environmental Affairs (GCEA). The project will formulate a national strategy and environmental action plan (EAP) to address the country's environmental issues and develop a roadmap for sustainable development. Other environmental projects include the METAP project, which is aimed at establishing an Environmental Input Assessment Unit at the GCEA, and a project to strengthen the GCEA with regard to implementation of the Montreal Protocol.

4. Institutional Framework

The two primary Ministries which control the Syrian energy sector are the Ministry of Electricity and the Ministry of Petroleum and Mineral Resources. The Ministry of Electricity was reorganized in 1994 into two separate entities, one for generation and transmission and one for distribution. The generation and transmission unit, called the Public Establishment for Electricity Generation and Transmission (PEEGT), is comprised of a technical affairs branch and an administrative and legal affairs, with each of the 10 major power plants operating as a separate company directly under the Ministry. The Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE) is organized similarly, with fourteen separate distribution companies. Particularly relevant to the proposed UNDP/GEF project is the fact that there is no entity within the MOE specifically designated with responsibility for energy efficiency or areas related to efficiency such as integrated resources planning, end use load research, policy development, conservation program design and implementation, or customer energy management services.

The state-owned Syrian Petroleum Company (SPC) controls all oil resources and in addition directly produces 140,000 b/d. The SPC comes under the authority of the Ministry of Petroleum and Minerals. The Al-Furat Petroleum Company (AFPC), of which 50% is owned by the SPC, and the other 50% by three foreign companies (Shell, its U.S. affiliate Pecten, and Germany's

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Deminex), is responsible for about 65% (400,000b/d) of Syrian output. France's Elf produces the remaining 60,000 b/d.¹²

The two ministries report directly to the Deputy Prime Minister for Economic Affairs. The Minister for Electricity and the Minister for Petroleum and Minerals also sit on the High Committee for Energy, which is chaired by the Deputy Prime Minister. This body deliberates on major energy policy and strategy issues for the country and makes proposals to the Prime Minister.

¹² "Syria", August 1996, United States Department of Energy, Energy Information Administration

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B. PROJECT JUSTIFICATION

1. Problem to be Addressed: The Present Situation

Syria has made remarkable progress since 1990 toward improving both its economy and energy situation. Its economy grew at 7-8% annually in the early 1990s, slowing only modestly to real GDP growth of 6.1% in 1995 and 5.5% in 1996. President Asad's program to provide every citizen with a secure supply of electricity initiated in 1993 has resulted in the virtual elimination of load shedding and the ability to meet projected demand to the year 2004.¹ The problem is that the current favorable situation cannot be maintained without significant new actions. Oil production is reaching a plateau as older fields, especially the 140,000 b/d Karatchuk field discovered in 1968, reach maturity. Production is expected to steadily decline over the next several years.² Oil is critical to Syria's economy, with oil exports accounting for 70% of Syria's total export earnings. The decline in oil cannot be made up with indigenous natural gas supplies as the production of natural gas is also approaching its limits.

The impact on the national economy resulting from the coming decline in oil production is compounded by other factors:

- population growth continues at 3.6%, creating high energy demand growth even in the absence of increases in per capita energy consumption, which there will surely be
- the 60% of the population under 20 will be requiring jobs in the near future which can only be created by a strongly growing economy
- oil exploration activity has slowed significantly due to unattractive contract terms and poor results; only 5 foreign companies remain in Syria of the 14 operating in the country in 1991
- movement toward a more market-oriented economy is proceeding at too slow a pace to capture the economic efficiencies and stimulus that would keep the economy growing sufficient to meet these new challenges.

Part of the solution to the above problems is for the country to embark on an aggressive program to improve the efficiency with which it uses energy. This is the focus of the proposed UNDP/GEF project. Substantial opportunities exist throughout the country to improve energy efficiency, in part, because of a long history of both public ownership of large portions of the economy and past subsidies of energy prices. Syria lacks much of the infrastructure necessary to design and implement a national energy efficiency program. Most critically, there is currently no point responsibility for planning and implementing energy efficiency programs within the Ministry of Electricity, either on the supply or demand side. Further, little capability exists

¹ Electricité de France, *Generation and Transmission Master Plan, Global Summary*, June 1997, p. 8

² "Syria", August 1996, United States Department of Energy, Energy Information Administration

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within the MOE with regard to conducting integrated resources planning in order to identify the least cost means of meeting electricity demand, or to implement programs and provide energy efficiency services to the generation companies or to the consumers, once opportunities have been identified. Finally, and fundamental to launching a national energy efficiency program, is the need to undertake the type of price rationalization that has already been initiated by the Syrian Government so that energy users understand and receive proper price signals regarding the true value of energy to the Syrian economy.

Potential for Improving Efficiency

Supply Side

The MOE has been implementing a capacity expansion program since 1993 intended to bring electricity supply in balance with demand. The MOE is now close to achieving this goal. Prior to this time, however, plants were operated on a run-to-fail mode in an attempt to meet demand at all costs. Planned maintenance schedules were not maintained and plant operating efficiencies fell accordingly. When plants were repaired, they were only brought to the point where they were again operational and were not rehabilitated to their original design efficiency.

In 1993, 90% of the electricity supplied to PEEGT's system came from thermal power production and four power plants accounted for 80% of this thermal production: Banias, Mehardet, Swedieh and Tichrin. These four plants consumed 13% of total national petroleum products. Their average net efficiency as measured in 1994 was 32.7%. Since Syria relies heavily on the export of petroleum for foreign exchange earnings, improving the efficiency of these plants is of national economic importance.

In the Banias power station, a UNDP-funded energy audit in 1994 found units 1 and 2 operating at 8.4% and 10.1% below original efficiency, and units 3 and 4 at 3.7% and 3.4% below original efficiency, respectively.³ In 1995, Banias generated about 20% of all electricity generated by former PEE plants, thus improving the efficiency at Banias has a singular importance. The Syrian government has committed itself to the rehabilitation of the Banias power plant to bring it as close to original guarantee efficiency as possible given the age of the plant. This rehabilitation is estimated to cost USD 37.3 million and represents part of the government's in-kind contribution to the UNDP/GEF project. Even with this rehabilitation, the plant will not possess modern, computerized efficiency and maintenance management systems. This UNDP/GEF project will thus provide incremental funds to demonstrate these systems and develop the institutional capacity to transfer this technology to the other plants, thereby improving the efficiency of the entire system.

3. "Feasibility Study: Capacity Building for Demand Side Management and Power Plant Efficiency", November 1994, Ekono Energy Ltd., Ministry of Electricity, Public Establishment of Electricity, Syrian Arab Republic, p. 36

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Demand Side

On the demand side little data exists with which to quantify the potential for energy efficiency improvements. Preliminary energy audits conducted by Ekono Energy Ltd. in 1994 of four industrial plants showed an average of 56.6% electricity savings potential, 41.4% fuel savings potential, yielding a 47.2% energy cost savings and a 44.9% reduction in CO₂ emissions.⁴ Within the residential and commercial sectors, there appears to be a large potential for improvements in the efficiency of end-use devices such as refrigerators, freezers, fluorescent lamps and ballasts, fans and air conditioners. Building energy efficiency is also low due to the use of stone and uninsulated concrete in old buildings and single glazing and low levels of insulation in new buildings. Most hot waters heaters are uninsulated and often have additional electric heaters to provide heat when the main boiler is off in the summer, thereby compounding the summer peak. Poor energy use habits exist in all sectors due to the lack of information on how to use energy wisely and the low incentive to conserve energy resulting from past subsidization of energy prices.

Barriers to Improving Energy Efficiency on the Supply Side

Among the barriers preventing improvements in power plant efficiency from being implemented at the present time are:

- **Lack of information:** Utility staff and decision makers lack information regarding the importance of preventative and predictive maintenance, maintenance management and energy management
- **Lack of training:** Technicians and engineers have become accustomed to relying on corrective measures rather than regularly scheduled preventative maintenance. They are thus insufficiently trained in preventative maintenance and operating a utility in an efficient and financially sound manner.
- **Lack of technology:** There are no Efficiency Management Systems (EMS) or Maintenance Management Systems (MMS) in use in Syria at the present time.

As a result of these barriers, the Syrian authorities see the initiation of EMS and MMS as involving a certain amount of risk and are unwilling to initiate such activities without outside assistance and support. If EMS and MMS can be successfully demonstrated, however, the Syrian government has committed itself to replicating the program in other power plants.

⁴ "Feasibility Study: Capacity Building for Demand Side Management and Power Plant Efficiency", November 1994, Ekono Energy Ltd., Ministry of Electricity, Public Establishment of Electricity, Syrian Arab Republic, p. 100

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Barriers to Improving Efficiency on the Demand Side

The barriers to improve demand side efficiency are perhaps more numerous and intractable than those on the supply side due to the disaggregated nature of energy end use, the years of subsidized energy prices, and the dynamics of a centrally planned economy. Among the many barriers to improving energy efficiency are:

- **Need for further energy price rationalization:** Even though Syria has cautiously initiated price rationalization, a significant barrier to investments in energy efficiency are low energy prices.
- **Absence of institutional focus:** There is no specific governmental entity with its primary responsibility being to monitor the nation's efficiency and to design policies and programs to improve efficiency.
- **No explicit policy:** There is as yet no explicit national policy promoting the more efficient use of energy.
- **Unavailability of attractive financing:** Energy efficiency investments are not provided with special incentives or even dedicated financing mechanisms, which are minimum requirement in order to overcome the effect of subsidized prices.
- **Paucity of data:** Very little data exists with which to assess the potential for energy efficiency programs or investments. The MOE does not conduct detailed customer load research so that the effect of specific end uses on the system load profile can be determined and targeted for efficiency or load management programs. Little data also exists on the relative efficiency of the end use devices themselves, customer usage patterns and habits, and consumer preferences and buying patterns.
- **Low level of awareness and motivation:** A direct result of the lack of institutional point responsibility for energy efficiency is the low level of awareness and motivation on the part of both consumers and industrial and commercial managers toward energy efficiency.
- **Lack of technology:** Without sufficient financial incentives to invest in energy efficient equipment, no market has developed for efficient technology. Thus, even for those who may be interested in purchasing high efficiency equipment or appliances, such equipment is not available in the market place.
- **Insufficient human resources:** Both within the MOE and throughout industry and the economy, there are few people trained and knowledgeable about energy efficiency. This covers all aspects of efficiency, from the manufacture of efficient products, to identification and implementation of potential measures.
- **Absence of integrating efficiency into power sector and energy sector planning:** Without an institutional focus for efficiency and the human resources to integrate efficiency into national energy planning, the Syrian government will overinvest in supply side solutions instead of developing a least cost approach to energy sector planning where all options are analyzed using common assumptions and methods.

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The result of all of the above barriers is a virtual standstill in improving the energy efficiency of the Syrian economy. The waste of energy which results slows the economic growth of the country and more rapidly depletes the country's scarce natural resources in addition to contributing to the increase of concentration of GHGs in the atmosphere.

2. Expected End of Project Situation

At the conclusion of this project, Syria will have a strong institutional and technical foundation for continued efforts to capture the energy efficiency potential within the economy and achieve the concomitant GHG reductions. On the power generation side, the end of project situation will include:

- establishment of energy efficiency and reliability management systems and the installation of the equipment necessary to support these system in the Banias units 1-4
- establishment of efficiency and reliability targets for Banias units 1-4
- staff trained to fully support the efficiency and reliability management systems
- creation of an efficiency and reliability management team within the technical department of the PEEGT to transfer the program demonstrated at the Banias plant to the other plants within PEEGT

On the demand side, the end of project situation will include:

- establishment of a fully functioning Energy Services Center within the Ministry of Electricity including permanent physical office space, a dedicated staff of 15 professionals, and equipment necessary to carry out the functions of providing energy conservation services, program design and implementation, and policy research
- establishment of an energy conservation services capability within the ESC and the completion of over 400 energy audits of industrial plants and buildings
- establishment of a specific financing mechanism to incentivize investments in energy efficiency
- completion of an assessment of the DSM potential and the design of DSM pilot projects
- establishment of a National Energy Efficiency Program including:
 - ⇒ information materials and programs regarding energy efficiency
 - ⇒ policy research and recommendations for possible legislative and other action
 - ⇒ load and energy end use research capacity building
 - ⇒ program monitoring and evaluation capability and results reporting
 - ⇒ development of energy efficiency codes and standards

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3. Target Beneficiaries

The target beneficiaries of the project include:

- industrial and commercial energy users who purchase the energy conservation services of the ESC
- all energy users who receive information regarding energy saving tips and measures
- industrial and commercial energy users who are able to take advantage of the energy financing mechanism
- the Banias Power Company which receives the efficiency and reliability management equipment, technical assistance and training, and the other power companies who take advantage of this demonstration project and implement similar measures in their own plants
- Ministry of Electricity and other Syrian government agencies which will receive the additional policy and planning information resulting from the integrated resources planning and policy analysis
- the Syrian people who will benefit from the economic stimulus created by improving efficiency and a more stable economy resulting from slower depletion of nonrenewable resources
- the global community which benefits from the reduced emission of greenhouse gases

4. Project Strategy and Implementation Arrangements

Project Strategy

Overall Strategy

The overall project strategy is to establish an institutional focus, responsibility and capacity within the Syrian government to identify barriers to improving efficiency and assist in removing them, and simultaneously establish the capacity to provide energy efficiency services to all sectors of the economy so that as barriers are removed, the capability is there to capture efficiency opportunities. The strategy is to locate this institutional focus within the Ministry of Electricity, and to sufficiently involve other stakeholders such that the efficiency program spreads throughout the public and private sectors. A comprehensive strategy will be used for program design and implementation where multiple intervention techniques, such as information campaigns, engineering services, financial incentives, and training are implemented in a carefully orchestrated sequence focused on a single efficiency program for maximum impact. The strategy will be to structure the energy service capability such that as the Syrian government moves gradually to a more market oriented economy, the institutional capacity will also be able to make this transition intact as either a public or private energy services company.

