Identification of National Energy Policies and Energy Access in Jordan

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1. Global and Local Energy Sector Characteristics

1.1 Global Energy Situation

As the world enters a new millennium, it is predicted that the global demand for energy will rise phenomenally. In the history of human energy use, the sustainable resources were the sole world supply and that the world will necessary again have to turn to sustainable resources before the present century is over.

Energy plays an essential role, as can be seen by analyzing current energy use in the world, industrialized countries, and developing countries. Fossil fuels account for more than 85% of world's commercial energy supply. However, there is evidence that world production of fossil fuels will begin to deplete early in the middle of this century. Current patterns of global energy use are not sustainable. The fossil fuel period is an era not an age and highly limited in time therefore it is critical for governments to view what remains of the fossil fuel era as transition.

Energy is of vital importance for the processes of production and manufacturing and, as such, a key element of sustainable development. With recognition that oil and gas supplies are finite, increasing attention is going to sources of energy that are renewable in the sense that they can be used without exhausting the source of the energy.

Billion of dollars are being invested into the development, exploration and application of non-renewable energy resources, which soon will be depleted, rather than spending the money on sustainable development: but the worst of all is the growing, irreversible disturbance of the balanced of the biosphere by the exponentially increasing use of such resources.

All fossil energy consumed today (coal, oil and natural gas) come from the sun's energy, which is stored solar energy –but it was stored in plants millions of years ago, and once used, it cannot be regenerated on a human time scale. The earth's remaining fossil fuel reserves can probably provide us with energy for another one to two centuries, but this is an insignificant amount of time in terms of the whole past history of human civilization and (one hopes) of its future.

A variety of factors converged last year which triggered energy, specifically oil, to once again become a topic of great national and international interest. Oil price hikes, power shortages, and concerns about energy self-sufficiency contributed to the resurgence of energy awareness. However, along with this awareness often did not allow recognition of the significant progress being made in achieving cleaner air emission standards, especially regarding fossil-fired power stations.

The environmental degradation associated with the production and consumption of energy today, particularly fossil fuels, threatens human health and quality of life, and affects ecological balance and biodiversity. Currently, most of the greenhouse gases added to the atmosphere by human activities is the result of carbon dioxide from fossil fuel combustion. Over two thirds of those emissions come from industrialized countries. But greenhouse gas emissions are increasing in developing countries much faster than in industrialized countries as a result of growth in both population and

national economies, and if that path continues without a significant shift toward renewable-based energy generation, there will be little hope of stabilizing greenhouse gas accumulations even if industrialized countries meet the modest goals set by the Kyoto Protocol. Renewable energies provide a timely gateway of global greenhouse gas emissions reduction. Renewable energies provide, particularly in the arid regions, the additional energy resources for needed large-scale water desalination projects. Sustainable development requires sufficient and low-cost energy supplies. Renewable energies provide worldwide secure access to inexhaustible energy resources; some already at low and all at further decreasing costs.

There are at least 2.40 billion people (i.e. as high as 40% of world population) is entirely dependant on biomass as their main source of energy. Biomass consumption in the world is around 1200 – 1500 million tons oil equivalent (m.t.o.e), around 14% of global end use energy consumption.

1.2 Local Energy Situation

Jordan occupies a strategic location in the Middle East, and is an important crossroads for regional energy integration. Jordan is a developing non-oil producing country. Its basic energy requirements are obtained from imported oil and petroleum products from different sources. Domestic natural gas covers only 3-4% of the Kingdom's energy need. The demand for primary energy in 2003 was 5.8 million ton of oil equivalent which represents an annual growth of 3%. The average energy consumption per capita in 2003 was 1054 kg oil equivalent. Energy import costs create a financial burden on the national economy. Jordan spends about 10.9% of its GDP on the purchase of energy. The levels of energy and electricity consumption will probably double in 15 years. The most important domestic sources of indigenous energy are natural gas, renewable energy and oil shale.

