Twinning Project Fiche

INSTITUTION BUILDING FOR THE NATIONAL ELECTRIC POWER COMPANY (NEPCO) IN JORDAN

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LIST OF USEFUL ACRONYMS/ABBREVIATIONS	
AA	Association Agreement
AES	Amman East Power
AFD	The French Development Agency
BOO	Build Own Operate
CEGCO	Central Electricity Generating Company
CRESMED	Cost efficient and reliable rural electrification schemes for South Mediterranean countries based on multi user Solar Hybrid grids
EBRD	European Bank for Reconstruction and Development.
EDP	Executive Development Program
EE	Energy Efficiency
EIB	European Investment Bank
EMS	Energy Management System
EU	European Union
EDCO	Electricity Distribution Company
EUE	Expected Unserved Energy
FDI	Foreign Direct Investment
GNI	Gross National Income
GDP	Gross Domestic Product
GWh	Gega Watt Hour
IDECO	Irbid District Electricity Company
IMF	International Monetary Fund
IPPs	Independent Power Producers
JD	Jordanian Dinar
JEPCO	Jordan Electric Power Company
JPRC	Jordan Petroleum Refinery Company
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
MEMR	Ministry of Energy and Mineral Resources
MS	Member State.
Mtoe	Million tonne of oil equivalent
Mw	Mega Watt
NEPCO	The (state owned) National Electric Power Company
NERC	The National Energy Research Centre
NG	Natural Gas
NIF	Neighbourhood investment facility
NIP	National Indicative Programme
NRA	The National Resource Authority
PCB	Polychlorinated Biphenyls
PL	Project Leader
PV	Photovoltaic
POPS	Persistent Organic Pollutants
PV	Photovoltaic
RE	Renewable Energy
REAC	Renewable Energy Air-Conditioning System for Mediterranean Countries
REEE	Renewable Energy and Energy Efficiency
REMAP	Southern and Eastern Mediterranean area
RET	Renewable Energy Technology
RETS	Renewable Energy Technologies
RTA	Resident Twinning Advisor
SAPP	Support to the Implementation of the EU Action Plan Programme.
SEPGCO	Samra Electric Power Generation Company
SOLARBUILD	Integration of solar technologies into buildings in Mediterranean communities
TOE	Tonne of Oil Equivalent
UNDP	United Nations Development Program
WED	Wind Energy Division
WECSP	Wind Energy and Concentrated Solar Power

STANDARD TWINNING PROJECT FICHE

1. BASIC INFORMATION

1.1 Programme:	Support to the Implementation of the Action Plan Program (SAPP II) CRIS No. 2009/ 020-478
1.2 Twinning Number:	JO/12/ENP/EY/21
1.3 Title:	Institution Building for the National Electric Power Company (NEPCO) in Jordan
1.4 Sector:	Energy Sector
1.5 Beneficiary Country/Institution:	The Hashemite Kingdom of Jordan / National Electric Power Company (NEPCO)

2. OBJECTIVES

2.1. Overall Objective

To improve the performance, operation and maintenance of the transmission network to meet the current challenges of demand and supply, while developing the national electricity market.

2.2. Project Purpose

To strengthen the institutional and operative capacity of NEPCO, with regards to renewable energy integration into transmission lines load management, electricity system strategic planning and management, effective use of simulators and neighbourhood interconnected capacity. The integrated approach is focusing on capacity building and international quality standards of equipment, operation and best practice based by EU-Member States.

2.3. Contribution to National Development Plan/ Cooperation Agreement and European Neighbourhood Policy

In 2002 the EU and Jordan signed the first Support to the **Association Agreement** Programme (SAAP). The agreement aimed at upgrading the Jordanian administration's institutional capacities so it could implement all aspects of the Association Agreement. A second support programme to the Association Agreement was concluded in 2005. The newer central element of the ENP is the bilateral **ENP Action Plans** agreed between the EU and each partner. The EU-Jordan ENP Action Plan **(AP)** was adopted in 2005, and has been implemented over a 5 year period. The AP defined a set of priorities covering a number of key areas for specific action, the implementation of which would facilitate the fulfilment of the provisions of EU-Jordan Association Agreement and consequently the Barcelona Process. The 6 priorities of the AP are: enhancing political dialogue and reform; **economic and social reform and development**; trade related issues, **market and regulatory reform**; cooperation in justice and home affairs; transport**, energy**, information society and **environments**, and people to people contacts, including education.

In November 2008, Jordan requested for advancing relations with the EU, with the aim of bringing Jordan closer to the EU by reinforcing the current Partnership and creating new avenues of cooperation in areas of mutual interest. The request was officially submitted to the Seventh Association Committee meeting held in Brussels in June 2009, which included the Government's views on how to enhance bilateral relations in the political, economic, trade, and social spheres, as well as deepen cooperation in key sectors such as **energy**, water, transport, agriculture, and science and technology. The EU approved Jordan's advanced status Action Plan in November 2010.

Support to the EU-Jordan Association Agreement and Action Plan: Jordan has been a frontrunner among the Mediterranean partners to embark on new association ties with the EU. From the Action Plan, in particular Article 48 on Environment and Article 49 on Energy are relevant..