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Supply Side Strategy

On the supply side, the strategy is to assist the PEEGT maintain high levels of efficiency and reliability in power generation by demonstrating the effectiveness of efficiency management and maintenance management systems in the Baniyas power plant. The technology, skills and experience from the Baniyas demonstration would then be transferred to the other power companies through training courses and the creation of a permanent team of experts who would assist and train the engineers and technicians in the other power companies in the design and implementation of efficiency and reliability management systems. In order to gain maximum benefit from the GEF assistance, the strategy will be to build upon programs currently underway or planned. Two important initiatives that will be used are the training facility under construction at Jandar and the rehabilitation program planned for the Baniyas power facility. In the latter case, the rehabilitation efforts will need to be closely coordinated with installation of the EMS and MMS equipment so that the objectives of each effort are achieved and the funds are spent most effectively.

There already exists within PEEGT a framework for maintenance and efficiency management, even though it is currently not sufficient to attain high and consistent levels of efficiency and reliability. The strategy of this project will be to build upon this existing framework. The existing framework includes the following:

Within Baniyas Station:

- a planning process for outages and overhauls
- an efficiency and reliability performance reporting process
- an organized maintenance department with the heads of key departments concerned and knowledgeable on the basics of good maintenance practices
- equipment stores with some documentation process
- measurement points installed for acceptance test purposes that are available for efficiency monitoring
- acceptance test data that will serve as a benchmark for acceptable performance

Within PEEGT:

- close involvement with the stations that will facilitate the spread of technical knowledge
- a performance engineer that can influence operations at the plant level
- a high level of commitment to EMS and MMS systems and to improve training
- a central training facility
- office space and equipment

Overall, the supply side effort will build upon this existing capability base by supplying new tools, training, expert technical assistance and equipment which will ensure that management systems are in place capable of maintaining high levels of plant efficiency and reliability.

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Demand Side Strategy

On the demand side, the overall strategy will be to create an institutional focus and capability to improve the efficiency of energy use, first within the power sector and subsequently within the entire economy. This will be accomplished by establishing an Energy Services Center within the Ministry of Electricity with a director reporting directly to the Minister. Over time, the strategy will be to develop a broad range of mutually reinforcing capabilities within the Center, including load and end use research, policy analysis, training and information development and dissemination. Initially, however, the focus will be on developing the capability to provide energy efficiency services to PEEGT and PEEDEE, to industrial and commercial customers, and to design and implement large scale energy efficiency programs.

As Syria is gradually moving from a centrally planned to a more market oriented economy, the strategy will be to structure the Center so that it is also capable of making this transition. The Center will be established as a financially and administratively distinct unit within the MOE, and the UNDP has secured a written agreement from the government to this effect.⁵ This will enable all or part of the Center to be removed from the auspices of the MOE at some point in the future and incorporated separately as either a stand alone public or private company. The goal will be for the energy efficiency services function of the Center, at a minimum, to become financially self-sufficient so that at some point in the future it might be able to be spun off as a private, financially viable ESCO, while the non-revenue producing functions of the Center, such as policy analysis, load research, and information dissemination, remain with the Center and therefore continue to be funded by the government. Thus, the strategy will be to use the UNDP/GEF funds to establish the energy efficiency capability and to sustain this by a combination of both public and private funds after the termination of the UNDP/GEF funds.

The Center will provide the institutional leadership and most of the initial staffing for the National Energy Efficiency Program (NEEP). The NEEP will use a comprehensive strategy employing a variety of mutually reinforcing interventions and programs.⁶ For example, a financing mechanism will be established to enable the industries to implement the measures identified in energy audits conducted by the Center staff, and these activities will be reinforced through parallel information, training and awareness programs. A low cost, high profile strategy will be employed for most information and awareness programs using such techniques as declaring a National Energy Efficiency Month, creating a program of Presidential Awards for Outstanding Achievement in Energy Efficiency, and targeting school children with energy efficiency information which they then take home to their parents.

⁵ UNDP Proposal for Review, *Syria: Supply-side Efficiency and Energy Conservation and Planning*, 1997, para 95

⁶ John R. Armstrong, "National Energy Conservation Programs: Critical Planning and Implementation Considerations", Asia and Near East Workshop on Energy Conservation and Private Power Generation, September 1986

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A general program strategy will be to target "horizontal technologies" such as boilers, steam systems, electric motors, power factor correction, and lighting using a "mass production" approach, i.e., addressing a common energy efficiency opportunity in a standardized, repeating fashion so that economies of scale and high levels of participation are achieved. This programmatic approach has been successfully used in other large scale programs in developing countries and is capable of realizing large energy savings at low cost. Another general strategy will be to pursue what are often termed "housekeeping" measures. These are no or low cost measures which would normally be done as part of good plant maintenance but are often overlooked due to inattention or lack of training. This general area of savings can typically reduce energy consumption by 5-15% in an industrial plant and is a good first target for energy efficiency programs because they are easily implemented by plant staff and are not heavily influenced by subsidized energy prices since the measures usually have no capital cost.

Staffing strategy for the Center will follow the comprehensive approach, i.e., there will need to be a diversity of staff capabilities to be able to handle each of the different functional capabilities required. The general functional capabilities required include engineering, training, information, analysis, and finance. A more detailed functional organization of the Center is given in Exhibit 2. These functions will then be combined into carefully orchestrated and sequenced programs using all of the Center resources to achieve the maximum synergy during program implementation. The Center staff will be supplemented by government employees seconded from various factories and trained to conduct energy audits and provide other energy efficiency services.

Implementation Arrangements

Overall responsibility for project implementation will lie with the Ministry of Electricity. The Deputy Minister will have specific responsibility for overseeing the current UNDP/GEF project and will, together with the UNDP Office in Syria appoint a National Project Director (Terms of Reference are available in Annex 2). Coordination among government agencies will be achieved through a Project Coordinating Committee which the Deputy Minister will chair. Responsibility for the Syrian Energy Services Center and the National Energy Efficiency Program will lie with the General Director of the SESC, who will report directly to the Deputy Minister. The Ministry of Electricity will appoint a full time person to this position. Responsibility for supply side activities will lie with the General Director, PEEGT, and within PEEGT, the Power Generation Directorate and with The General Company for Baniyas-Generation. A Six-person Efficiency and Performance Section will be formally created within the Power Generation Directorate to assist the staff in the Baniyas Generation Company and to transfer this technology to the other generation companies. Detailed roles and responsibilities are presented below.

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Project Coordinating Committee

The Project Coordinating Committee will serve to coordinate activities with other government agencies and relevant organizations (see Exhibit 1). Issues that the PCC can be expected to deal with include:

- application of the energy efficiency financing mechanism
- development and implementation of appliance and equipment efficiency standards
- coordination of various aspects of national energy efficiency programs
- discussion of policy recommendations
- coordination of energy efficiency national planning activities and target setting

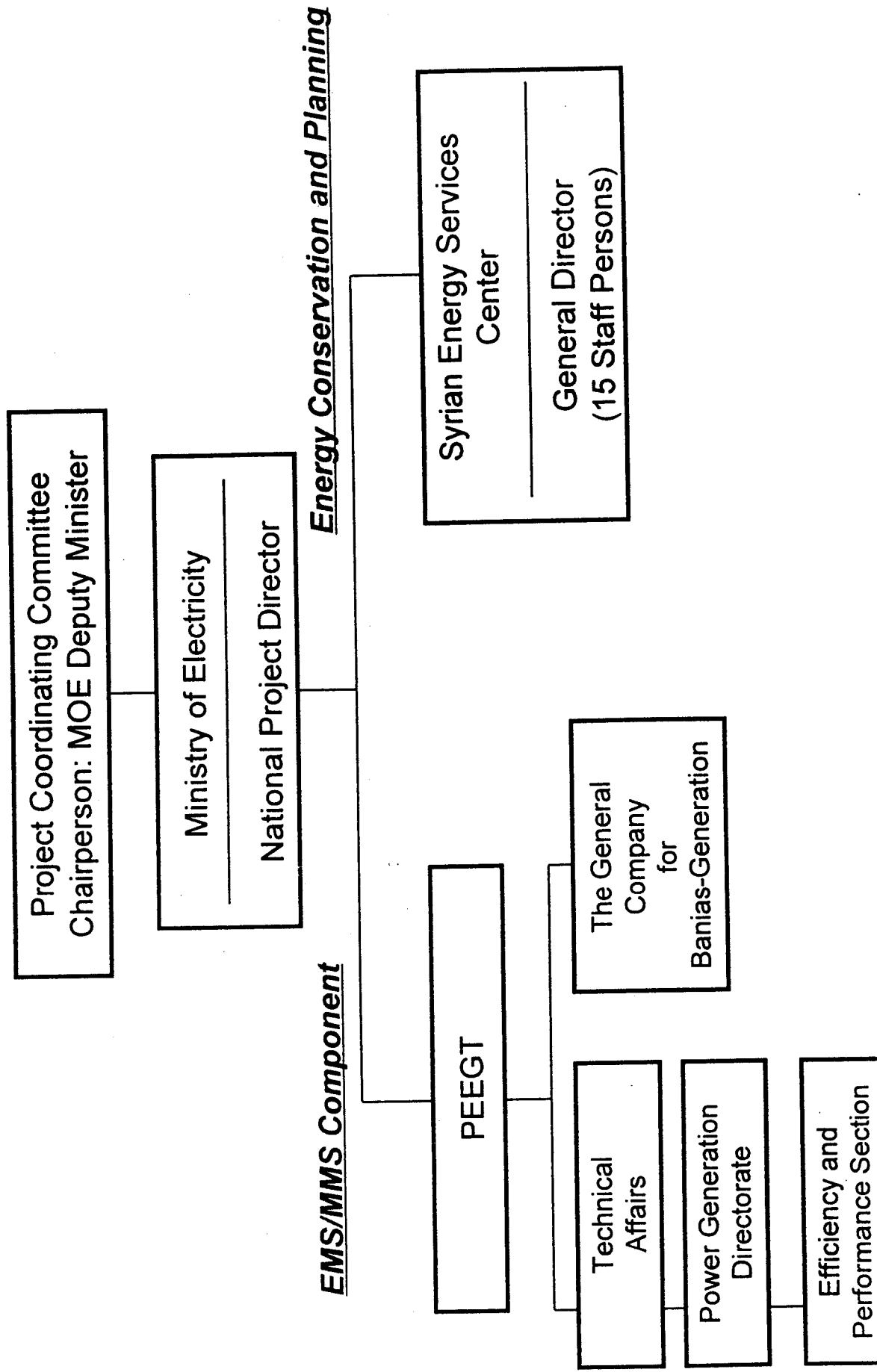
The PCC will function not only to coordinate national energy efficiency programs, but will also act as a discussion forum for proposed policies and initiatives. The PCC can also serve to coordinate national energy planning activities so that they adequately incorporate energy efficiency potential and corresponding funding. The membership of the PCC would include representatives from the UNDP, the MOE (PEEGT and PEEDEE), the Ministries for Environment, Industry, Petroleum and Mineral Resources, Information, Planning, and Economy as well as business and consumer groups and experts from academia. A reasonably broad membership in the PCC will help accelerate the development of awareness of energy efficiency and create a stronger base for launching the National Energy Efficiency Program.

Syrian Energy Services Center

The Syrian government has agreed that a new and independent unit will be created within the MOE with broad responsibility for energy conservation and planning services. The Center's General Director will report to the Minister through the Deputy Minister and will have day-to-day responsibility and authority for the activities of the Center, including the design and implementation of the National Energy Efficiency Program. The General Director of the Center will coordinate his activities with the National Project Director, who will monitor overall project progress and assist the Deputy Minister and UNDP Resident Representative to oversee the entire project. The Center will be a financially and administratively separate unit within the MOE with the capability and intention that all or part of the center will be incorporated as a unique public or private company at some point in the future when financial viability of the company can be assured. Initially, the ESC will contract for services to PEEGT and PEEDEE so that some outside income is assured until it is able to successfully market its services to other public and private organizations.

Exhibit 1

**Organization Chart for UNDP/GEF Project
Syria: Supply-Side Efficiency and Energy Conservation and Planning**



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Functions

The Center will have a comprehensive set of functional capabilities so that it can provide a complete array of services both internally to the MOE and government planners in terms of policy, research and planning, but also externally in terms of consumer information, training, and energy efficiency services and programs. A functional organization chart is given in Exhibit 2. The engineering and training functions can often be provided on a cost recovery basis and therefore would provide the foundation of revenue generating activities when the Center is established as an independent company. Information development and dissemination generally cannot generate sufficient revenues to support itself as a separate cost center and thus would need to be covered by the revenues generated by engineering and training. The policy and planning functions could potentially generate revenue if the Syrian government was in a position to contract out for these types of consulting services. If not, these functions should probably remain within the government. Some level of administrative support would be needed by the independent energy services company.

Organization

The Center will be organized initially into four units: Energy Services, Information and Training Services, Finance and Analysis, and Administration (see Exhibit 3). Overall management and direction would be the responsibility of the General Director. The GD would have day-to-day responsibility for the UNDP funded National Energy Efficiency Program and all activities carried out under the GEF funding for energy conservation and planning for this project.