Renewable energy applications in Jordan includes solar water heaters of more than 300,000 units, solar photovoltaic of more than 200 kW peak, wind farms of 1.5 MW, hydropower of 5 MW and biogas of 3 MW. The total contribution of renewable energy in Jordan is less than 2% of the total energy mix. Oil shale reserves in Jordan are estimated at 40 billion tons, containing 40 billion barrels of oil. This strategic source of energy could be adequate to cover Jordan's current energy requirements for hundreds of years if the resources are to be economically exploited on a large commercial scale. Table 1 summarizes Potential new & renewable energy resources in Jordan.

Table 1: Potential New and Renewable Energy Resources

1.	Oil Shale	Geological reserves	40 billion tons
2.	Tar Sands	Geological reserves	40 million tons
3.	Uranium	Uranium to phosphate ratio Uranium reserves	80-160 PPM 8-16 thousand tons
4.	Solar	Average 5.5 kWh/m^2/day	More than 1000 MW
5.	Wind	5- 8 m/s average wind speed	More than 1000 MW
6.	Bio gas		More than 50 MW
7.	Hydro	When connecting RSDS canal	600 MW
8.	Geothermal	Under investigation	

The current energy situation in the country does not lead to energy independence, therefore, it is critical for Jordan to develop its indigenous sources of energy, and the establishment of the National Energy Research Center in 1998 with mandate of promoting the renewable/non-conventional energy utilization in Jordan came to assist the Government in developing such resources to a commercial level.

The possibility of directly burning oil shale to produce electricity is also being investigated. At presents, Jordan is importing natural gas from Egypt through 170-mile natural gas pipeline for transporting Egyptian gas from the Nile Delta to Aqaba. Initially, the pipeline is transporting 212 million cubic feet per day and 318 million when it is fully operational in 2008. This will enable gas to replace diesel and oil in electricity generation.

2. National Energy Policies

In recent years, Jordan has been undergoing a momentous transformation process, based on a major restructuring of the country's economy. The economy of Jordan has the potential to progress towards sustainable growth and development.

The main aims of National Energy Policy are:-

- Development of local energy resources; Natural Gas, Oil shale, Solar, Wind, Biogas and Hydro Power.
- Penetration of new energy forms in the final consumption.
- Marketing exploration zones in Jordan.
- Participation of private sector in the energy sector.
- Improvement of efficiency.
- Introduce competition.
- Tariff development so as to reflect the real cost.

Concerning the renewable energy sources the Ministry of Energy and Mineral Resources (MEMR) is implementing a policy for the penetration of renewable energy in the energy mix by allocating about5% of the total energy from renewable energy by year 2015. This will be done by promoting renewable energy in the electricity generation sector mainly through private investment also by enhancing the usage of solar heating in households, services and agriculture sectors and utilization of solar water pumping in rural areas.

The Government has recognized that research and development activities related to new and renewable energy and energy conservation should be started immediately due to the long lead time between R& D and the use of its results in commercial applications. The environmental characteristics of renewable energy, energy-water conservation and energy security brought about by increasing the use of indigenous energy sources are the most common reasons cited for establishing the NERC by the Government. Therefore, the government has initiated the NERC in 1998.

Regarding the production of electricity, the enactment of the General Electricity Law made the institutional framework of Jordan the most liberal in the region. The sector was restructured in a way permitting at the first stage the competition in generation until the sector is gradually freed to into a competitive market in full. The government is implementing a program to privatize the generation and distribution

sectors, while the transmission and system operation will remain fully owned by the government.

The government has passed an overall strategy for the energy sector resulting in general policies that guarantees reaching the goals in this sector. This plan indicates that the required investment for the next 10 years is estimated at US$ 3 billions.

2.1 Pricing Practices

Jordan does have a policy to provide subsidies. Consequently the prices vary across customer segments to a significant extent. The electric tariffs also vary with the level of consumption and time of usage. These tariffs imply a subsidy for small industry, water pumping, agriculture and street lighting. Table 2 details the electrical tariff in Jordan across different customer segments.