The development of renewable or alternative energy sources is also highlighted in the Country Strategy Paper (NIP 2011-2013) under sub-priority 2 and the current twinning is thus relevant to the jointly identified priorities for the EU's cooperation with Jordan.

The ENPI Jordan National Indicative Programme 2011-2013 specifically states that 'Reducing dependency on imports of traditional sources of energy, namely oil and natural gas, is a key priority for Jordan. The wider exploitation of renewable energy (RE) sources, along with improved energy efficiency, is part of Jordan's strategy to meet the increasing energy demand, enhance its security of energy supply, develop new activities for local industries and services and promote economic and social development'.

It also underlines that the development of Jordan's Energy Strategy requires substantial work on strengthening institutional and administrative capacity in all relevant areas to ensure effective implementation and enforcement of the operations and standards,. to generate energy using renewable energy sources and thus to improve energy efficiency. The planned Twinning Project is aiming to support implementation of the above cited aims and practical measures in the fields of renewable energy and electricity operation.

The present Twinning project is also in line with the "Joint Declaration on the priorities for cooperation between the European Commission and the Hashemite Kingdom of Jordan in the energy sector" signed on 31st October 2007. These priorities, among others, are as follows:

- Energy networks: Reinforce dialogue and cooperation at technical and, as appropriate political level, on the upgrading and development of the domestic and regional electricity, gas and oil networks including as regards those designed for transit to the EU; exchange information and best practices on network losses as well as network safety and security;
- Energy efficiency: Accompany further development of Jordan's energy efficiency policy, including the policy on energy efficiency in buildings; work towards the development of appropriate policy measures by Jordan based on the EU legislation and best practice, in the area of energy efficiency across all sectors of the economy and including, inter alia, labelling of domestic appliances and building codes.
- Renewable energy: Follow-up on the implementation of Jordan's renewable energy policy; Progressive convergence by Jordan with EU legislation and best practices in the area of energy renewable sources, including through the policy targets; identify possibilities for cooperation to facilitate transfer of technology; cooperate towards developing appropriate instruments for funding renewable energy projects.

3. DESCRIPTION OF THE TWINNING PROJECT

3.1. Background and Justification

Jordan is an upper middle-income country with a population of 6 million and a Gross National Income/ per-capita GNI of $4,390. The population is around 80% urban and is one of the youngest among upper-middle income countries, with 38% under the age of 14. The country has limited natural resources, potash and phosphate are its main export commodities, limited agricultural land, and water is especially scarce. Jordan ranks as the world's fourth poorest country in terms of water resources. Services account for more than 70% of gross domestic product (GDP) and more than 75% of jobs. As one of the most open economies of the region, Jordan is well integrated with its neighbours through trade, remittances, foreign direct investment (FDI), and tourism, and has especially strong links to the Arab Gulf economies. Jordanian policymakers aim to use the demographic opportunity of a well educated, young population to build a dynamic, knowledge-based economy, as articulated in the National Agenda and Executive Development Plan (EDP).

In 2011, low revenue intake and a sharp increase in spending for fuel, food and public servant salaries led to a deficit, excluding grants, of 12.1% of GDP (6.2% when grants are included). The debt-to-GDP ratio rose from 61% in 2010 to 65.6% in 2011 as the government extended loan guarantees to the electricity company[1]. The latter has accumulated $1.7 billion in losses due to recurrent attacks on the Egypt gas pipeline. The budget for 2012 aims to scale this deficit back to 8.6%, by increasing domestic revenues, while putting a brake on non-interest expenditure growth. The government expects growth to edge up to 3% in 2012, but the financial crisis in the energy sector, and heightened instability in the region pose risks to the short-term fiscal and macroeconomic outlook.

Jordan has very limited indigenous energy resources and its energy supply depends at 96% on imports of oil, oil products, natural gas and electricity, which accounted for 19.2% of total imports and 11.8% of GDP in 2009 (18-19% of GDP in 2006-2008).

Jordan's primary energy requirements reached 7.7 Mtoe in 2009, or about 1.3 toe per capita. These requirements split into 57.6% for crude oil and oil products, 39.8% for natural gas, the rest being imported electricity and indigenous renewable energy: indeed, renewable energy (RE) provides a minimal contribution to energy supply: solar water heating is officially estimated at 1.6% of total primary energy requirements (probably an optimistic estimate). Hydroelectricity, biogas, solar PV and wind energy (ranked by decreasing importance) altogether contribute to 0.5% of electricity generation, or 0.2% of primary energy supply. Indigenous production of natural gas accounts for 2.1% of primary energy supply.

Final energy demand (5021.1 Mtoe) splits into transport 38.9%, industry 21.9%, households 21.6%, services 7.4%, and non specified uses (probably including e.g. water pumping) 6.5%. The biggest consumer is the domestic sector.. see fighture (1) below while the industrial is consumping about 25%.