Staffing

Part of the Syrian government's in-kind contribution to this project are the salaries and services of fifteen government employees (approx. SP 300,000 annually). These persons would be selected to fill the functions and positions identified in the SESC organization chart. The selection process for the staff should begin such that they can all be selected and ready to work in 1998. See Annex 2 for position descriptions of each of the SECS staff. The availability of qualified staff to fill these positions (including the position of GD as the SESC) as an in-kind contribution of the GoS is a prerequisite for this project.

The SESC staff will be supplemented by government employees from various industries who are seconded to assist the SESC staff in conducting energy audits and providing other energy services. These seconded staff will be trained by the Center and when their tour of duty is complete, will return to their plants and be able to function as sources of information and expertise on energy efficiency within their plant.

Exhibit 2

SESC Functional Organization Chart

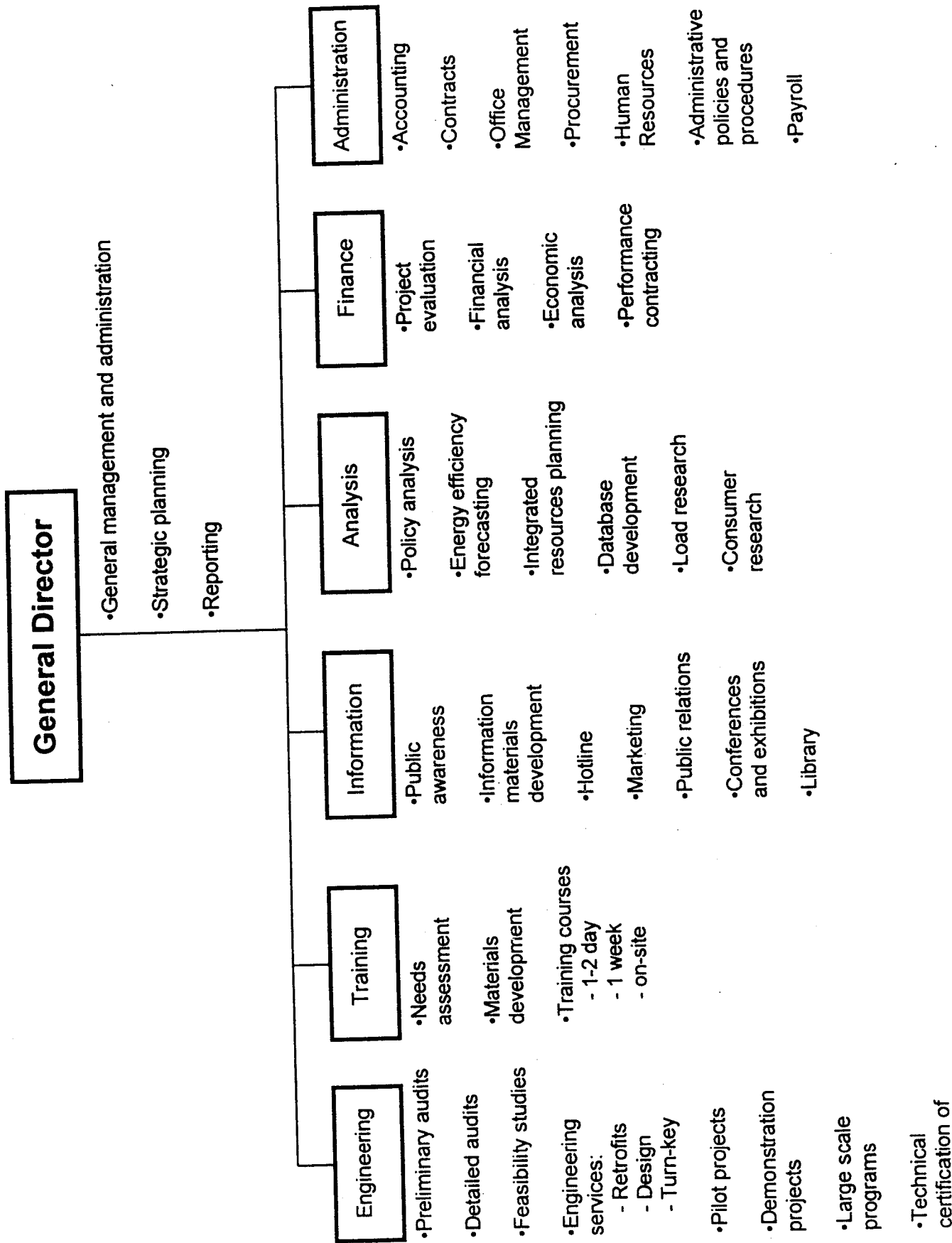
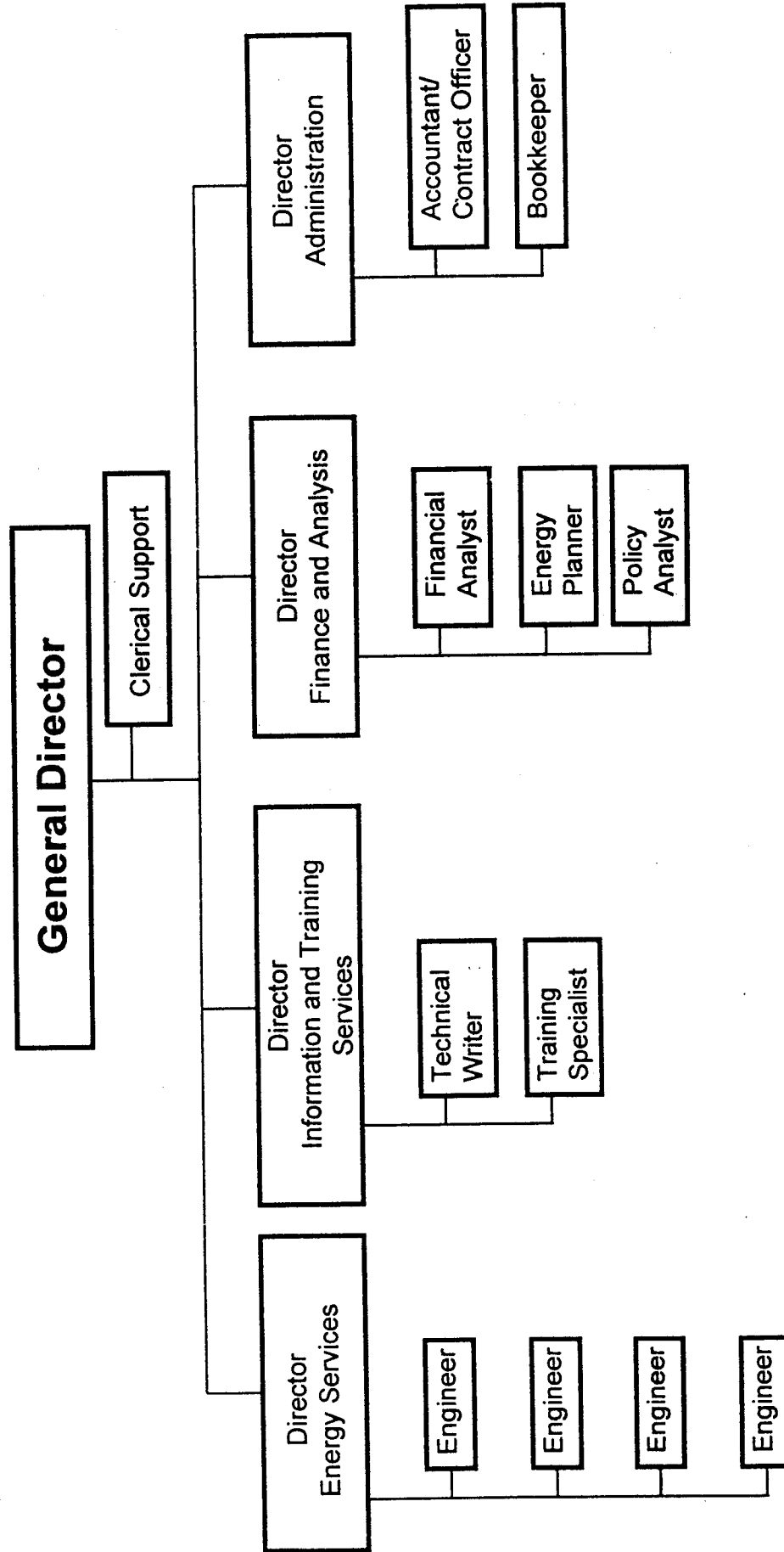


Exhibit 3
SESC Staff Organization Chart



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Location

The Syrian government is also providing as part of its in-kind contribution six office units, each of which has two rooms and a bathroom, on the eighth floor of a building located at Dar Al-Mouhandeseen, Maisaloon St., in the center of Damascus. The total floor area is 525 square meters. This contribution includes the annual cost of services for the offices, plus the office furniture and three computers.

Financing

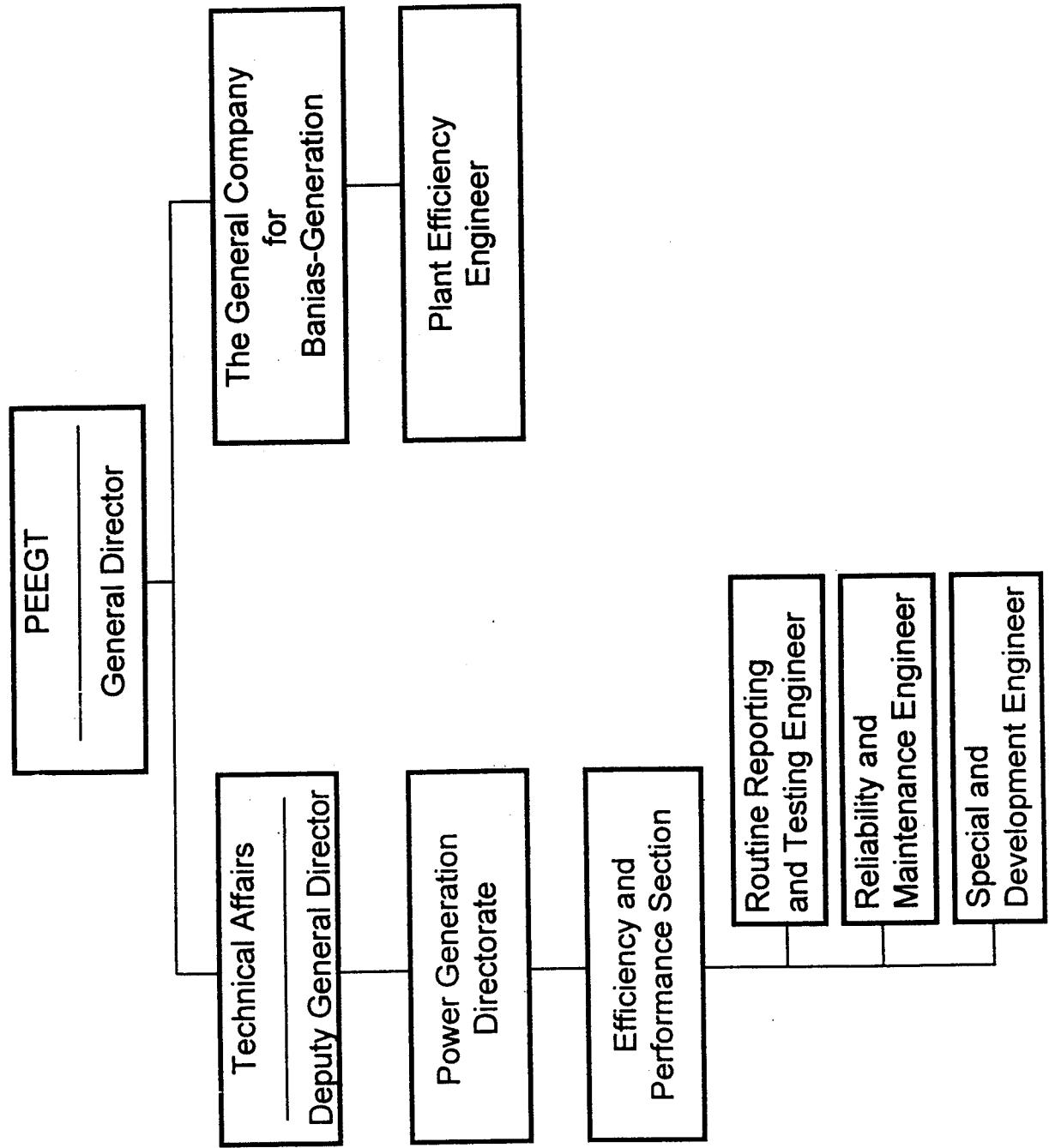
Preliminary arrangements have been made for a mechanism to provide financing for energy efficiency projects that are certified by the ESC. Discussions were held with the Director Money and Banking, Ministry of Economy, in which the Director described a mechanism where the Minister of Economy could issue a directive to the heads of banks instructing them to give priority to energy efficiency projects. In order to ease the burden on the banks of doing technical and financial feasibility assessments, the directive could include a requirement that the energy efficiency projects must first be approved by the ESC. The funding mechanism would not only help industries obtain financing for energy efficiency projects, but it would also stimulate business for the ESC. A similar mechanism currently exists for promotion and implementation of solar energy projects.