Table 2: Electricity Tariff as of End 2002

1- Bulk Supply Tariff	Until 15/6/2002	From 16/6/2002
A- Electricity Companies		
1- Peak load (JD/kWh/month)	2.4	2.4
2- Day Energy (fils/kWh)	29	31.4
3- Night Energy (fils/kWh)	19	21.4
B- Large Industries		
1- Peak load (JD/kWh/month)	2.4	2.4
2- Day Energy (fils/kWh)	47	48
3- Night Energy (fils/kWh)	32	33.5
2- Retail Tariff		
A- Domestic (fils /KWh)		
First block : from 1-160 kWh/month	30	31
Second block : from 161-300 kWh/month	52	55
Third block : form 301-500 kWh/month	60	64
Fourth block : More than 500 kWh /month	75	80
B- Flat rate tariff for TV and broadcasting stations (fils/kWh)	60	60
C- Commercial (fils/kWh)	60	62
D- Small Industries (fils/kWh)	36	38
E- Medium Industries		
1- Peak load (JD/kWh/Month)	3.05	3.05
2- Day Energy (fils/kWh)	33	35
3- Night Energy (fils/kWh)	21	25
F. Agriculture (fils/kWh)	23	26
G. Water pumping (fils/kWh)	34	38
H. Hotels (fils/kWh)	60	60
I. street lighting (fils/kWh)*	20	25
Note : Monthly minimum charge		
A- domestic (JD/Month)	1	1
B- Other consumers	1.25	1.25

The prices for oil products are also subjected for subsidy, which varies by regions and customer segments. However, the subsidies have come down over the years. Fuel oil for electricity production and LPG still continue to be subsidized though to a small extent. The Retail Prices of Petroleum Products are shown in table (3)

Table 3: Retail Prices of Petroleum Products Effective: April, 3rd, 2004

LPG-Fils/Cylinder (12.5 kg)	3250
Regular Gasoline - Fils / Liter	330
Unnleaded Gasoline - Fils / Liter	470
Premium Gasoline Fils / Liter	435
Avtur - Fils / Liter (Local Companies)	160
Avtur - Fils / Liter (Foreign Companies)	200
Kerosene - Fils / Liter	135
Diesel - Fils / Liter	135
Fuel Oil - JD / ton (electricity)	75
Fuel Oil - JD / ton (Industry except Aqaba)	88
Fuel Oil - JD / ton (Industry at Aqaba)	91
Asphalt - JD / ton	80

3. Energy Access in Jordan with Special Emphasis on Rural Electrification

Jordan policy gives high priority to the development of remote areas and improving the living situations of the people living there. The government of Jordan is leading efforts and plans related to the development of this region. Many authorities have been established under the government umbrella with considerable budget to provide services for inhabitants living in remote areas.

Between 1980 and 1985, per capita consumption of electricity in Jordan doubled from 500 kilowatt hours per year to 1,000 kilowatt hours per year. The demand increase reflected the doubling in the number of households supplied with electricity as rural villages were electrified. By 1985 about 400,000 households, or 97 percent of the population, had access to electricity. Electricity penetration in rural areas has reached about 98.8 in year 2002 as shown in table (4) due to the implementation of the rural electrification policy that detects 2 filses per each kWh sold in Jordan.

Electricity generation increased 23 percent in 1986 and 18 percent in 1987 to total 712 megawatts. After rural electrification was completed, growth in electric growth in consumption, which was limited by conservation measures to about 3 percent to 4 percent per year in 1987. Roughly 40 percent of the electric power generated was used by industry, 30 percent was used by private citizens13 percent was used by commercial businesses, and the remainder was used by water pumping stations. The Hussein Thermal Power Station at Az Zarqa historically had produced more than 70 percent of the country's electricity, but at the end of 1987, the opening of the Aqabah Thermal Power Station added 650 megawatts, boosting Jordan's generating capacity to 1500 megawatts. A 400-kilovolt transmission line connected Aqabah and Amman.

The reform program was embodied in new legislation such as the new investment law and the new electricity law that has opened the power sector to private competition. Almost all electricity production in Jordan currently is carried out by the National Electric Power Company (NEPCO), a state-owned utility. The Zarqa power plant, with a capacity of 400 megawatts (MW), and the Aqaba power plant, with a capacity of 650 MW, is the country's two main power generation facilities. Electricity demand is growing - around 3.5% in 2001 - and the Jordanian government has been seeking ways to attract foreign capital to fund additional capacity. In December 2001, the

Jordanian government awarded a contract to provide advice on the privatization scheme. Jordan's basic plan for the future of its electric utility system involves having NEPCO maintain ownership of transmission assets, but relying on private power generation and privatizing existing generation assets. NEPCO's distribution subsidiary, the Electricity Distribution Company (EDCO), also is to be privatized. Two other private distribution firms already exist - the Jordan Electric Power Company (JEPCO) in the Amman area and the Irbid District Electricity Company (IDECO) covering the area around Irbid. Jordan is seeking to increase and diversify its energy sources with oil, gas and electricity projects, including wind farms. The Kingdom has linked its electricity grid to those of Syria and Egypt, and within a year it will have begun laying pipelines to import Iraqi oil and Egyptian natural gas.