[1] World Bank/ 2012. *Jordan - Country partnership strategy for the period FY11-FY15*. Washington D.C. - The World bank. http://documents.worldbank.org/curated/en/2012/02/15780007/jordan-country-partnership-strategy-period-fy11-fy15

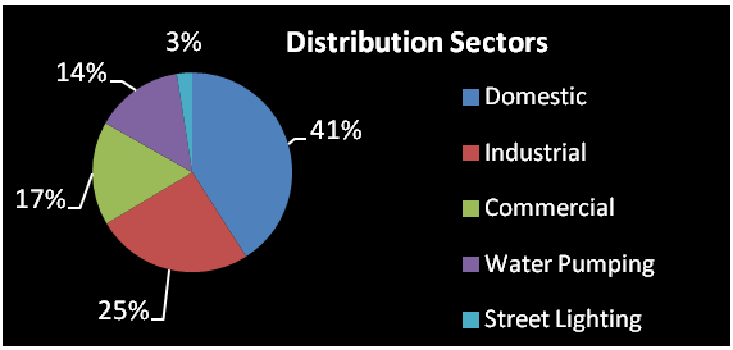


Fig. (1)-Distribution Sectors

As less than 5% of Jordan's territory is arable and 2.5% is cultivated, agriculture contributes for only 3% to GDP; Mining and industry contribute to 16% of GDP in 2009 and employ 21% of the labour force; the main subsectors are phosphate and potash (Jordan main natural resources; mining is 3.1%, while manufacturing is 16% of GDP, which includes fertilizers, inorganic chemicals, pharmaceuticals, clothing, cement, light manufacturing, and construction, which represents itself 4.5% of GDP, as well as power and petroleum refining.

Both goods and services export receipts are estimated to have grown by close to 17 percent on average over the past five years (2005-09). Imports amount at US$16 billion in 2009 and include: crude petroleum and derivatives, machinery and equipment, vehicles, iron, and cereals. Major suppliers are Saudi Arabia (mainly crude oil and derivatives), EU, China, U.S., Egypt, South Korea, Japan and Turkey.

According to IMF Country Report No. 10/297 (September 2010), following a decade of strong growth, the Jordanian economy has slowed considerably, largely due to the global and regional downturn... real GDP growth fell from almost 7⅓ percent in 2008 to 2⅓ percent in 2009, mainly due to weaker activity in the finance, manufacturing, energy and trade sectors.

Headline inflation declined steadily through 2009 to near zero, in line with lower world commodity prices, although core inflation remained stable at around 3% year-on-year (y-o-y). The currency has been stable with an exchange rate fixed to the U.S. dollar since 1995 at JD 0.7-0.65 to the dollar. Inflation picked up to 5⅓ percent y-o-y in June 2010, driven mostly by higher international fuel, energy and food prices.

Challenges include vulnerability to fluctuations in the international oil market, due to the country's high energy import dependency and disruption of gas supplies from Egypt; high unemployment and dependency on remittances from Gulf economies; and increasing pressure on natural resources, especially water. The greatest challenge (and also the largest opportunity) remains the necessity to create adequate conditions for increased private investment and improved competitiveness. This will help to deliver the high and sustainable growth needed to create a sustainable development and to reduce poverty.

Important reforms took place over the past decade in electricity, as well as in upstream and downstream petroleum. A general electricity law (n° 64) was issued in 2002, following legislation steps in 1996 and 1999. A Petroleum and Mineral draft Law is under review. A Gas Law may be developed. A Renewable Energy and Energy Efficiency Temporary Law has been passed in February 2010.

A national energy strategy endorsed by the Cabinet in 2004 has been reviewed by the Royal Committee on Energy since February 2007. The Final Report on Updated Energy Sector Master Strategy in Jordan for the period (2007-2020) is now available. This document reviews actions and studies undertaken in the past decade, lists most important completed investments, examines constraints, provides medium and long term forecasts with several scenarios, describes possible alternatives and options in each

energy sub-sector, including the energy mix, and comes up with broad guidelines and an investment assessment. Its main conclusions can be summarised as follows:

I. Further electric power expansion is discussed to be undertaken through Independent Power Producers IPPs with Build Own Operate BOO type contracts. Nuclear energy and generation based on renewable energy are part of the "fuel mix" for the medium and long term. While further steps will be carried out on oil shale exploitation, and electricity generation through direct combustion; the electricity market will be further liberalised according to the provisions of the existing legislation.
II. The National Petroleum Company NRA will promote oil and gas exploration through production sharing or other agreements The refinery, JPRC, is expected to continue its operations and carry out investments to increase capacity and improve the quality of products (to EU standards); a pipeline should be constructed between Aqaba and the refinery.
III. 600 MW of wind energy should/would be installed by 2020. Studies would be carried out with the objective of reaching 300-600 MW of thermal solar projects in the long term.
IV. Programmes and measures for energy use rationalisation is recommended to be undertaken in all economic sectors.

The State owned National Electric Power Company (NEPCO), the transmission company, which acts as transmission service provider, system operator (including the National Control Centre), single buyer of produced electricity and single seller to distributors and a few large industrial customers; NEPCO is also responsible for exchanging electricity with neighbouring partners (Egypt, Syria and Palestine). Transmission losses are up to 3.2% (2011), while in distribution systems, get up to 10%.

The Organizational chart for Energy System in Jordan is presented in Annex (1), with specific reference to figure (2.)