Program Advisory Groups

In order to improve the design and effectiveness of energy efficiency programs, the ESC would establish ad hoc advisory groups for programs as they are designed and implemented. The advisory groups would be comprised of key stakeholders affected by each program. The advisory group input would be supplemented by consumer research using focus groups, surveys and other techniques, as appropriate, in order to assist in program design. The following advisory groups are envisioned during the four-year UNDP/GEF project:

- Industrial Efficiency Program Advisory Committee
- Boiler/Furnace Efficiency Program Advisory Committee
- Steam System Efficiency Program Advisory Committee
- Motor Efficiency Program Advisory Committee
- Energy Efficiency Labeling and Standards Advisory Committees specific to each type of equipment or appliance selected

Exhibit 4
EMS/MMS Project Organizational Structure



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EMS and MMS Program

The Baniyas power plant produced approximately 20% of all electricity generated by PEEGT plants in 1995 and is operating well below design efficiency.⁷ The Syrian government has committed to the rehabilitation of the Baniyas power station to a level close to its original commissioning. This represents an in-kind contribution of approximately USD 37.3 million and provides the baseline condition for the incremental funding of an efficiency management system and a maintenance management system through GEF funds. The EMS and MMS are not self-launching due to lack of familiarity with the technology and its operation by PEEGT and Baniyas Power Company staff and therefore the high perceived risk in installing and operating such a system.

General Overview of EMS and MMS

The exact meaning of the terms "maintenance management systems" (MMS) and "efficiency management systems" (EMS) are often confused. A true management system for efficiency maintenance is not restricted just to a system of computer hardware and software. A complete system is more than this. It includes all the components that are associated with any management process, such as systems employed in financial, human resources or even environmental management. This document refers to both the more encompassing management process (capital "M") needed to ensure overall results as well as the specific hardware and software components (small "m") needed to support the higher level process.

Generally, all management systems have the basic elements of planning, acting (implementing and capability) and reviewing. To be effective, systems need to incorporate the concepts of "higher level commitment" and "continuous improvement". This UNDP/GEF project will result in a system employing these elements being installed within the PEEGT for the Baniyas power station. The establishment of this capability within PEEGT will help ensure sustainability. The small "m" management systems (EMS and MMS) will be tools (part of "acting element") in that system. Use of targets, the central team, project review, etc., are also processes that form part of the overall ("M") management system.

Baniyas Rehabilitation

Rehabilitation at Baniyas has been established as a prerequisite to for the GEF funding. The PEEGT has agreed to rehabilitate units 1 and 2 and make necessary instrumentation upgrades on units 3 and 4 to accommodate EMS and MMS systems. This project needs to be fully integrated with the rehabilitation and instrument work on units 3 and 4.

⁷ Syrian Arab Republic, Ministry of Electricity, *Annual Statistical Report Year 1995*, p. 21

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A few brief details to clarify rehabilitation and how this project will fit into the process are provided below. The rehabilitation project has three major phases:

a. Study Phase

Work needs to be done to establish the feasibility of carrying out such a project and to determine the project's cost-effectiveness. This includes some study and analysis work that provides a gross level of costs, scope and schedule. With regard to the Baniyas rehabilitation, this phase is essentially completed.

The study commissioned by the PEEGT provided advice on the feasibility of rehabilitating three stations, Mehardeh units 1&2, Baniyas units 1&2, Qatineh unit 6. It recommended proceeding with Baniyas units 1&2 first. The estimated costs for Baniyas would be USD 37.3 million. The study noted an uncertainty of 40 to 50 percent in this estimate. Experience with other rehabilitation work would indicate that the estimates are usually on the low side. The project would increase available capacity from 2x140 MW to 2x170 Mw (design) and improve efficiency from 32.5% to 38%. A concurrent goal is to extend life by 15 years and increase operating hours per year to 5000 hours at nominal capacity.

An additional goal of the project is to "increase the skill of maintenance and technicians and operators by training on-site and off-site." From the feasibility study it is evident that there are a number of similar areas of performance being dealt with on this UNDP/GEF project that may seem similar. The work is not duplicated however. This project is incremental to the rehabilitation project. Rehabilitation scope does not include the establishing of an MMS and EMS system and rehabilitation alone would not ensure a sustained improvement in performance. However, the PEEGT has advised of the importance of a close tie between the two projects to ensure effective use of resources and optimum scheduling.

b. Definition Phase

The next step is to clearly define the rehabilitation project, looking at schedules, engaging engineering help, and accurately defining the scope of the work and associated costs. In rehabilitation work of power plant equipment, this last task - i.e., establishing scope and costs is very difficult. In the case of Baniyas this is compounded by lack of detailed reliability and performance monitoring data. The cost of fixing everything is prohibitive.

The cost of fixing the most important thing is difficult unless you know both what has contributed to the unreliability of the component and how that unreliability contributes to the overall unreliability of the plant. The project definition phase is intended to significantly improve the understanding of the former through a very detailed inspection of the equipment and that, in turn, will marginally contribute to the latter.

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During this stage of the process, this GEF project must provide the specifications for the equipment to be purchased, and most importantly define any modifications to the plant required to accommodate monitoring equipment installation. This includes such things as temperature, pressure and flow sensing equipment upgrades or provision of plant ductwork or pipework for some additional sensing instrumentation. In many cases, the instrumentation changes envisaged would normally be part of the rehabilitation project. In this case sensing equipment upgrades have been identified as part of the scope of work for the rehabilitation.

There is an issue, however, on units 3 and 4 where no rehabilitation is planned. The PEEGT has also agreed to upgrade instruments on the non-rehab units, i.e., units 3 and 4 as necessary to accommodate the EMS and MMS systems. From a brief review at site of the equipment, it is estimated that most of the existing equipment should be of sufficient quantity and quality to be used as inputs to any monitoring system and upgrades would not be major on those units.

This stage of the project is expected to begin by the end of 1999 and should be completed by about mid 2000.

c. Implementation Phase

This is where the task of repairing the deficiencies to improve the performance of the units is carried out. Installation of the monitoring equipment, instrumentation upgrades and necessary plant modifications would be a work package that should be passed to the rehabilitation project to administer. Making this work integral with rehabilitation takes advantage of the scheduling, engineering, tracking and supervising capabilities that are part of such a large project. The project consultants need to monitor the progress but do not need to get involved in the day-to-day mechanics of the installation process.

Organization

The EMS/MMS project will be organizationally located within the Technical Affairs branch of PEEGT in the Power Generation Directorate and the Banias Generation Company (see Exhibit 4). The existing Efficiency and Performance Section within the Directorate will be expanded to a team of four including a Section Head, a Senior Engineer for Routine Reporting and Testing, a Senior Engineer for Special Testing and Development Initiative, and a Senior Engineer Reliability and Maintenance. This central team will work with EMS and MMS consultants to design and install the systems. As a result of participating in this project, the central team will have acquired the skills and experience necessary to provide similar assistance to other power companies, thus creating a sustainable capability within PEEGT to improve efficiency and maintenance monitoring throughout the generation system.

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The Baniyas Generation Company staff will coordinate with the central team during the design and installation of the EMS and MMS and will take responsibility for the systems once they have become operational and their performance confirmed. It will then be the responsibility of the Baniyas staff to establish efficiency and reliability targets and use the EMS and MMS to maintain those targets.

Training

There is a significant gap in the level of knowledge of the Baniyas staff in the area of maintenance and efficiency management. Since a significant amount of training is required, a process of selective training (i.e., some trained to very high levels of knowledge and some to lower levels) will be necessary. There will be a need to rely on the normal plant processes to spread much of the knowledge throughout the plant.

Tasks in this document will refer to "Expert Level" training, "High Level" training, and training. These are defined as follows for the purposes of this document:

Expert Level - A number of key people in leadership and high contact positions must be trained at an expert level. This would include such things as how to use the EMS and MMS software and how to employ the data to pinpoint deficiencies.

High Level - Others need to have a good idea of the systems and processes in place as well as the importance of reliability and efficiency to the PEEGT and how the processes contribute to the success of overall plant operation and management.

General Level Training - Most station (and some central) staff will need to understand the importance of efficiency and reliability and some basic ideas as to how they can contribute to their improvement through their jobs, e.g. looking for steam leaks and other routine plant maintenance.

UN DESA Support to Project Implementation

UN DESA will provide support the GoS and to UNDP/Syria in executing Budget Line allocations for the procurement of international and regional expertise only. Please refer to section E (Inputs) or Section J budget for further information. As such, UN DESA will sign a Letter of Agreement with the National Executing Agency that it will execute the budget lines identified and specified for DESA in Section J of this document according to the rules and regulation of the National Executing Agency.

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5. Reasons For UNDP/GEF Assistance

The proposed project will work to strengthen the capacity of the Syrian Arab Republic to implement and sustain long-term energy efficiency efforts that have a well documented positive impact on both the global as well as the local environment. At the same time, the project is in line with the country's sustainable development objectives and is perceived in Syria as being a crucial facilitating factor and catalytic step for the effective re-organization and efficient operation of the energy sector.

The long-term goal of the project is to reduce the growth of greenhouse gas emissions resulting from the combustion of carbon based fuels and the consumption of electric power, and thereby contribute to mitigation of climate change.

The project funds are devoted to removal of barriers as a cost effective mechanism of institutional strengthening and capacity building within the Ministry of Electricity in general and the two Syrian electricity establishments specifically, hence achieving the desired impact on the long-term reduction of greenhouse gas emissions. More specifically, the project will remove barriers to the effective adoption of energy efficiency measures in the Syrian power sector and the introduction of energy conservation in the private and public sectors and thereby conforms with Operational Program number 5 "*Removing Barriers to Energy Efficiency and Energy Conservation*" of the GEF Operational Strategy.

Through the barrier removal mechanism the project will address the need for restructuring, greater efficiency, self-sustainability and for the introduction of appropriate technologies and concepts within the Syrian energy sector. Furthermore, through barrier removal, the effective adoption of energy efficient measures in the Syrian supply and demand side sectors will be encouraged and nurtured, thus facilitating the implementation of follow-up "win-win" projects to which the GoS is already committed. Lastly, the project will also provide a policy action framework for meeting climate change mitigation objectives within the existing system in a cost effective way.

Even though limited donor activity already exists in the country addressing the targeted sector, it does not, contrary to this project, ensure the transfer, replication and widespread use of energy efficient technology and concepts. Moreover, the nationally executed nature of this project will dictate a level of continuity and sustainability that appears to have been absent in other donor programs.

Anticipated greenhouse gas reductions

The GEF project at hand will, in the long-term, achieve substantial greenhouse gas reductions. As shown below in Exhibit 5, CO₂ emissions curtailed by the year 2008 will amount to 7.6 million tons. Within the power generation sector, the project will result in the reduction of CO₂ by 1.8 million tons and 5.8 million tons from the demand side. The GEF funding will reduce the transaction cost for the implementation of energy conservation and energy efficiency, so that the

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invisible transaction for the reduction of CO₂ emissions is US \$ 1.34 per ton within the supply side component and US \$ 0.41 per ton within the demand side component of the project. The above Unit Abatement Cost is calculated on the basis of a GEF contribution of US \$ 2.4 million on the supply side and GEF and UNDP contribution of US \$ 2.355 on the demand side. The assumptions and methodology used for the calculation of the above figures are shown in Annex 7.

Exhibit 5 Estimate of Total Energy Savings and CO₂ Reductions (Cumulative Savings by 2008)			
Objectives	Energy Savings		
	Total (MTOE)	% of Total Energy Consumption	CO ₂ Reductions (000 Tons)
1	1,436.8	1.08	4,468.5
2	422.8	0.32	1,315.0
3-5	572.8	0.43	1,781.4
Total	2,432.4	1.83	7,564.9

6. Special Considerations

This project entails a number of unique considerations. These include:

- **Central Efficiency and Performance Team within PEEGT** - Special consideration will need to be given to the formation of an efficiency and performance team within the Technical Affairs Branch of PEEGT. The project calls for a team of three engineers who will form a central capability within PEEGT to work with the managers and operating personnel within each power generation company to develop efficiency and maintenance management systems, in many cases replicating the system installed in the Baniyas plant as a result of this project. This team will need the support of top management within PEEGT and the acceptance of the personnel in each power generation company if they are to be effective. Superior training and skills of these three engineers will help them establish credibility among the plant staff as experts in efficiency and maintenance management.
- **Parallel Tariff Reform** - Special consideration will need to be given to the Syrian Energy Services Center and its programs if tariff reform, in particular the removal of subsidies, does not continue concurrent with the UNDP/GEF project. An option that may need to be considered is a mandatory program for industries and government facilities over a certain

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size. Such a program, which other countries have implemented such as Thailand, might include mandatory energy audits for plants and facilities over a certain size, the designation of an energy manager, development of energy saving targets, and mandatory reporting of consumption and output so that compliance with targets can be measured.

- **Program Launch** - The project proposes that a very high/top ranking Government official launch the National Energy Efficiency Program much in the same manner that the President himself launched the capacity expansion program in 1993. Special consideration will need to be given to this area both if the President of the Republic is willing/agrees to undertake the launch and if he does not. If the President feels this program worthy of his attention, it will place heavy demands on the Center staff and the Ministry of Electricity to make sure everything is well prepared. If the President for whatever reasons is unable to launch the program, special efforts will need to be made to create the same level of public attention in his absence.
- **Creation of the Syrian Energy Services Center** - The Syrian government is committed to creating this important new unit within the Ministry of Electricity. Certainly such commitment is essential to the success of such an undertaking. Nonetheless, there are many special considerations that will need to be made as the Center is created and as it evolves toward an independent company (see Exhibit 6). These include selecting motivated and skilled staff with an interest in building a potential business; establishing its credibility and acceptance in the market place; being effective as a policy development organization; gaining the necessary political support to become an independent public, and eventually private, company.