Table 4: Population Supplied With Electricity in Jordan

Year	Total population (000's)		Population supplied (000's)		(%) of population under supply	
	Kingdom	Rural	Kingdom	Rural	Kingdom	Rural
1997	4604	1655	4590	1644	99.7	99.3
1998	4755	1715	4745	1706	99.8	99.5
1999	4900	1777	4895	1768	99.9	99.5
2000	5039	1826	5033	1820	99.9	99.70
2001	5182	1878	5177	1874	99.9	99.80
2002	5329	1931	5324	1927	99.9	99.80

PV- water pumping systems used in remote areas have proven high techno-economic feasibility over all other competitive systems. Experience in Jordan has indicated the advantages of these systems over traditional diesel systems through implementing and running many systems during the last fifteen years. The success of this technology in Jordan has led to the replacement of most diesel systems that were running in the past by Photovoltaic and wind energy systems

Many photovoltaic water-pumping systems have been installed in remote areas to pump underground water to storage tanks. It has been discovered that some of these resources are brackish. For the case of Jordan, 22 water-pumping stations are operated by solar energy. PV- water pumping systems used in remote areas have proven high techno-economic feasibility over all other competitive systems. Experience in Jordan has indicated the advantages of these systems over traditional diesel systems through implementing and running many systems during the last fifteen years.

A new solar desalination project is located in Aqaba using reverse osmosis concept.This project is currently under implementation process.

4. Emphasis of Policies on Poverty Alleviation

Sustainable development means meeting the economic, environmental, and social needs of today’s society without compromising the opportunity of future generations to do the same. In all three areas, energy plays an essential role, as can be seen by

analyzing current energy use in the world, industrialized countries, and developing countries. Energy, like food and shelter, is a basic need of people throughout the world. But as the 21st Century begins, more than two billion people – one third of humanity – do not have access to grid electricity.

Of these, the vast majority live in rural areas of developing countries where only a minority of people have access to grid supply – in some countries the proportion is less than ten per cent.

The issue of energy choice is fundamental to the great challenge facing the world at the beginning of the 21st century – how to eliminate the obscene levels of poverty without further polluting the planet. Electricity is needed to power small industries and enterprises, run health clinics and light schools. Without it, rural poverty will not be eradicated. Decentralized energy options using local resources – such as wind, biogas, solar power or micro-hydro – offer many advantages for meeting the needs of the rural population. Technologies can be made appropriate, affordable and accessible for poor communities.

This section explores the linkages between renewable energy, poverty alleviation and sustainable development in developing countries including Jordan. Access to basic, clean energy services is essential for sustainable development and poverty eradication, and provides major benefits in the areas of health, literacy and equity. However, over two billion people have no access to modern forms of energy to supply basic needs such as cooking, lighting and heating. Instead they rely on dangerous and polluting energy sources that damage human health and the environment. Over 100 million women spend hours every day gathering fuel wood, and then spend additional hours cooking with poorly vented stoves. This wasted time could be used to have opportunities for education or more productive income-generating activities. About 2 million premature deaths occur every year from exposure to indoor air pollution caused by burning solid fuels in poorly ventilated spaces.

In many developing countries, the lack of access to convenient and efficient energy services is a major barrier to achieving meaningful and long-lasting solutions to poverty. Renewable energy technologies using biomass, wind, solar, hydropower and geothermal energy sources can provide energy services for sustainable development based on indigenous sources, with almost no net emissions of greenhouse gases.

NERC's activities focus on the upstream enabling environment and policies needed to support energy options for sustainable development addressing economic, social and environmental goals simultaneously to address poverty and promote sustainable development.