Weaknesses and challenges

a) **Vulnerable to external shocks.** The political upheaval that swept the Arab region has had a significant impact on Jordan, taking the form of energy and economic shocks as well as inspiring domestic demands for improvements in services and living conditions. Tourism receipts, Foreign Direct Investment and, to some extent, remittances fell dramatically in 2011, while the import bill (Prime Energy) increased as a result of higher commodity prices.
b) In addition, numerous interruptions in the gas supply from Egypt have forced the government to switch to costlier heavy fuel, resulting in an expected additional cost of $2.4 billion by the end of 2012.
c) Growth stood at 2.3% in 2011 compared to an average of 6.5% over 2000-2008.
d) A growing population is exerting increasing demand on all service taking into consideration that energy is a cross cutting services for health and education. One of the government's principal goals is to expand access to energy needed in a competitive economy

In terms of human development, Jordan is above average in relation to middle-income countries. These positive results are based on consistent levels of spending—more than 25% of GDP—on human capital, but immigrations of highly skilled labour had affected heavily the energy sector heavily.

e) In 2008, tariffs were raised by 23.6% on average following changes in fuel prices, but this increase apparently was not timely enough to avoid a financial loss for NEPCO at the end of the year.

f) The retail tariff for households ranges from 72 to 114 fils/kWh, depending on consumption level; a "lifeline" tariff has been maintained at 33 fils/kWh for small consumptions up to160 kWh/month. Other tariffs are set for small industry at 50 fils/kWh, medium size industries 37 night and 47 day

tariff (+maximum load 3.79 JD/kW. month), commercial 87, water pumping 42. Despite this increase in tariff, it looks like it's broadly balanced and tends to reflect the cost of supply to each consumer category (2011).

g) However, since 2012 the tariffs are now ranging from 72 to 235 fils/kWh. For the Small Industries the tariff is now 57 fils/kWh, while for Medium Industries, is set for 53 fils/kWh at at night and during the day, the tariff is set at 63 fils/kWh. Commercial tariff is becoming 91 fils/kWh, while for water pumping the tariff is 66 fils/kWh[2].

h) As the whole region including Jordan is moving towards renewable energy, there is a high need to analyze the impact of wind energy in the operation of the system during minimum load hours. Solar has no negative impact but the other renewable (Wind, Geothermal, biomass, biogas) have a constant predictable impact on minimum load hours.

i) Short term planning of NEPCO is focusing on meeting short forecasted load at minimum cost, without due considerations to the reserve, even in the event of low frequency. This is not sustainable in the light of the regional unreliable interconnections.

Economic dispatch approach and its challenges based on tools and skilled labour. Decision making is not based upon analysis and accurately data considering all parameters which are critical to operating the system reliably and economically.

Opportunities:

- The Government and ERC have opted for maintaining a single buyer arrangement, whereby NEPCO is the single buyer of energy produced by the largest Independent Power Producer (IPP) and distribution companies in specific cases for small IPPs.
- There is a possibility for operators of RET based power generation plants to sell directly to NEPCO and not to consumers, even for small generation capacities (a few MW). Such an option could create an incentive for potential projects involving for instance an industry willing to buy a mix of electricity from different sources including RET, and investors willing to establish wind farms and solar power plants in Built Own Operate [BOO] approach.
- High support from European Union to diversify the economy, energy mix and support the generation of energy from green sources such as Renewable Energy Resources like solar, wind, biomass and biogas etc..
- As Jordan is part of the ENPI region, the neighbouring countries to EU, the opportunity for technology transfer and know how transfer will be easy and supported under the European Neighbourhood Policy Instrument and Neighbourhood investment facility (NIF) beside the European Investment Bank (EIB) and the new interest of the European Bank for Reconstruction and Development (EBRD).
- Political stability and high support to the energy sector from Government.
- Electricity tariffs are transparent and clearly split between generation, transmission and distribution; they tend to be consistent with costs of supply; fuel is purchased by NEPCO
- The Government will negotiate additional deliveries of natural gas from Egypt, and will look for alternative supply from Saudi Arabia, Iraq and other countries.

[2] Information was taken from the ERC/Tariff Structure- 31/5/2012. Provided by the technical staff