7. Coordination Arrangements

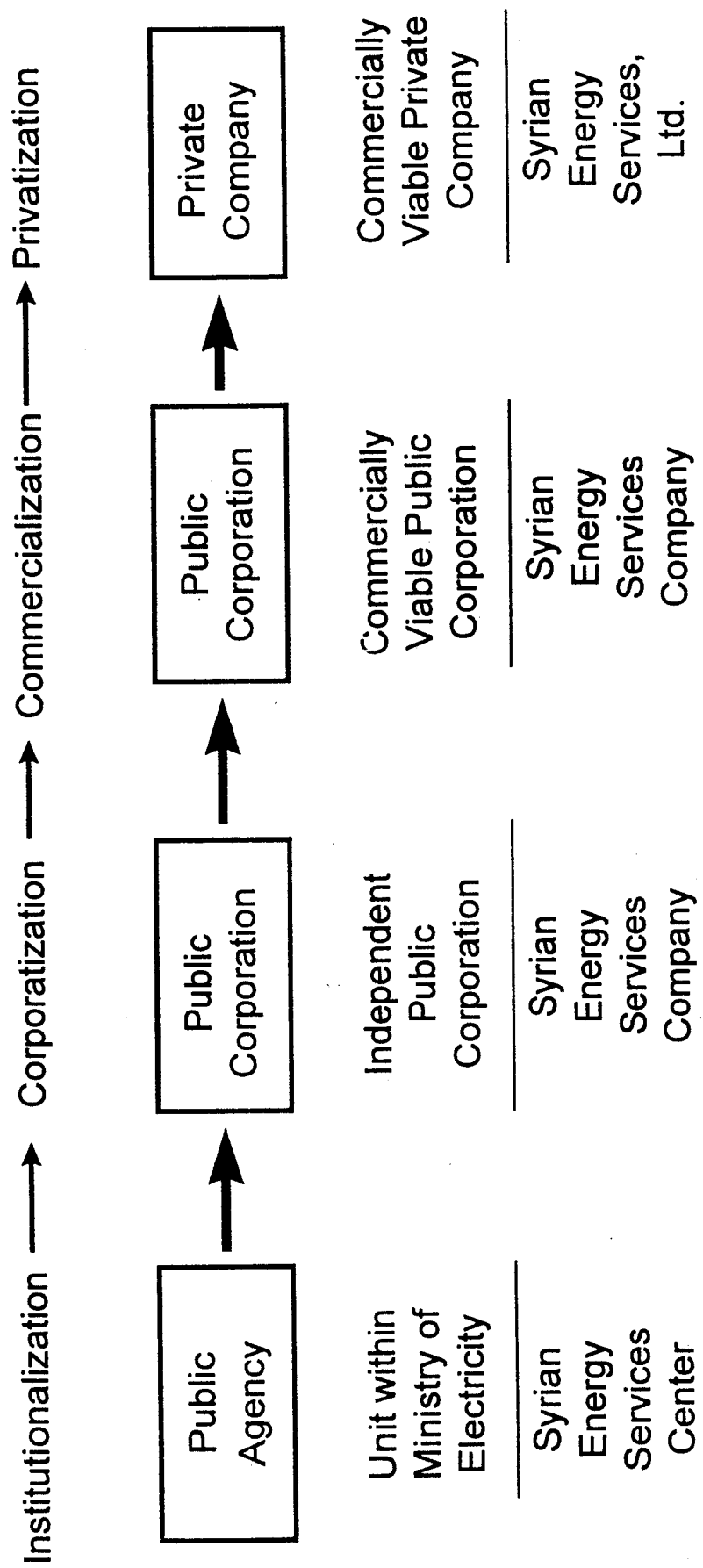
Coordination has been structured into this UNDP/GEF project at multiple levels to ensure that all stakeholders are involved and exposed to the project's efforts, and to multiply the effectiveness of the program expenditures. Arrangements for coordination include:

Interministerial Coordination - A Project Coordinating Committee will be formed including representatives of the Ministry of Economy, Ministry of Industry, Ministry of Planning, other relevant ministries, the UNDP mission and other stakeholders. The Committee will be chaired by the Deputy Minister of the MOE (see Exhibit 1). Any policy issues/recommendations or other actions requiring higher authority can be taken by the Minister of Electricity to the High Committee on Energy, which is chaired by the Deputy Prime Minister for Economic Affairs.

Intraministerial Coordination - To assist the Deputy Minister coordinate tasks of the project within the MOE on a day-to-day level, a National Project Director will be hired with project funds. The NPD will monitor progress, help resolve issues and problems, and

Exhibit 6

Institutional Evolution of the Energy Service Center



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provide upward and downward reporting for both the supply and demand side components of the overall project.

- **PEEGT Coordination** - Within the PEEGT, coordination of the EMS/MMS initiatives will be the overall responsibility of the General Director PEEGT. Within the Technical Affairs branch, the Director Power Generation will be responsible for the establishment and coordination of the Efficiency and Performance section with other units (see Exhibit 4). At the plant level, the plant manager will be the point of contact for coordinating implementation of the current UNDP/GEF project within his plant.
- **Syrian Energy Services Center** - Overall coordination of Center activities will be the responsibility of the General Director of the Center. However, because of the multiplicity of programs and the need to involve all key stakeholders in each program, the current UNDP/GEF project is designed to have ad hoc advisory committees to coordinate and inform each program so that it fits well within other existing activities. Thus, there will be an advisory committee for each energy service developed, and policy advisory committees as various policy issues are explored. An energy efficiency standards committee will be formed to develop the minimum efficiency standards and labels for each appliance, and standards will be developed using a consensus process.

International Coordination - The effectiveness of this UNDP/GEF project will depend in no small part on the coordination of its activities with other countries and the energy efficiency agencies and programs of these countries. For example, several other developing countries have established national energy conservation centers which have been in operation for a number of years. The staff of the Syrian Energy Services Center could learn a great deal from these centers which they could apply to their programs. The centers the SESC should coordinate with include the Pakistan National Energy Conservation Center (ENERCON), the Mexican National Energy Conservation Center (CONAE), the Energy Conservation Center of Thailand (ECCT), and activities in Egypt under the auspices of the Organization for Energy Conservation and Planning (OECF). Initial links should be established with the above entities for support and information immediately after initiation of this UNDP/GEF project.

The current project also relies heavily on training manuals and other information materials prepared by the above mentioned centers. It has been assumed in the budget estimates that these materials will be used and therefore that the cost to develop training manuals and information materials will only involve updating these existing manuals and adapting them to the Syrian context. Also, regional consultants have been assumed in the budget estimate, many of them trained by programs in these other countries, such that there is excellent pool of well-trained, Arabic speaking energy efficiency experts available within the region at lower cost than contracting with international experts.

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8. Counterpart Support Capacity

The UNDP/GEF project will receive extensive support from the Syrian government, primarily from the Ministry of Electricity. The Deputy Minister of Electricity will personally oversee the entire project and serve as the Chairman of the Project Coordinating Committee. The Deputy Minister will be assisted in his duties by a National Project Director who will be paid for by the UNDP/GEF project..

The entire staff of the Syrian Energy Services Center will be provided to the project by the Syrian government as an in-kind contribution. Most likely, the staff for these positions will be drawn from within the Ministry of Electricity. The government will also provide the office space, furniture and some computers for the Center. Such a setup indicates GoS commitment to the center also following the completion of the current project where the assigned staff are expected continue work.

The staff (team member and leader) for the Efficiency and Performance Section within the Technical Affairs branch of PEEGT will also be drawn from with the Ministry. Additional counterpart support for the supply side component will come from the Baniyas Power Generation Company, both in terms of its facility and its staff.

Counterpart support will also come from outside the MOE in the form of participation by both senior and junior staff from other ministries including the Ministry of Industry, Ministry of Economy, Ministry of Planning and others. These staff will participate on the Project Coordinating Committee and on ad hoc advisory committees. Counterpart support will also be drawn from experts within industry, the private sector, the residential sector and academia to participate an ad hoc advisory policy and program committees.

9. Regional Framework

This UNDP/GEF project will take place within the larger context of energy efficiency barrier removal and economic development within the entire Arab region. The current UNDP/GEF project can benefit from significant energy efficiency program experience that has taken place throughout the region, most notably in Egypt, but also in Morocco, Tunisia, and Pakistan. Provisions have been made throughout the current project to take advantage of this regional experience:

- The Quick Savings Program (Output 1.1) will build on the experience of "mass production" style boiler tune-up programs pioneered in Pakistan and replicated in

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Egypt.

- The Industrial Efficiency Program (Output 1.2) will take advantage of audit manuals and experience gained in both the Egypt and Pakistan industrial audit programs.
- The boiler and steam programs (Outputs 1.3 and 1.4) will take advantage of similar programs conducted in Pakistan, Egypt and Mexico.
- The Motors Programs (Output 1.5) will build on experience in Mexico, Egypt, and Indonesia, among others.
- The Power Factor Correction Program (Output 1.6) will build on similar programs pioneered in Pakistan and replicated in Egypt.
- The Technical Training Program (Output 1.7) will incorporate the review and adaptation of technical training manuals prepared under the Pakistan and Egypt programs.
- The Information Program, Hotline and President's Awards (Outputs 2.1, 2.2 and 2.3) will make use of broad sets of consumer information materials developed under the Pakistan and Egypt programs.
- The DSM Assessment and Pilot Projects (Output 2.4) will make use of DSM efforts in Egypt and the DSM assessment and residential pilot program in Morocco, as well as similar efforts in other countries.
- The Energy Efficiency Labeling and Standards (Output 2.6) will take advantage of work in Pakistan (with buildings), Brazil (with refrigerators and freezers), and Mexico (with air conditioners).
- All of the above programs will utilize regionally available experts who have been trained as a result of these various efforts, particularly in Egypt and Pakistan.
- Lastly the SESC should initiate joint activities, coordination on strategies and exchange of information with newly established regional Mediterranean energy conservation NGO MDEENER which has its seat in Tunisia.

The availability of the above mentioned programs, materials and personnel represents an important resource to this project which should make use of these resources at every opportunity.

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C. DEVELOPMENT OBJECTIVE

The Syrian government has committed to a national program of improving energy efficiency. This commitment results from the country's need to reduce the rate of consumption of precious nonrenewable energy sources, to sustain economic growth and to reduce the environmental impacts resulting from energy production and use, including the production of greenhouse gas emissions. This commitment is expressed in the creation of a Syrian Energy Services Center and the launching of a National Energy Efficiency Program and the staff (15) and facilities necessary to support this effort. It is also reflected in the funding by the government of the rehabilitation of the Baniyas power station, which will result in a significant improvement in its energy efficiency.

The above government commitments form the foundation for important efforts to improve efficiency but are not sufficient to achieve major efficiency gains due to the barriers discussed in Section B. The development objective of the proposed UNDP/GEF project is to remove these barriers and create a sustainable institutional capacity to provide energy efficiency services and conduct related policy, planning and research activities so that Syria can capture all of the economic and environmental benefits associated with efficiency improvements. Specifically, the development objective is:

- To remove perceived risks associated with the installation and operation of efficiency and maintenance management systems in power generation facilities by demonstrating the effectiveness of the technology and training plant staff in its operation and use.
- To remove barriers to improving the energy efficiency of industrial and commercial facilities by providing highly skilled energy audit and engineering services, project financing, and training and information to plant managers and operators.
- To remove barriers to the implementation of demand-side management programs and other large scale efficiency programs by creating the institutional capacity for load and customer research, program design and implementation, monitoring and evaluation.
- To remove barriers to energy efficiency policy development, integrated resources planning and national energy efficiency planning by creating the institutional capacity to conduct policy analysis, IRP, economic analysis and national energy efficiency planning.

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D. IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES

Immediate Objectives:

1. Syrian Energy Services Center
2. National Energy Efficiency Program
3. Baniyas Efficiency Management System
4. Baniyas Maintenance Management System
5. PEEGT Efficiency and Maintenance Management Support Team

Improvement Targets:

By the year 2008, the five objectives will reduce energy consumption by a total of 1.83% compared to current levels and reduce CO₂ emissions by 756.5 tons per year.

Objective 1: To reduce energy consumption in the Syrian economy by 1.08% annually and achieve a cumulative CO₂ reduction by the year 2008 of 4.5 million tons through the establishment of a sustainable institutional capacity to provide a broad range of energy efficiency services to all sectors of the Syrian economy.

Objective 2: To reduce energy consumption by 0.32% annually and achieve a cumulative reduction in CO₂ through the year 2008 of 1.3 million tons through the establishment of the institutional capacity to develop and implement energy efficiency policies, conduct national energy efficiency planning and integrate it into overall power and energy planning, and to create awareness and understanding among the Syrian people regarding the importance of energy efficiency and the specific techniques for capturing energy savings.

Objective 3-5: To reduce energy consumption by 0.43% annually and achieve a cumulative reduction in CO₂ of 1.8 million tons through the year 2008 through the demonstration of efficiency management and maintenance management systems in the Baniyas power station and the replication of this technology in the other power plants in Syria through the establishment of a central institutional capability within PEEGT for efficiency and performance management.

IMMEDIATE OBJECTIVE 1. SYRIAN ENERGY SERVICES CENTER

To reduce energy consumption in the Syrian economy by 1.08% by the year 2008 through the establishment of a sustainable institutional capacity to provide a broad range of energy efficiency services to all sectors of the Syrian economy.

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The implementing agency responsible for achieving this objective is the Ministry of Electricity, and within the Ministry, the Syrian Energy Service Center which the Syrian government is establishing. The General Director of the SESC will have day-to-day responsibility for planning and implementing the various programs detailed below. He will be assisted in these tasks by his staff of 14 professionals (government employees) and international and regional technical experts and local consultants funded by this project. Staff will also be seconded from various government factories to be trained in conduct energy audits and then to assist the SESC staff in providing energy efficiency services.