NERC will propose some projects aiming at analyzing the integration of solar and wind energy for electricity supply in the rural regions of country. Research was carried out on the selection of the most appropriate sites to install the renewable energy systems, on the technologies most suited, on the cost/benefit analysis and on

the possible financing schemes. NERC with the cooperation of the Rural Electrification Project has implemented several electrification projects in some remote areas using photovoltaic system. A major issue was the competitively of renewable energies vis-à-vis fossil fuel options and thus detailed selection of the adapted sites (where the solar or wind resources are highest and which are close to load centres) have been done based on cost/benefit analysis in order to select the least cost options. The external benefits related to social or environmental aspects were also taken into account.

5. The Role of Renewable Energy

Renewable energy sources, such as solar, wind or wave power, are not only inexhaustible, but their deployment is generally environmentally benign and free of consequent pollution. Other renewable energy sources, such as municipal solid waste (MSW), are available at a substantial negative cost by virtue of the tipping fees paid for their disposal. Use of some of the above sources requires further development and full-scale demonstration**.**

Jordan enjoys a substantial potential of renewable energy sources. Considerable efforts have been made and great progress has been achieved in the application of solar, wind, biogas and hydro energy utilization.

There is a policy for the penetration of renewable energy in the energy system by allocating 5% of the total energy from renewable energy within 10 years. This will be done by promoting renewable energy system in the electricity generation sector mainly through private investment also enhancing the usage of solar heating in households, services and agriculture sectors and utilization of solar water pumping in rural areas.

5.1 Solar Energy

Jordan has started its solar energy program 25 years ago in cooperation with many well-known scientific international institutions. As a result, Jordan is considered now as one of the leading countries in the region in the field of solar energy.

Jordan is blessed with an abundance of solar energy. The annual daily average solar irradiance is 5-7 kWh/m2. Solar energy is widely used for water heating especially in the domestic sector (25% of households), and solar energy is used for electricity generation in several stand-alone applications. Several pilot applications especially for water pumping, telecommunications and lighting for remote sites have been successfully introduced.

Nationally, solar power has been harnessed through both photovoltaic modules and solar domestic hot water systems although it is the latter technology that has brought Jordan to the forefront of global development. Right now there are 200 kWp of installed PV power for water pumping,

In addition to being used extensively in the domestic sector, solar energy is also used for a variety of agricultural purposes (greenhouses, drying and water heating),

minerals extraction at the Dead Sea Works and water heating production in many educational/commercial buildings.

Photovoltaic Applications

Photovoltaic generators are known for their low maintenance requirements and high reliability in stand -alone applications; therefore, these systems are suited to supply the basic energy needs in remote areas.

Some examples of PV applications are the following:

1. Emergency telephones
2. Rail radio communication systems
3. Relay stations for radio telephone communication
4. Non – directional radio beacon systems
5. Provision of the minimum basic energy needs in (electric lighting, educational TV and small refrigerators for the preservation of medicines and vaccines) for schools, mosques and clinics in remote areas.
6. Water pumping in remote areas.

Solar Pond

Solar pond is being used to evaporate 90 million m3 per year of the Dead Sea Water for Potash Production. This amount of solar evaporation is equivalent for about 5 million tons of oil per year.

Solar Desalination

Around 3% of the total population in Jordan occupies 41% of the total area of Jordan. This part represents the rural and remote areas, which lack electric and water networks. Securing potable drinking water in this region is a major problem facing authorities that are responsible for water policy in Jordan. Utilizing and desalinating available brackish water in these regions can attribute towards the alleviation of water shortage and improve living conditions of inhabitants. However, Using renewable energy as a power source to power the desalination units is the most feasible option since electricity networks are even not available or very expensive to extend it to the these remote locations.

It is important to investigate the technical and economic prospects of small-scale desalination technology by using renewable energy (solar and/or wind energy) in remote and rural areas, which are not connected to the national electrical grid and have a high potential of solar radiation and wind speed.

The first desalination plant in Jordan was erected and commissioned in 1977. It has used the heat pipe principle to desalinate seawater. Distilled quantities achieved during summer were 5 liters/m^2 /day and 2.5 to 3.0 liters/m^2 /day in winter. The seawater salinity is 41400 ppm where the product water has a quality of 35ppm.