- The energy intensity of the Jordanian economy for the year 2009 is 0.38 toe per 1,000 US$ of GDP, while it is now around 0.1 in most EU member countries, and 0.21 toe per 1,000 US$ of GDP in Tunisia, a country which has implemented comprehensive and steady strategies to promote energy efficiency since 1985[3] . Long term objectives include the development of wind energy, with a total installed capacity of 1,000 MW in 2020, and solar thermal electricity generation (600 MW). Initial steps include the selection of three sites to implement wind energy projects under BOO (Build-Own-Operate) arrangements with a total capacity of around 300 MW, and tendering of projects. A first consortium led by a Greek company was chosen to implement the wind energy project in Al-Qamshih area in the governorate of Jerash, with a capacity of 30-40 MW. The Ministry of Energy and Mineral Resources (MEMR) has launched a second tender for a wind energy project in Fujiej (close to Al-Shobak), with a capacity of 80-90 MW. The commercial operation of this project is expected by 2012-2014.
- The Government intends to introduce measures to impose new norms, induce changes in approaches for realization, and encourage investment in Renewable Energy Technology (RET) and Energy Efficiency (EE). In this respect, two institutions are now in place and have already acquired strong experience, but may need further support: the MEMR and the National Energy Research Centre (NERC; MEMR is mainly responsible for energy policies and legislations, while NERC which belongs to the RSS (Royal Scientific Society), deals with renewable energy and energy efficiency research issues. A new financing institution, the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) would also be established under the umbrella of MEMR, and commitments have been made to provide financial support for large grid-connected renewable energy investments. In addition to energy efficiency investments in industry and the promotion of energy efficiency standards in buildings, identified measures include the standardisation and labelling of household appliances, promotion of low consumption bulbs, energy efficient street lighting, and measures in the transport sector: promotion of a better maintenance of vehicles, encouraging energy saving driving, favourable taxation for small or hybrid vehicles and railway infrastructure investments.
- During 2010, the MEMR has elaborated an Energy Efficiency Roadmap, which confirms the need for Jordan to implement EE action plans and provides indications about the possible implementation solutions (more details on the institutions involved is presented in chapter 3.2 and 3.5). A national Energy Efficiency Action Plan (NEEAP) is currently being prepared with the support of the Regional EU Program building on the roadmap.

Threats, preventive measures and way forward:

a) The interdependency in the region: Interrupted gas supply from Egypt and Syria due to the political instability. If you see below the imports from Egypt and Syria in 2009, was reaching 98%, while it dropped to 77% in 2010 and reach now about 42%.almost half within 2 years. That represents ultimate threats to the continuity of the energy supply. See Figure (6) below clearly shows the drop in the recent years of imports, from Syria
b) Increasing demands and limited capacity, resulting in scheduled cut off and affecting the country overall economy sector.
c) Preventive Measures: Therefore, there is a need to diversify the energy sources with regards to forms of prime energy and increase the shares of renewable energy sources. While focusing on

[3] This indicator (primary energy per unit of GDP in current US$) is only a first approach: more accurate indicators, based on GDP in PPP in constant currencies, can be used.

integration and interconnection energy supply from the region based on best practice of European transmissions networks.

d) Load forecasting: The variability in customer demands (system loads), is one of the most uncertain and variable parameters that resources planning need to deal with at urgency level, taking into consideration points (b&c).

e) System varies each hour in a day and this variability's affects the amount of energy that resource planning needs to predict and its directly linked to the amount of fuel needs to be delivered in a country where there is a daily limitation in fuel delivery regardless of the amount of natural gas imported from Egypt. Tools for predications and man power capacity need to be strengthened to meet such demands.

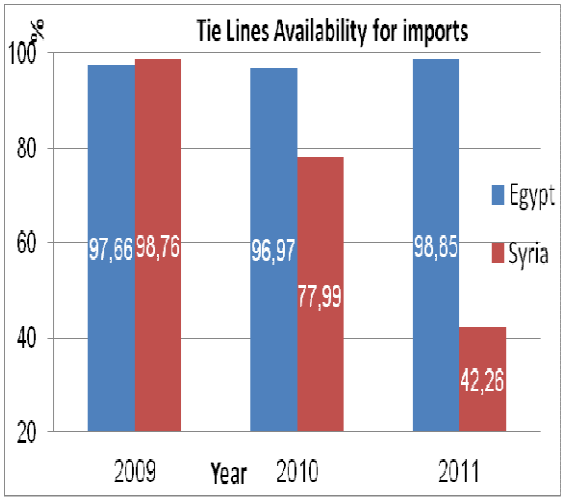
f) Therefore, there is a need for strengthening the capacity of the local technical staff to implement demand side management best practice to avoid highly expensive supply of peak loads

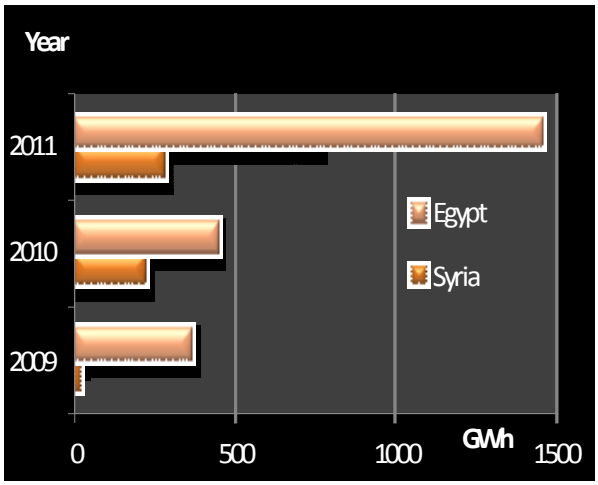
g) Increase the capacity of the technical staff by using advance analysis simulators for designing, and applying cooperate energy management practice.

h) Maintain daily and weekly index of accuracy in load forecast to assist in planning load from the reserve (tool performance applications)

i) Consider using advanced system economic dispatch which represents an economic modelling to support decision making, such as Energy Management System (EMS) to manage and monitor the reliability.

j) Need to review the reserve requirements and grid code as well as the interconnections agreements to close any gab in the current practice and modify operating procedures.