The outputs described below are energy efficiency services that the Center will offer. They represent a mix of plant focused services, such as detailed energy audits and feasibility studies, as well as technology focused services, such as boiler, steam system and motor efficiency programs. All of these programs, including training, are professional services for which the Center could charge a fee to recover its costs if it chose to do so at some point in the future. Charging fees for services would be a prerequisite for the SESC to operate as a viable, independent public or private company.

Success Criteria

By the end of this project, the Government of Syria and the Ministry of Electricity will have achieved the following results:

- established a Syrian Energy Services Center with a professional staff of 15 capable of providing a broad range of energy efficiency services to the industrial, commercial and residential sectors
- developed and successfully marketed the following specific energy efficiency services:
 - * a Quick Savings Service to 192 plants
 - * an Industrial Efficiency Service comprised of detailed energy audits and follow-up to 20 plants
 - * a Boiler/Furnace Efficiency Service to 48 plants
 - * a Steam System Efficiency Service to 48 plants
 - * a Motor Efficiency Service to 48 plants
 - * a Power Factor Correction Service to 48 plants
- conducted technical training programs across a range of subjects on energy efficiency to over 1,200 participants
- established a financing mechanism for energy efficiency to assist facility owners and managers to implement the efficiency measures identified
- developed a business plan capable of charting a financially sustainable course for the provision of efficiency services after the cessation of UNDP/GEF funding

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Output 1.1: A fully Operational *Quick Savings Program* Designed to Capture Low/No Cost Energy Savings

Program description

The Quick Savings Program (QSP) will be the Energy Service Center's first major large scale program. It will help launch the Center and will bring widespread attention to both the concept of energy efficiency and the role and services of the Center. The program would be launched in conjunction with a Presidential announcement of the initiation of the National Energy Efficiency Program. Participation in the program would be mandatory for all public sector establishments over a certain size but the QSP service will be provided to all clients free of charge in order to maximize participation.

The primary focus of the program is to capture no/low cost energy savings widely available throughout the industrial, commercial, and government sectors in Syria. The program would produce large, cost-effective savings in a very short time period thereby demonstrating to both the public and private sectors the benefits of energy efficiency. The program also serves several other purposes:

- a) it provides a reasonably simple first program for the Center in which it will be easy to achieve success, thereby bolstering support for the Center and gaining confidence for its staff
- b) it will provide an excellent learning experience for the staff in many respects: they will learn the rudiments of energy auditing and energy use in various plants; they will become familiar with the wide variety of plants in Syria; and they will learn how to plan and implement a comprehensive program using all Center staff to achieve a single, focused result
- c) the program will provide an excellent source of detailed plant data which can be used to target marketing efforts for detailed energy audits, feasibility studies and efficiency projects; the data can also be used for national energy efficiency planning, policy analysis and other analytical purposes

The program would be executed using an "energy bus" approach, i.e., a small, visible vehicle which would go plant to plant loaded with equipment capable of quickly identifying energy saving opportunities which, in most cases, would be implemented by the QSP team on the spot. The focus of the exercise is to capture energy savings immediately, not to conduct an energy audit, although useful audit information will definitely result. The Quick Savings visit should take, on average, 4 person days - two people, two days each - more for large plants, less for smaller ones.

The General Director of the ESC will have overall responsibility for the program. The Director Energy Services would have the primary responsibility for implementing the field visits, while the Director Information and Training would be responsible for the public relations program and the Director Finance and Analysis would be responsible for collating data collected and

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preparing data sets for future analysis. An international consultant would be contracted to assist in the design of the audit format and train the ESC staff and consulting engineers in the QSP audit and implementation techniques.

The QSP should run at a high level of activity for the first year after which it would be evaluated and planned to be continued on an "as requested" basis. During the first month, the ESC engineers would conduct all of the QSP visits themselves in order to gain familiarity with the work and the clients. The five engineers (including Director Energy Services) should be able to complete approximately 20 plants in the first month. After the first month, engineering support would be contracted for (contracted to a local consultant) or obtained from seconded government staff and only one ESC staff continue to manage the program while the remainder begin other programs. The goal would be to complete 240 QSP visits over the life of the project, achieving a 2% reduction in consumption with each visit.

Activities for Output 1.1

Develop a plan for the QSP program. The plan would establish the target industries and plants, estimate the number of person days per plant, establish efficient travel routes among plants, set objectives, milestones and schedules.

1.1.1. Develop the QSP audit procedure. The QSP audit will focus primarily on "housekeeping" measures, i.e., no/low cost actions to reduce energy waste. The QSP audit will be standardized and computerized so that calculations are automated and high quality reports can be printed out automatically in the field. Handheld instruments will be used wherever possible to improve speed and accuracy of measurements. The audit procedure should include a general questionnaire that can be used for future program planning and analysis purposes. The QSP visit will likely include the following elements:

- a boiler/furnace mini-audit and tune-up
- steam system mini-audit and recommendations
- lighting mini-audit and recommendations
- power factor analysis
- motor mini-audit and recommendations
- compressed air mini-audit and recommendations
- analysis of energy accounting and management procedures
- analysis of training needs

1.1.2 Develop an advertising program and roll out plan. The plan for the QSP should be integrated with the planned Presidential launching of the National Energy Efficiency Program and should be one of the signature programs in the President's agenda. The

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plan should include media coverage for the QSP visits.

- 1.1.3 Conduct training of staff and pilot test of audit, instruments and programmatic approach. An international consultant will assist in developing the audit procedure and will then train the staff in the conduct of a QSP audit. This will be comprised of both classroom instruction as well as on-site training. The consultant will also assist in conducting a pilot test of the program including an evaluation of how the ESC staff conduct their QSP visits.
- 1.1.4 Subject to the outcome of the pilot test, conduct the first 20 QSP visits using ESC staff. Evaluate the QSP program following these first 20 visits and determine the extent to which the program can be contracted out to consulting engineers. If this proves feasible, one ESC engineer would remain in charge of the program while the other staff moved on to other program activities.
- 1.1.5 Develop a program monitoring and results data base to track client communications and contacts, store results and provide a basis for periodic evaluation. Separate data sets should be established to store the plant specific information acquired during the QSP visits.
- 1.1.6 Prepare one-year report on program results with recommendations for modifications and continuation. The report will include an evaluation of the impact of the program based on a survey of participants covering such topics as their perception of the effectiveness of the program, how much energy they saved (before and after energy use data should be collected), which of the housekeeping recommendations were and were not implemented and why, and recommendations as to how the program can be improved. The report should make recommendations as to whether the program should be continued, whether improvements need to be made to the program, and whether customers should be charged for the program in the future and, if so, suggest optional pricing strategies.

Output 1.2 A Fully Operational *Industrial Efficiency Program* Offering Feasibility Study Services to Major Industries.

The industrial sector accounts for approximately 17% of Syria's national energy consumption.¹ The 1994 Ekono energy audits demonstrated that substantial energy savings are possible in Syrian industrial plants, implying that improving industrial efficiency should be a high priority target for the ESC. The challenge is not only capturing these energy savings given the reasonably limited resources of the ESC and GEF funding, but doing so in a manner which is

¹ Ekono Energy Ltd., "Feasibility Study: Capacity Building for Demand Side Management and Power Plant Efficiency", Ministry of Electricity, Public Establishment of Electricity, Syrian Arab Republic, November 1994, p.6

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commercially viable.

Program Description

The Industrial Efficiency Program (IEP) will build upon the increased awareness and motivation created by the Quick Savings Program. It will offer detailed energy audit services followed by feasibility study services on projects requiring major capital investments. The program will be driven by the availability of financing to the plants to implement the energy efficiency projects, if those projects are certified by the ESC. Certified projects will be given to banks instructed by the Minister of Economy to give priority lending to such projects.

The program will be directed by the General Director for the ESC with the Director Energy Services having day-to-day responsibility for implementation. An ad hoc advisory group will be established to coordinate the program with the Ministry of Industry and other stakeholders, such as equipment suppliers and private engineering firms. The program would begin with detailed energy audits of the four plants in the Ekono study. These four plants alone represent about 3.5% of Syria's total energy consumption and thus are important initial targets of opportunity. The audits following these four plants will be based on an analysis of where the greatest potential lies for energy efficiency improvements in the remainder of the industrial sector.

The IEP is intended to help establish a possible commercial basis for SESC services. The program will initially be offered at no cost to the client and opportunities for pricing services will be explored at the program is implemented. The skills and services developed by the SESC staff as a result of this program should be commercially saleable to industrial sector. As the staff gains experience and the program gains acceptance throughout the industrial sector, the SESC can migrate to more sophisticated forms of services contracting than fee for service, such as performance contracting, which will enable it to broaden its market further.

Activities for Output 1.2

- 1.2.1 Conduct four week training course for the ESC staff and seconded and consulting engineers on detailed energy audits. The training will be done by two international consultants expert in industrial energy efficiency. The training will involve two weeks of classroom instruction followed by two weeks of on-site instruction in which an actual detailed energy audit is completed. The audit report will be formally presented to the plant management for follow-up by the ESC.
- 1.2.2 Develop a plan for the industrial audit program. The plan will include the following:
 - a) A targeting plan based on analysis of energy use in the industrial sector and estimates of the potential energy savings, including savings goals for the program.

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- b) Manpower estimates of the level of effort required for each plant.
- c) A one-year schedule of detailed audits.
- d) Estimates of follow-up time required to take the audits to the feasibility study stage, if necessary, and through to financing and implementation.
- e) A monitoring and results reporting plan.

1.2.3 Develop a standard industrial energy audit manual and report format for use by the program. An international or regional consultant will assist in the manual and report format preparation. Development of the manual should make use of the many materials which are available regionally, such as in Egypt and Pakistan, so as to not "reinvent the wheel", and thereby save time and money. The manual should be computerized to the extent possible to facilitate report preparation and maintain consistent standards of quality.

1.2.4 Conduct detailed energy audits. The audits can be expected to take four person weeks on average (two persons, two weeks). The audits would begin late in the first year of the GEF project, after the QSP has had time to generate increased interest on the part of industry and after the staff have fully developed the Industrial Efficiency Program and are ready to roll it out.

1.2.5 Conduct feasibility studies. Based on the detailed energy audits, areas of high capital investment, such as cogeneration systems or major process upgrades, may require feasibility studies. The ESC will also contract with the plants to conduct these studies.

1.2.6 Certify plant projects based on the detailed audits and feasibility studies for bank financing. Each detailed audit will be followed up by ESC staff to identify those plant improvements that will require external financing. As a condition of financing, all no and low cost measures must first be implemented and the cost/benefit analysis submitted to the bank must be based on plant energy costs after implementing the no/low cost measures, otherwise returns will be inflated and the bank may be taking on additional risk. The ESC staff will help the plants implement all no/low cost measures and will certify that the plant has done so.

1.2.7 Conduct training in energy efficiency project financing for participating banks. A one-day course would be held in four different locations around the country for bank loan officers on the IEP and how to finance energy efficiency projects. The course would be taught by an international consultant with assistance from the ESC and staff of the Ministry of Economy, and will be cosponsored by the Ministry of Electricity, the Ministry of Industry and the Ministry of Economy.

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- 1.2.8 Assist the plants close the financing with the bank. This may require helping the bank understand the project and some of the unique characteristics of financing energy efficiency projects, such as issues with collateral.
- 1.2.9 Prepare a data base for tracking client contacts on each audit, audit recommendations, implementation actions, energy consumption before and after, follow-up contacts, plant data and other important parameters in tracking program progress and reporting results.
- 1.2.10 Conduct a one-week course on performance contracting and ESCO development for the ESC staff and interested local consultants. The purpose of the course will be prepare the ESC staff to begin to utilize performance contracting in selling their services to the industrial sector, which it turn will help prepare them for operating as an independent, commercial energy service company. The course will be conducted by an international expert in ESCOs and performance contracting.

Output 1.3 Fully Operational *Boiler/Furnace Efficiency Program* Capturing Readily Available Energy Savings with Low-No Cost Interventions

Boilers and furnaces comprise a substantial portion of total energy consumption in Syria, possibly in the range of 25-30%, although no national inventory of boilers and furnaces in the country exists. Experience in other developing countries has shown that energy savings in the range of 5-20% can be achieved through measures from a simple tune-up to a complete retrofit or replacement of the boiler or furnace. Boilers are one of a number of "horizontal technologies" which are widely used throughout the economy and are subject to a limited number of common efficiency improvement measures. These characteristics make boilers and other horizontal technologies ideal targets for a "mass production" type of program design where highly trained teams conduct the same energy analysis techniques plant to plant, covering virtually the entire plant population in the country. Mass production programs achieve very high penetration rates, low administrative costs, high energy savings and high benefit/cost ratios. Boiler/furnace efficiency programs of this type have been successfully implemented in Pakistan, Egypt, Mexico and other developing countries.

Program Description

The program would involve the development of a boiler/furnace energy audit, the training of the ESC staff and local consultants in its use, development of an advertising campaign, and then implementing the audit program. The program would build on the data and experience developed as a result of the Quick Saving Program. Design and implementation of the program would be the overall responsibility of the General Director ESC and day-to-day responsibility of the Director Energy Services. As with the IEP, the program would be linked to financing of

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major capital improvements. An ad hoc advisory committee would be established to guide program design and implementation and would be comprised of representatives of the Ministry of Industry, the Ministry of Economy, local boiler/furnaces suppliers and repair or maintenance firms.