Parabolic trough desalination plant was also tested in AqabaIn where a 24 m long parabolic trough with a sun tracking system was installed. In the trough, the working fluid is heated in a closed circulating loop. Seawater passes through a multistage evaporator is heated by absorbing heat from the working fluid in the trough, evaporated, condensated and collected as potable water. This unit was producing 1m3 /day at solar radiation of 5.6 kWhr/m2/day. Solar stills made of available

materials in Jordan such as cement, glass and black paint were tested to compare the result obtained by these units with the heat pipe solar desalination units.

5.2 Wind Energy

The wind atlas of Jordan indicates that large areas have an average annual wind speeds in excess of 6-6.5 m/s; some more limited areas have an average wind speed above 7 m/s. Two major wind farm pilot plants have been commissioned in Jordan with a rated power of 320 kW and 1,125 kW respectively. There are many other wind energy water pumping stations especially in the remote areas.

After the new electricity law was enacted in 1999, it is now expected that new wind farms will be installed. A 100 MW wind farm has been studied and identified as suitable for implementation at Wadi-Araba (North of Aqaba). Local industries have the potential of manufacturing a considerable percentage of wind farm components.

Water pumping by wind energy

There are two available technologies to pump water by wind energy**:** Mechanical Wind Pumps and Electrical Wind Pumping.

5.3 Biomass

A techno-economic feasibility study for 1 MW size electric power generation from municipal solid waste has been carried out in cooperation with UNDP. The pilot project was commissioned in March 2000. The project, which is located at the Amman municipal waste disposal, has cost JD 4 million, and will provide energy savings equivalent to 2 thousand tons of oil per year.

Direct combustion of biomass provides some energy for cooking and heating in some rural areas. The utilization of bio-energy in the form of bio-gas from animal and domestic wastes has also been investigated with the aim of introducing family fermentation units which produces biogas for domestic purposes.
It has been estimated that animal and solid wastes in Jordan represent an energy potential of about 100 thousand tons of oil equivalent annually.

The introduction of the biogas as an alternative source of energy has found considerable acceptability in Jordan that combines methane emission reduction and producing clean renewable electricity and high quality fertilizer.

The successful construction and operation of the combined landfill/biogas pant resulted in expediting the implementation of the capacity building program to disseminate the information and awareness and to create educational, training, management for replication.

The main objective of the master plan is to design a long term development strategy for SWM and biogas production and utilization in Jordan. Also to replicate similar projects in Jordan and in interested Arab Countries and to include this master plan in the national energy and planning framework. The plan aims at establishment of Jordan's internal capability to sustain biogas production and utilization.
The master plan will be an integrated part of the Jordan's overall energy policy as a source of renewable energy and the production of fertilizer from organic residues.

SWM should be elaborated in the national planning framework in Jordan. The main challenge is to move biogas projects toward a vision of sustainability by constructing and operating several replicable biogas projects in Jordan and in the region.

5.4 Hydroelectric

Hydro power sources are very limited in Jordan. Currently, the only hydroelectric station that generates electricity is King Talal Dam with a power generation of about 25 GWh per year. Other applications of hydropower are the hydro turbines at Aqaba Thermal Power Station, utilizing the available head of cooling sea water. Other major future potentials of hydro-electric of more than 800 MW are in the Dead Sea – Red Sea Canal, and the Al-Wehda Dam.

5.5 Geothermal

Several Studies have been conducted with the British Geological Survey and aimed at assessing the potential and availability of geothermal energy sources in Jordan. It was found that there is a significant evidence of geothermal activity almost all along the Dead Sea rift at two levels:

1. Medium energy ($110\ ^0C - 114\ ^0C$) resulting from vertical tectonics.
2. Low energy ($30\ ^0C - 65\ ^0C$) resulting from aquifers heated by the deep fluid circulation.

There are 108 hot springs in Jordan discharging about 25 million cubic meters of hot water each year into the Dead Sea.

The major spring complex of Zarqa Ma'in together with the Zara springs forms the main geothermal manifestation in Jordan. Many of these sources are currently being used on a small scale either for heating greenhouses or on several fish- breeding farms run by the Arab Fish Company.