Strengths

a) NEPCO now employs more than 720[4] technical staff and 160 at the National Control Centre (planning and operation, transmission, substation, project designers, maintenance and administration departments). At the substations, the company has more than 150 technical staff

b) The maintenance department alone has more than 40 engineers and about 70 staff in the substations, apart from the technical staff. Despite the drain-drainage of the highly skilled technical staff, the company has many IT staff and programmers for the operating rooms, and the whole size of NEPCO seems to be adequate for the size and economy of the country, and for the dimension of

[4] Information were taken during the 2nd mission (August-Sept. 2012) from the Human Resource department -NEPCO

energy related issues. While for the RET and EE it might deserve a higher priority in terms of trained staff, compared to other sub-sectors within the NEPCO.
c) NEPCO has carried and being empowered to take the responsibility for the implementation of RET based electricity generation, connected to the grid (Transmission lines), as well as to implement an EE strategy in the power sector to increase the energy saving
d) NEPCO has acquired strong technical capabilities and considerable experience in a number of areas, while it needs strengthening and upgrading of skills in the components identified below.
e) NEPCO is capable of making facilities and equipment, management and technical personnel for seminars, training, exchanges and study tours, when mutually agreed upon with partners and specifically for the implementation of this twinning fiche project.
f) NEPCO's management and professional staff are ready to engage in developing concrete strategies and technological skills to work amid these rapidly evolving national, regional and global challenges.
g) NEPCO owns many valuable resources and facilities which are listed below to assist in the realization of this twining fiche program.

Assessment of institutional and absorption capacity

a) NEPCO is a well established company, with a control centre in Amman and several substations (56 in 2012) all over Jordan. The level of manpower there and their skills is high enough to handle problems and cut-off but access to new tools of energy management, high technical equipments such as simulators, new tools for schedule of maintenance are highly needed taking into consideration the level of the energy crisis in the country and the inflow of people from the neighbouring countries. While the Jordanian existing institutions working in RET & EE sector are not adapted to handle ongoing and new medium and small scale RET and EE programmes, even if these remain reasonably limited in their ambition, there is a high need to increase and strengthen the capacity of the institutions concerned by transfer of the knowhow and training of trainers.
b) NEPCO now employs almost 1330 staff, more than half are technical staff while currently about on third working in the control centre. And at substations, the company has more than 150 technical staff. While the size is adequate for the operations as explained, but still the company needs more attention in transmission lines operation, maintenance, interconnection areas, load management and economic dispatch etc.
c) NEPCO has acquired strong technical capabilities and considerable experience in a number of areas, presented below.
d) NEPCO has carried and being empowered to take the responsibility for the implementation of RET based electricity generation, connected to the grid (Transmission lines) and as well as to implement an EE strategy in the power sector to increase the energy saving: this does not mean that NEPCO is the only national entity for energy, but in the case of RE and EE, other agencies such as NERC (a new national RE and EE centre), carries out individual projects by itself (e.g. occasionally an energy audit in a single industrial plant), i.e. practically operates as a medium size engineering / consulting NGO.
e) And in the light of the new mandate for integrating RETs, the technical staff is requiring skills upgrading and support capabilities in Load flow, considering the two scenarios of maximum and minimum load (e.g PV system integrated power supply); short circuit analysis (to check the system strength in handling large variations of generation –RETS and its impact on power

quality such as flickering and harmonics; stability studies concerning the dynamic and transient behaviour during grid disturbances and disruptions etc..

f) NEPCO would act on behalf of the Government, as a supervisor of market oriented sectoral programmes (Selling and buying). It needs to have a highly skilled staff and budget for e.g. RE connected to national grid; energy saving know how; maintenance; simulations programs for designing and shifting of loads; marketing issues, financing and tariff structure, campaigns information and marketing issues and carrying transmission projects. Some of the projects need resource capacity and strengthening of its manpower to carry the national and regional Act.
g) All the activities carried out by NEPCO so far has had a national impact, in terms of electricity buying and selling and that will include the energy produced from RE or energy saved. The accumulated impacts of such activities over NEPCO's life remain as high as 95%.of the delivered energy services. Simply because NEPCO has the mandate and budget to carry out national electricity programmes targeting whole populations of energy consumers and investors in the residential, industrial, and commercial, transport and agriculture sectors of Jordan economy.
h) Over the years NEPCO has built-up a multi range of Technical know-how and expertise which has made it a progressive organization compared to many other companies in the region. NEPCO International was created in the year 1988 to market NEPCO's Technical expertise locally, regionally and internationally and to enhance cooperation in the energy field in general and the electrical field in particular with the Arab, Middle Eastern and the International utility providers.

3.2 Linked Activities

European Union-EU:

The long term effective support of European Union to Jordanian Government in the sector of energy had resulted in many activities, focusing on renewable energy integrated into the economy sector and disseminating the RE as well as encouraging and supporting the energy efficiency measures in the country.

The most significant contribution made is a program on development and implementation of effective policies so that Jordan is able to reach renewable energy and energy efficiency goals set by the Government for 2020. The program budget is set for Euro 35 M, while among the long term cooperation; the following projects had a significant impact. For more details see Annex (2).