Activities for Output 1.3

- 1.3.1 Compile data collected as a result of the QSP and any other data available to develop a profile of boilers and furnaces in Syria. The profile should include the total number of boilers/furnaces, a frequency distribution based on size, type, fuel, manufacturer, efficiency improvement results from the boiler tune-ups, and observations of the general condition of the boilers/furnaces. Based on this profile, preliminary estimates of the savings potential of the program should be made as well as any considerations relevant to program design and implementation.
- 1.3.2 Prepare an overall plan for the BEP. The plan should include manpower requirements, travel and equipment requirements, schedules, and progress monitoring and evaluation plans.
- 1.3.3 Procure necessary boiler analysis equipment. This will include handheld electronic combustion analyzers, hand held thermocouples, portable chemical analyzers and other related equipment.
- 1.3.4 Conduct a one-week training course in boiler furnace efficiency. The course will be taught by a regional or international boiler efficiency expert and will include both classroom and in-plant instruction using the equipment procured above. The course audience will include ESC staff and local engineering consultants.
- 1.3.5 Develop a boiler/furnace energy audit. Development of the audit will be assisted by a regional or international consultant. Boiler audit manuals developed in other developing countries should be used as a starting point for the ESC manual so as to save time and money. The audit report production should be computerized to the extent possible in order to make report preparation as efficient as possible and to maintain consistency in quality.
- 1.3.6 Develop an advertising campaign for the program. To the extent possible, the QSP should be used to market the boiler/furnace program and can be presented to clients as a possible follow-up, more detailed energy engineering service. The campaign will be developed by the Director Information and Training with input from the advisory group.

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1.3.7 Carry out the boiler/furnace audits. The audits will be conducted by teams of two engineers taking on average one week per plant.

1.3.8 Conduct follow-up assistance to assure audit recommendations are implemented and to assist in preparing a loan request package for ESC certification. Experience has shown that energy audits need a high degree of follow up if there is going to be a high implementation rate of audit recommendations. Each audit should be followed with a call to evaluate client response to the audit, plans for implementation of recommendations and needs for further assistance. The audit team should continue follow up assistance until all no/low cost measures are implemented and the client has prepared a loan request package for financing high capital cost measures.

1.3.9 Develop a data base to track client contacts and program progress. As with other ESC service programs, a data base should be developed to track all client contacts, record plant specific data, audit recommendations, implementation actions and before and after energy consumption data so that program progress and results can be measured and reported.

Output 1.4 Fully Operational Steam System Efficiency Program Decreasing Steam System Losses

Steam systems present a technical and programmatic opportunity similar to that of boilers. It may be preferable to operate a separate and distinct steam system program from the boiler program for several reasons:

- a) steam system audits require somewhat different skills and instrumentation than boiler audits; it is more difficult to become proficient and expert in both areas than in just one
- b) plants may need one or the other but not necessarily both
- c) operating the programs separately may permit greater economies of scale, and may be more manageable because the programs can be launched at different times and thus not strain the resources of the Center

On the other hand, if there are significant distances between plants, the savings in travel costs and time may offset the above advantages of operating the programs separately. The advantages and disadvantages of operating the programs separately or together will need to be analyzed in more detail during the design stage of outputs 1.3 and 1.4.

Program Description

The program will involve the development of a steam system energy audit, training of the ESC staff in steam system efficiency and the conduct of an audit, development of an advertising campaign and rolling out of the program. Program design will utilize data collected and the

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experience of the QSP program and Industrial Efficiency Program, if the latter is launched before the Steam System Efficiency Program (SSEP). Design and implementation of the program will be the overall responsibility of the General Director, ESC, with day-to-day operation and management of the program being the responsibility of the Director Energy Services and his/her staff. The program will be linked to financing and will have an ad hoc advisory committee established to help guide program design and implementation. The members of the advisory committee may be similar to those of the boiler program and thus these two programs may utilize the same advisory committee for purposes of efficiency.

Activities for Output 1.4

- 1.4.1 Compile data collected as a result of the QSP and any other data available to develop a profile of steam systems in Syria. The profile should include data on several parameters related to steam systems affecting their efficiency such as insulation of the steam pipes, the efficiency of the pipe layout, leaks, number and condition of steam traps, and condition of the steam pipes. Based on this profile, preliminary estimates of the savings potential of the program should be made as well as any considerations relevant to program design and implementation.
- 1.4.2 Prepare an overall plan for the SSEP. The plan should include manpower requirements, travel and equipment requirements, schedules, and progress monitoring and evaluation plans.
- 1.4.3 Procure necessary steam system analysis equipment. This will include such items as ultrasonic leak detectors, infrared pyrometer, dissolved solids meter, and related equipment.
- 1.4.4 Conduct a one-week training course in steam system efficiency. The course will be taught by a regional or international boiler efficiency expert and will include both classroom and in-plant instruction using the equipment procured above. The course audience will include ESC staff and local engineering consultants.
- 1.4.5 Develop a steam system energy audit. Development of the audit will be assisted by a regional or international consultant. Steam system audit manuals developed in other developing countries should be used as a starting point for the ESC manual so as to save time and money. The audit report production should be computerized to the extent possible in order to make report preparation as efficient as possible and to maintain consistency in quality.
- 1.4.6 Develop an advertising campaign for the program. To the extent possible, the QSP and boiler/furnace program should be used to market the SSEP and can be presented

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to clients as a possible follow-up energy engineering service. The campaign will be developed by the Director Information and Training with input from the advisory group.

- 1.4.7 Carry out the steam system audits. The audits will be conducted by teams of two engineers taking on average one week per plant.
- 1.4.8 Conduct follow-up assistance to assure audit recommendations are implemented and to assist in preparing a loan request package for ESC certification. Each audit should be followed with a call to evaluate client response to the audit, plans for implementation of recommendations and needs for further assistance. The audit team should continue follow up assistance until all no/low cost measures are implemented and the client has prepared a loan request package for financing high capital cost measures.
- 1.4.9 Develop a data base to track client contacts and program progress. As with other ESC service programs, a data base should be developed to track all client contacts, record plant specific data, audit recommendations, implementation actions, and before and after energy consumption data so that program progress and results can be measured and reported.

Output 1.5 Fully Operational *Electric Motor Efficiency Program*

Industry consumes approximately 17% of Syria's electricity.² Based on experience in industrial plants in other developing countries, it can be estimated that about half of this electricity is consumed in electric motors and the potential for energy savings in these motors is around 20%. The 1994 Ekono study estimated that, overall, there was a 25% savings potential in electricity in Syrian industrial plants (p. 103). Indeed, industrial electric motors are often the largest single end-use of electricity in many developing countries and various studies or programs have been conducted or are underway to capture these potential savings, including in Mexico, the Philippines, Indonesia and Egypt.

Motor efficiency programs need to address three fundamental areas:

1. *The availability and purchase of new, high efficiency motors.* An assessment needs to be conducted to determine the current availability of high efficiency motors in the Syrian market place. There may be a variety of reasons for low availability including no local manufacture, high import duties, lack of awareness of the savings potential, and low electricity prices which undercut the savings potential. These need to be determined and policy initiatives developed to remove

² Syrian Arab Republic, Ministry of Electricity, *Annual Statistical Report Year 1995*, p. 15

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- the market barriers to high efficiency motors.
2. *The installation, operation and maintenance of motors in the plant.* Whether motors are the high efficiency type or not, many sources of inefficiency can be introduced in the design of their installation, the drive system and in the device the motor is operating. These types of inefficiencies can be addressed through a motor audit program.
 3. *The refurbishing and rewinding of used motors.* The design efficiency of an electric motor can be significantly degraded through the use of improper techniques in refurbishing and rewinding motors. This source of inefficiency needs to be addressed through an awareness program for those purchasing rewind services or rewound motors and a training program for motor repair personnel.

The MEP will address each of these three areas. The issue of barriers to the market for high efficiency motors will be discussed in Output 2.8, Energy Policy Initiatives. Program design and implementation for the other two areas will be described in this section. Design and implementation of the MEP would be the overall responsibility of the General Director, ESC, with the Director Energy Services having responsibility for day-to-day operation and management of the motor audit program and the motor rewind program. The policy study on market barriers to high efficiency motors would be the responsibility of the Director Finance and Analysis. An advisory committee would be established, as with the other programs, with representation from the Ministry of Industry, Ministry of Economy, motor manufacturers, and motor rewind and repair firms.

Activities for Output 1.5

Motor Audit Subprogram

- 1.5.1 Conduct a one-week training course in motor efficiency. The course will be taught by a regional or international expert in motor efficiency. The course will involve classroom as well as in-plant instruction and will include ESC staff as well as local engineering consultants.
- 1.5.2 Conduct a survey of motor efficiency in two industrial plants. The survey will be conducted by the ESC staff with the assistance of a regional or international motor efficiency expert, preferably the same person conducting the training in activity 1.5.1. The purpose of the survey is to determine typical in-plant motor efficiencies including the equipment driven by the motor, identify efficiency improvement opportunities, identify barriers to improving efficiency, and to collect other information needed to design the motor audit subprogram.
- 1.5.3 Develop a motor efficiency audit. Development of the audit will make use of the

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survey information in activity 1.5.2, as well as audit procedures and manuals developed by other programs, such as that in Mexico under USAID funding. The audit report should be computerized to the extent possible in order to minimize report preparation time and maintain consistency in quality.

- 1.5.4 Design the motor audit program. Information collected in activity 1.5.2 as well as from the QSP and IEP will be used to help design the motor audit program. The design should include estimates of the number of person days required per motor per plant, expected costs, schedules, and the most efficient travel routes.
- 1.5.5 Conduct a pilot test of the program design and audit. Given the complexities of improving motor efficiency, it is advisable to pilot test the program before making a commitment to conduct the program on a nationwide basis. The pilot test will determine the efficacy of the program, likely cost/benefit, actual savings potential, plant response, willingness/ability to implement recommendations, and possible program modifications that would improve results.
- 1.5.6 Based on the outcome of the pilot program, the motor audit program would be modified, if necessary, and then implemented on a nationwide basis as one of the revenue generating services offered by the Center. The program would be linked to financing to the extent necessary, as an added incentive to implement audit recommendations. As market barriers to high efficiency motors are removed, these would be incorporated into the audit program and recommendations.
- 1.5.7 Develop a data base to track client contacts and program progress. As with other ESC service programs, a data base should be developed to track all client contacts, record plant specific data, audit recommendations, implementation actions, and before and after energy consumption data so that program progress and results can be measured and reported.

Motor Rewind Subprogram

- 1.5.8 Conduct a study of motor rewind and refurbishing practices at a sample of rewind shops, both within plants that do their own motor rewinding and in outside shops. The survey should determine current practice in motor rewinding, knowledge and attitudes on the part of the motor repair people, barriers and constraints to improving their practices, and the effect on motor efficiency as a result of current practices. The study should estimate the overall impact on the country's power consumption as a result of the motor rewind practices and should make recommendations as to how these can be improved, both through policy actions and through training and technical assistance.

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1.5.9 Conduct a series of training workshops in motor rewinding and refurbishing practices that do not degrade efficiency. The course audience may be segmented into ESC and other MOE staff, motor repair personnel from public industries, and motor repair personnel from independent shops. The training for the ESC staff should be sufficient to enable them to continue to conduct the training on their own for other groups (i.e., a "train-the-trainers" approach).

1.5.10 Implement policy recommendations resulting from activity 1.5.8. These could include the development of minimum standards for efficiency loss resulting from motor rewind, a certification program for shops meeting motor rewind standards, and an awareness campaign targeted at plant managers regarding the certification program and the costs associated with improper rewind practice.

1.5.11 Conduct a monitoring program to determine improvement in motor efficiency as a result of improved motor rewind practices. The monitoring program could include spot checks on rewind shops to determine whether they have changed their practices and the impact of these changes on motor efficiency.

Output 1.6 Fully Operational Power Factor Correction Program to Improve Low power Factor Currently Existing in Syria

Low power factor is a significant problem in Syria. The power factor fluctuates widely and can be as low as 0.6. The Ekono energy audit conducted of the GECO Steel plant in Hama in 1994 found that low power factor was a serious constraint to production capacity, not to mention its affect on the grid. The capacitor banks originally installed were not in use due to lack of spare parts.³ Correction of power factor has been a highly cost-effective program in a number of developing countries including Egypt, Pakistan and India and would appear to have substantial potential in Syria.

The Power Factor Correction Program (PFCP) will need address several issues associated with low power factor, including:

- a) the existence of a power factor penalty in the current tariff structure and the amount of the penalty
- b) awareness and knowledge of the penalty within the industrial and commercial sectors
- c) enforcement of the penalty
- d) ability of industry to respond to the penalty, if enforced, i.e., availability of necessary

³ Ekono Energy Ltd., "Feasibility Study: Capacity Building for Demand Side Management and Power Plant Efficiency", Ministry of Electricity, Public Establishment of Electricity, Syrian Arab Republic, November 1994, p.

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equipment and financial resources

The General Director, ESC, will have overall responsibility for the program. The Director Finance and Analysis will have responsibility to determine the current status of the power factor penalty and its effectiveness. If there are barriers to improving power factor at this point, it will be his responsibility to identify the barriers and work to develop the policy analysis necessary to support recommendations for increased penalties and stronger enforcement. Once a reasonably strong power factor penalty is in place and it is being enforced, it will be the responsibility of the Director Energy Services to design a program that programs power factor correction services to the industrial and commercial sectors.