Some ambitious projects do exist, which use geothermal energy for refrigeration by absorbing technology to conserve fruit and vegetables and to desalinate water from deep and aquifers at Azraq.

5.6 Energy Conservation

Energy conservation is considered as a new energy source due to its potential in energy savings. The extensive conservation programs implemented have led to a direct saving in energy estimated at about 80 thousand tons of oil equivalent per year. Improvement in the efficiency of energy and encouragement of energy conservation will lead to reduce oil imports, postpone the need for new investment in production facilities such as oil refineries and power stations, and reduce the emission of toxic gases to the environment.

One of the primary functions of the conservation program is to inform the public about energy savings by collecting and disseminating information about energy conservation. Activities include holding seminars, advertising, preparing and distributing publications on energy conservation. A second major activity of the center is that of conducting energy audits and providing technical advice based on on-site inspections. The advice has encompassed using thermal insulation, designing passive-solar heated buildings, installation solar water heaters and using more efficient electrical equipment.

6. Jordan's Experience in Privatization of the Electric Power Sector

The government of Jordan has embarked on a privatization program that is to include most public sector enterprises. This program is supervised by the Cabinet Committee on Privatization, recently created by the Council of Ministers. The Committee is responsible for setting broad policy and guidelines for the privatization program.

The power sector reform program embodies the following elements (i) separation of policy making, regulation and operation: the policy making, regulatory and operational aspects of the electrical power sector are to be separated. The Ministry of Energy and Mineral Resources plays the primary policy making role for the sector and the Regulatory Commission regulates the sector, including issuance and enforcement of licenses to companies operating in the sector, establishment and review of bulk and retail tariffs, enforcement of compliance by companies with environmental, safety and other standards and protection of the rights and interests of consumers.

The electricity industry had started in Jordan in 1938 when a group of entrepreneurs established a small company to provide electrical energy to the capital city of Amman. In 1947, that company was converted into a share-holding company called the Jordan power electricity company (JEPCO) which was granted a concession to generate and distribute electrical energy in Amman and its suburbs. JEPCO's concession was renewed in 1962 for fifty years and extended to cover four governorates in the central part of Jordan including Amman. JEPCO supplies electricity to about 64% of the total electricity consumers. It buys all its bulk power from NEPCO (former JEA). In 1961, another privately owned electrical power company called Irbid District Electricity Company (IDECO) was established to generate and distribute electrical energy in the northern part of the country. IDECO supplies electricity to about 23% of the total consumers.

In 1967, and realizing the need for a modern and reliable electricity system, the government established the Jordan Electricity Authority (JEA), under the provisions of the general electricity law No.21 (which was amended in 1986). JEA was entrusted with (i) generation of electrical energy through modern and reliable power plants (ii) transmission of electrical energy through a reliable high voltage network (iii) distribution of electrical energy in all areas that are not covered by the privately owned distribution companies and (iv) implementing an electrification program to ensure that most inhabitants of Jordan would have access to electricity. JEA was autonomous government institution enjoy juristic personality with financial and administrative independence. It was directly distributing electricity to approximately 13% of the countries consumers.

In accordance with the Jordan economy reform program which included encouraging the participation of the private sector to invest in principal infrastructure projects, the government of Jordan has decided, through is issuance of the new General Electricity law , to take the first practical main step towards privatization by transferring Jordan Electricity Authority (JEA) into a public share holding company named National Electric power company (NEPCO) owned totally by the government , In 1999, NEPCO was divided in to three companies as a main step towards

privatization in the future. This new electricity law, provides for the Ministry of Energy and Mineral Resources to establish the policies and the general rules related to the power sector and in accordance to this new law, an independent regulatory commission was established to control the electricity pricing policy, to set up the electricity tariff, and to grant the license of generation and distribution of electrical power.

The recently enacted Temporary Law No. (64) for the year 2003 (General Electricity Law) permits the licensing of independent power producers and independent power distributors. The General Electricity Law also allows industrial enterprises to set up their own power generating facilities and allows them to exchange their electricity with other independent power producers.

The responsibility of electricity generation, transmission and distribution in Jordan were covered by the following entities.