Institutional strengthening and Capacity Building for the National Energy Research Centre NERC (Twinning fiche) Europe Aid was implemented in 2007-2008, which was very successful. The project had build on many other initiatives and programs such as Action Plan for high-priority renewable energy initiatives in Southern and Eastern Mediterranean area (REMAP), which was focusing among others, on compilation of solar and wind date resources, prioritizing demonstration sites, stakeholders effective involvement and enabling environment for financing and dissemination strategy.

The capacity building project focusing on Wind Energy and Concentrated Solar Power (WECSP) which is amounting to Euro 10 M is an ongoing project until 2014, and expected to enhance the national technical capacities in these two areas by building two facilities, linked to the national electricity grid and equipped with testing facilities as well as training centre. This is a unique project in its nature and technology used in the region.

Cost efficient and reliable rural electrification schemes for South Mediterranean countries based on multi user Solar Hybrid grids (CRESMED). This project deals with the design of rural village

electrification technology and schemes for rural communities, schools or dispensaries in Mediterranean partner countries.
Project Title: "Integration of solar technologies into buildings in Mediterranean communities (SOLARBUILD). The project started in 2007 and was completed in 2008. It was focusing on assisting non European Mediterranean countries utilize solar energy in heating and cooling, in addition to establishing a network of partners to disseminate information in this field.
A Self-sufficient Renewable Energy Air-Conditioning System for Mediterranean Countries (REAC) project was running for 3 years and aimed at designing and installing a heating and cooling system that utilizes solar energy (42 kW cooling and 105 kW heating). This system is to be installed in a hotel in Petra-Jordan.
The French Development Agency-**AFD:**
Is currently establishing a credit line in the range of Euro 40 M for Jordan to promote energy efficiency and renewable energy projects investment. In that respect AFD had funded a market needs assessment study in support of the private sector and in April 2012, pursuant to the adoption of the policy law, they were requested by WB to participate in the JEEREF . In addition, AFD extended the support to draft a roadmap for Energy Efficiency (EE) together with the EU. Coordination among the implementers and donors is of key importance and necessary to avoid any duplication of work, and to ensure that different agencies complement each other while supporting Jordan's energy sector. There is, however, a general agreement on the need to upgrade the capacity of NEPCO on the integration of RE into the transmission load system. The AFD is currently considering the request of NEPCO in reinforcement of the high voltage transmission line and use of either mobile substation in Amman West (180). ToRs are in place, awaiting the approval of AFD.
United Nations Development Program - UNDP: the twinning fiche was welcomed by UNDP and confirmed that the synergy and complementarities will be taken into consideration during the preparation of their country plan cycle (2013-2017). Currently the focus is on climate change mitigation and biodiversity, labelling of EE appliances and elimination of Persistent Organic Pollutants (POPS), with regards to electric materials such as Polychlorinated Biphenyls (PCB). UNDP is focusing on the PCBs with regards to testing, disposals and legal side of the material use. UNDP is supporting NEPCO by recruiting a technical team and facilitate testing of the material, equipment and accreditation, while guiding them in taking measures.

US Agency for International Development - USAID: USAID supports the Government of Jordan’s reform of the energy sector by forging partnerships for sector investment and development, enabling development of renewable energy sources and promoting energy efficiency and conservation. As a part of U.S.-Jordan Electric Power Transmission Partnership Program, an ongoing project, a delegation of eight NEPCO executives officers, are engaged in meetings, presentations, roundtable discussions and site visits in Phoenix and surrounding areas to share information on how to improve the technical and financial performance of an electric utility. This partnership targets improvements to NEPCO’s commercial viability by providing concept papers on incentives mechanisms and service. The Arizona Public Service (APS) partnership is also targeting the use of key performance indicators (KPIs). During this program, NEPCO and APS officials met to discuss technical and non-technical issues of strategic importance to Jordan’s transmission company: creating and instituting KPIs to track and benchmark NEPCO’s technical performance against industry standards; power system modelling; attaining and maintaining quality assurance certifications; and auditing and financial management.

Furthermore, APS advised NEPCO on the process for obtaining ISO 14001 (environmental management) and OHSAS 18001 (occupational health and safety) certifications NEPCO received many documents from APS, including risk mapping templates and guides, training materials for environmental standards compliance and a step-by-step guide to establishing and certifying an

environmental management system. In addition, the assistance is extended through National Association of Regulation Utility Commissioners (NARUC) to cooperate with ERC on energy labelling, while working with private sector –distribution companies on energy efficiency.

Kreditanstalt Für Wiederaufbau (KfW): is currently carrying an intensive negotiation with the stakeholder of EE to extend a loan regarding the EE in buildings, code of practice, labelling and standardization. The support is also going to cover the establishment of ESCOs (Energy Service Companies). The interest has been strong in the current project as this might open the door for a new cooperation line with NEPCO on the RE and new transmission lines taking into consideration the environmental issues.

3.3 Results

The proposed twinning fiche aims to achieve the following 6 mandatory results, with indicators which fall under 5 components.