Activities for Output 1.6

- 1.6.1 Determine current status of power factor penalty in Syria. This will include discussions within the Ministry of Electricity as to the level of power factor penalty, the level of enforcement, the awareness on the part of the industrial and commercial sectors of the penalty, and the estimated impact on the system of the low power factor.
- 1.6.2 If the power factor penalty is found to be insufficient, a study will be conducted to determine:
 - the economic cost to the country resulting from low power factor,
 - the level of penalty necessary to provide sufficient incentive to invest in power factor correction on the part of the industrial and commercial sectors, and
 - the amount of investment in power factor correction equipment necessary to correct the problem.
- 1.6.3 Work with the Ministry of Electricity to design, implement and enforce a new power factor penalty that will stimulate industry to correct low power at the plant level. Implementation and strict enforcement of the new penalty should be done in parallel with a program to assist industry correct the problem. For example, the new penalty could be launched with a one-year grace period, during which time the ESC would offer its power factor correction service to industries in combination with financing. Thus, industries acting responsibly could avoid the penalty by taking advantage of the program during the grace period.
- 1.6.4 Design a power factor correction service program for the commercial and industrial sectors. The design could include different options for customers such as a complete turn-key service provided by the Center, an audit only with recommendations and equipment specifications, a performance contract with the Center financing the installation and maintenance of the equipment, and other possible service options.

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1.6.5 Implement the power factor correction service in parallel and in coordination with Ministry of Electricity actions to implement and enforce its power factor penalty.

1.6.6 Develop a data base to track client contacts and program progress. As with other ESC service programs, a data base should be developed to track all client contacts, record plant specific data, audit recommendations, implementation actions, and before and after power factor data so that program progress and results can be measured and reported.

Output 1.7 Technical Training Programs Designed and Implemented

The technical training courses described in this output refer to those conducted for general audiences throughout the country, over and above those mentioned in other outputs, which are directed more specifically at program delivery personnel such as ESC staff, local consulting engineers who may work under contract to the ESC, bank staff involved in financing ESC certified projects, and others. To the extent possible, the persons conducting the technical training programs will be the same individuals involved in training persons involved in program delivery, so that expenses for travel can be reduced. For example, the regional or international consultant helping develop the boiler efficiency audit and conducting the staff training in boiler efficiency will also conduct a general course in boiler efficiency improvement in several locations around the country. This not only makes the most effective use of this trainer, but also helps prepare the target audience for the ESC program to follow, in this case the boiler/furnace efficiency program.

The general training strategy will be to use a "train-the-trainers" approach. This will entail the expert for each training course to initially train the ESC staff or consulting engineers in the particular subject. These trained staff will then assist the expert in subsequent training courses, taking increasing responsibility with each successive course. By the end of a course sequence, the trainee(s) should be able to conduct the course themselves. This will help provide sustainability to the training and also create another source of revenue for the ESC.

The General Director, ESC, will have overall responsibility for the technical training program, but the Director Information and Training Services will have day-to-day responsibility for design, implementation and evaluation. To the maximum extent possible, the technical training program will make use of technical manuals already prepared in other countries. The two most extensive and relevant sources of such information are Egypt and Pakistan, where large energy efficiency technical assistance and training programs were funded by USAID. In all, these two programs produced over forty technical training manuals related to energy efficiency and would be extremely useful to the new Syrian Energy Service Center.

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Activities for Output 1.7

1.7.1 Conduct an assessment for the training needs for various audiences in the industrial and commercial sectors. The target audiences should include top management, plant and building managers, plant and building engineers, equipment operators, maintenance and repair personnel, as well as relevant technical and management personnel within the various ministries, such as the Ministry of Industry, Ministry of Planning and the Ministry of Economy. The training needs assessment will be conducted by an international expert in conjunction with the relevant staff in the ESC, including the Director Information and Training and the Director Energy Services. The training needs assessment should help guide the subsequent development and priorities of the training program.

1.7.2 Develop a priority list of training courses and an approximate schedule for the courses. In general, the courses will be 1-2 days each and will be held in 3-4 locations throughout the country with 20-30 attendees at each course. Experience has shown that more courses may need to be held for boilers and steam systems than the other areas. An illustrative list of courses might be the following:

- Energy Management for Companies (plant managers, engineers and technicians)
- Energy Management for Executives
- Energy Accounting
- Boiler Efficiency Improvement
- Steam System Efficiency Improvement
- Electric System Efficiency Improvement
- Lighting Efficiency Improvement
- Power Factor Improvement
- Boiler Water Treatment
- Waste Heat Recovery
- Energy Efficiency Financing
- Energy Measurement and Instrumentation
- Air Conditioning and Refrigeration

Training manuals for most of these courses have already been developed.

1.7.3 Conduct the technical training courses. A one-year schedule of technical training courses should be prepared and published well in advance of the first course. This will allow people to schedule attendance in their area. Each course should have specific objectives about what the attendee should know and be able to do as a result of the course.

1.7.4 Prepare a training evaluation program. This should include some type of

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evaluation of course effectiveness on the part of attendees at the end of each course, and some evaluation of what the attendee has learned, perhaps through a test at the end of the course. Course completion certificates should also be given to each attendee. Finally, the evaluation should include random sampling of course attendees after they have returned to their jobs to determine whether what was learned in the course has been applied to their work.

Output 1.8 A Long-Term "Business Plan" for the Syrian Energy Services Center (SECS) Developed and Initiated

A goal of this project is to create an independent, commercially viable energy efficiency services capability within Syria. This will be accomplished by establishing the Syrian Energy Service Center under the authority of the Ministry of Electricity so that this service capability can be incubated within the Ministry and then set up as a commercially viable company when it is ready. In order to implant the business discipline necessary to be a commercial success, it will be important to organize and manage the Center as a business from the outset. To help accomplish this, the Center will develop an annual business plan and track revenues and costs, just as it would as an independent company. Output 1.8 is designed to help the Center plan and manage its operations as an independent business.

Development of the SESC business plan will be the responsibility of the General Director, ESC. He/she will be assisted in this by each of the Directors and their staff. Accounting systems will need to be established to produce the cost and revenue detail needed to determine business viability. Monthly statements should be produced as soon as possible so that the management gets in the habit of tracking revenues and expenses in order to determine profitability.

Activities for Output 1.8

- 1.8.1 Conduct a training course in energy service companies and the energy efficiency service business. This will be a one week course involving all the senior staff in the Center and appropriate MOE staff. The course will review the ESCO business in other countries, present various models of successful ESCOs and describe the types of services and products being offered by ESCOs around the world. The international expert conducting the course will assist the ESC staff prepare the business plan and strategy described below as part of the training exercise.
- 1.8.2 Develop a general business plan and strategy for the duration of the UNDP/GEF project with a goal of at least a portion of the Center becoming commercially viable at the end of the project, i.e., after four years. The plan should identify products and services to be offered, management support systems needed, marketing strategies, and areas of responsibility.

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- 1.8.3 Develop a specific business plan for 1999. An international consultant will assist in this exercise using a computer-based business planning tool and training the staff in its use. The staff will develop a detailed plan of their activities, level of effort allocations, expense and revenue projections. The plan should include the UNDP/GEF funds for this project so that a complete financial and human resource projection can be made. The plan will of necessity be subject to change since this will be the first such plan for a new organization. Nonetheless, by using the UNDP/GEF Project Document as a starting point, the first plan should be able to be quite detailed and reasonably accurate.
- 1.8.4 Monthly financial and progress reports. The General Director shall prepare monthly financial statements comparing actual costs and revenues relative to plan. These financial statements should accompany progress reports on Center activities. The financial and progress reports should be reviewed with Center staff.
- 1.8.5 Annual financial statement and progress report. An annual report should be prepared by the General Director summarizing the finances of the Center for the year and accomplishments to date.
- 1.8.6 Develop business plan for 2000. This plan should be able to be more precise than the first plan, given one year's operational experience. Again, a computerized business planning model should be used to come up with a detailed annual plan and budget.
- 1.8.7 Develop business plan for 2002 and beyond. This plan should include not only year 2001 activities, but also describe the steps necessary to establish those services that are commercially viable as a separate, independent company. This plan would then lay the framework for the government to take the actions necessary to establish the Center as a separate public or private business.

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IMMEDIATE OBJECTIVE 2. NATIONAL ENERGY EFFICIENCY PROGRAM

To reduce energy consumption by 0.32% in the year 2008 through the establishment of the institutional capacity to develop and implement energy efficiency policies, conduct national energy efficiency planning and integrate it into overall power and energy planning, and to create awareness and understanding among the Syrian people regarding the importance of energy efficiency and the specific techniques for capturing energy savings.

The National Energy Efficiency Program (NEEP) funded by the UNDP/TRAC resources is intended to provide both a visible public focus on energy efficiency at the same time that it is establishing a long-term institutional foundation for the development of policy, planning and programs for energy efficiency. The NEEP will be used to help launch the Syrian Energy Services Center and reinforce its programs through the provision of information, analytical support, and parallel policy development and implementation. The critical baseline funding provided by the UNDP will succeed in creating the sustainable capacity to plan for energy efficiency at the national level, identify and remove barriers to efficiency, and design and implement programs and services for energy efficiency.

The implementing agency for achieving this objective will be the Ministry of Electricity. Within the Ministry, the Syrian Energy Services Center will be the executing unit, with the General Director, ESC, having the day-to-day responsibility for planning and implementing the programs. He will be assisted in these tasks by his staff of 14 professionals (government employees) and international and regional technical experts and local consultants funded by this project.

The outputs described below are, for the most part, not typically revenue generating activities in a developing country. They include policy analysis, financial analysis, energy efficiency planning, and information development and dissemination. These activities are certainly supportive of revenue generating services, but in most countries, both industrialized and developing, to a greater or lesser degree, these functions are part of government's responsibilities. Thus, looking to the time when the Center is established as an independent company, some of the activities and functions described below can be expected to remain as part of the government.

Success Criteria

By the end of this project, the Ministry of Electricity and the Syrian Energy Services Center will have achieved the following results:

- developed and disseminated information materials in support of the various energy efficiency services provided in Immediate Objective 1;

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- developed and disseminated information materials aimed at providing the residential sector with energy efficiency information;
- developed a successful hotline service that is responding to at least 100 calls per month;
- launched a major energy efficiency awareness campaign (if possible sponsored by His Excellency the President) which helps supports all of the Center's programs;
- presented a number of Energy Efficiency Awards on an annual basis to various plant and facility owners and operators in recognition of their outstanding efforts for energy efficiency;
- completed an assessment of the potential for demand-side management programs in Syria
- completed the design of a number of DSM pilot programs and submitted some of theses designs for funding by a donor agency;
- initiated the development of labeling and minimum efficiency standards for room air conditioners;
- established a policy analysis and development capability and formulated policy recommendations for the use of life cycle costing in government procurement and incentives for more efficient plant operation in public industries, or similar such policies.

Output 2.1 Well Informed Demand-Side Energy Stakeholders through Cross Sectoral Information Dissemination and Promotion Program Designed and Implemented by SESC

Information is a critical barrier to energy efficiency in Syria. However, information programs by themselves may have little impact if other barriers to improving efficiency remain. In order to achieve maximum impact, many of the information activities to be carried out under Output 2.2. will be in support of the energy services programs described under Immediate Objective 1 and will be conducted concurrently, so that both programs are mutually reinforcing.

Nonetheless, critical areas for improving efficiency, such as the residential sector, which consumes almost half of all electricity, need to be given information now to help eliminate waste while demand side management and other programs are designed and implemented. These information targets will be determined and materials developed early in the project. In particular, it will be important to have basic information materials ready to distribute at the time that the President launches the NEEP.

The Director Information and Training Services will have primary responsibility for developing the information program. He will work in coordination with the Director Energy Services and under the overall guidance of the General Director, ESC.

Activities for Output 2.1

- 2.1.1 Develop information materials to support the QSP. The QSP will be the first program of the Center and persons conducting the QSP visits should have a standard

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package of presentation and information materials. Many such materials are available from similar programs in other countries. This activity will collect as many of these materials as possible, assisted by an international consulting firm specializing in the energy efficiency area, and select those most appropriate for the QSP. These will be rewritten to be appropriate to Syria and a common graphic presentation developed. A local ad firm should be hired to develop a logo, graphics package and "brand image" for the Center which will be used in all subsequent materials and presentations.

2.1.2 Develop an information plan for the remainder of the Center programs. The Director, Information and Training should work with the Director Energy Services to coordinate the schedule for the various service programs identified in Immediate Objective 1. Information materials should be identified which would support each service program. For example, for the Boiler/Furnace Efficiency Program, information pamphlets such as "Tuning Boilers and Furnaces for High Efficiency" and "Combustion Analyzers & Controls: A Selection Guide", can be developed and given to industrial clients as part of the service. These and other such pamphlets already exist and can be easily adapted for Syria.⁴ The plan should make use of feedback and information collected from the QSP, the hotline and other sources to target information needs perceived by plant operators and technicians.

2.1.3 Implement the information plan for the Center's service programs. These would include the following:

- Industrial Efficiency Program
- Boiler/Furnace Efficiency Program
- Steam System Efficiency Program
- Motor Audit Program
- Motor Rewind Program
- Power Factor Correction Program

2.1.4 Prepare a plan for the development and dissemination of information to the residential sector. Development of the plan will need to be based on analysis of energy consumption in the residential sector, attitudes and behavior of residents, and the identification of significant opportunities for improving efficiency which can be implemented at no or low cost. Initially, this information will be collected from existing sources by the ESC staff and significant use will be made of previously researched and prepared materials from other countries. However, as more detailed information from Outputs 2.5 and 2.6 become available, information materials will be refined. The plan should include information materials covering energy use in the

⁴ A complete set of energy efficiency pamphlets, facts sheets, and other materials for the industrial, commercial, transport and agriculture sectors has been developed by Hagler Bailly Services, Inc. for Pakistan's national energy conservation center, ENERCON, under funding by USAID.