The Central Electric Generation Company (CEGC) which was established in 1998 is responsible for electricity generation and selling the generated electricity to electricity distribution companies through the National Electric Power Company.

The National Electric Power Company (NEPCO), a governmental company, is responsible for the electricity dispatch and transmission network through the high voltage network from generation stations to distribution networks.

The Electric Distribution Company (EDC) established in 1998. The EDC is responsible for electricity distribution in the southern and eastern Jordan. EDC will be privatized in the near future.

Linking national transmission grids into a regional network is one of the most important projects in the Middle East. A regional network can take advantage of national differences in peak demand periods and thus lead to significant savings to all countries. Jordan estimates that its savings will be around $250 million. In 1995, Jordan, Turkey, Egypt, Syria and Iraq agreed to a $590 million investment to link their electric power grids. The interconnection of the Jordanian and Egyptian networks has already been completed and put into commercial operation in March 1999. The interconnection between Jordan and Syria in also has been completed and put into commercial operation.

The electricity tariff charged to all classes of consumers will gradually be reformed such that the tariff eliminates subsidies and cross- subsidies, encourages energy conservation and loss reduction, covers cost of supply and provides a reasonable rate of return to the electrical utilities. Private sector participation in generation will be fostered by (a) the introduction of independent power producers (IPPs) for the establishment of new generating plants that will sell electricity to the NEPCO and (b) the privatization of the company or companies succeeding to NEPCO's generating.

7. Trans-Mediterranean Renewable Energy Cooperation “TREC”

The world's deserts are sufficiently large that, in theory, covering a fraction of their landmass with PV systems could generate many times the current primary global energy supply. Moreover, the energy produced is from solar radiation - a clean and

renewable source - hence such systems would have the potential to contribute massively to the protection of the global environment.

Trans-Mediterranean Renewable Energy Cooperation (TREC) project is mandated to initiate a common market and an interconnection infrastructure for renewable energies among the countries surrounding the Mediterranean Sea. The technologically highly developed European countries in the North are using fossil fuels heavily for their energy demands. The countries to the south and east of the Mediterranean have vast but unused sites offering superior solar and wind energy resources.

The desert sunny area of the Middle East and North Africa region with abundance of solar radiation that can capture the solar energy and transmit the power generated to Europe via the power grid loop sparing the use of fossil fuels for higher economic benefits.

Combining wind and solar power from large and from far distant regions can significantly reduce fluctuations by compensating effects.

- If Europe decides to buy a substantial volume of its energy as solar and wind electricity from the less developed countries in North Africa and Near East (hereafter referred to as NA/NE), and
- if the NA/NE countries develop the capability and capacities of producing renewable electricity from sun and wind, with technical and financial support from Europe, then the proposed Trans-Mediterranean Renewable Energy Cooperation could turn the formerly contradictory goals of *climate protection* and *economic development* into mutual reinforcing objectives by making clean energy production in NA/NE for both local and European markets a motor of industrial and socio-economic development in NA/NE countries.

The impact of TREC would extent far beyond the regions adjacent to the Mediterranean. Firstly, any contribution to climate protection and to political stabilisation is clearly of worldwide benefit. Secondly, the greatest energy resource worldwide is solar radiation. The technology of solar steam production for power generation using concentrating collectors such as parabolic trough or flat mirror arrays is suitable for all arid and desert regions of the world, which also provide abundant free space for their deployment.

The TREC project requires a close and structured cooperation of various players in a region that calls for peaceful relations. A master plan is indispensable for a coordinated approach. A team of experts in renewable energies and in developmental matters, with members from Benin, Egypt, Germany, Jordan, Morocco and at the EU level has been formed at the initiative of the German Association for the Club of Rome and of the Hamburg Climate Protection Foundation. Members from further countries are highly welcome.

In an initial step the TREC team has already assessed the technical means required and verified that the physical resources are sufficient. In a second step it will be formulating a master plan, which will show a way to such a Trans-Mediterranean Renewable Energy Cooperation. The master plan is not intended to be a prescription that has to be followed exactly, but rather to prove that there is at least one realistic concept to bring the TREC into existence. It has the purpose of identifying open questions and initiating work for their solutions.

8. References

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