Component 1: Integration of energy produced from renewable energy technologies.

Result 1: Strengthened system capacity to integrate energy produced from renewable energy into the Transmission lines load management.

Indicators:

- A best practice procedure on RE harmonization in power system is in place;
- No of skilled staff ;
- Operationalization through tested models for RE integration is in place

Component 2: Load management and Cooperate Energy Management best practice (Economic dispatch, scheduled dispatch and Unit commitment).

Result 2: Enhanced capacity of NEPCO's staff to establish best approaches to strategic planning and management, with a focus on economic dispatch and schedule dispatch.

Indicators:

- Roadmap for strategic energy management and planning procedures;
- Raw energy data is transformed into actionable information (patterns, costs and forecast);
- Simulation program and model is in place to predict transmission, congestions and costs;
- No of staff skilled in economic dispatch, operation of schedule dispatch and unit commitment based on EU best practice;
- Energy Purchase Agreements for different RETs is prepared;
- Manuals and training of trainers program is in place

Component 3: Institutional strengthening and capacity building of NEPCO in usage, design and operation of Simulators

Result 3: Upgraded skills and capacity of the technical staff in the usage, designing and operation of Simulators

Indicators:

- ❖ Training of trainers in the use and operation of the Simulator
- ❖ No of staff upgraded skills in Operation department
- ❖ Case studies
- ❖ Manuals and materials for training
- ❖ Simulator is used for prediction of RETs operation (models developed)

Component 4: Maximizing efficiency to reduce use, cost and environmental impact

Result 4: Enhanced transmission planning procedure and management to maximize efficiency, reduce cost and environmental impacts

Indicators:

- ❖ Training of trainers on modem forecasting methodologies, rehabilitation and upgrading of transmission lines, protection schemes, maintenance and control systems
- ❖ Curricula, manuals, assessment reports for decision making on rehabilitation and upgrading of transmission systems
- ❖ Prepared report on identified ways to reduce expenditure

Result 5: Enhanced capacity and capabilities for systematic maintenance and Control System (Balancing between demands and increased supply with limited capacity)

Indicators:

- ❖ No of people skilled in Control System and systematic maintenance
- ❖ Curricula, manuals, assessment reports for decision making
- ❖ Promotion of mobile substations use based its effectiveness[5]
- ❖ Software and some tools (132 KV) for Live Line Maintenance training are in place

Component 5: Reduce System vulnerability to external shocks, in interconnected neighbourhood countries

Result 6: Reduced power system vulnerability to shocks in an interconnected areas (Egypt and Syria)

Indicators:

- ❖ Report on opportunities and consequences of interconnected power supply system
- ❖ Data collection methodology is in place
- ❖ Guidelines for power system analysis data is developed (power flow and voltage stability)
- ❖ Procedure for harmonization of interconnected systems, EU criteria on planning, regulation, standard, accreditation procedure is in place
- ❖ Workshop and No of staff attending

[5] Substations are key installation in the power Grid that transform voltage levels and facilitate the safe and efficient transmission and distribution of electricity. They include equipment that protects and controls the flow of electric power

3.4 Activities[6]

A. Kick off meeting

The implementation of the project will start with the arrival of the Resident Twinning Adviser (RTA) in Jordan. The RTA will have to be placed in his/her office. S/he will be introduced to the BC stakeholders of the project and to his/her counterparts and staff. S/he will finalise the hiring of the project assistant.

A one-day kick off meeting will be organized in the first month of the project, aiming at launching and presenting the project to the stakeholders, the media and the public at large. In order to guarantee large public information and visibility about the start of the project, the meeting will be concluded with a press conference and a press release.

B. Steering Committee Meetings

A Project Steering Committee (PSC) will be established for the supervision and coordination of project activities and for ensuring that an effective coordination takes place between the different components of the project. PSC will meet quarterly, and ad hoc as required, and will be chaired by the NEPCO. The Steering Committee members shall include the EU MS Twinning Partner, NEPCO, the Ministry of Planning and International Cooperation through its PAO, the EU Delegation (as observer) and other relevant institutions with an observatory status. PSC composition will be detailed during the drafting of the work plan.

C. Closing Conference

A closing conference (wrap up meeting) will be held during the last month of the project at which the results and impact of the project will be presented to the beneficiary, the Jordan Government, the civil society and other donors to increase the visibility of the project outcome/results. The Conference will present recommendations for possible follow-up and lessons learned for similar projects.

Result 1: Strengthened system capacity to integrate energy produced from renewable energy into the Transmission lines load management.

1.1. Data collection, review, assess the load flow considering the two scenarios of maximum and minimum load (e.g. PV system integrated power supply) and support the intergradations of RE in to the system generated capacity based on EU member States best practice (Simulation and computerization)..

1.2. Examine and identify the transmission impacts as the MW output from renewable resources will vary depending on resources type, location and time of the day, and would not be dispatch during the peak model. While conducting screening level study to be tested and scenarios should be developed

1.3. Assisting to prepare study on short circuit analysis (to check the system strength in handling large variations of generation –RETS and its impact on power quality such as flickering and harmonics;

[6] Note: The listed activities and the proposed means for achieving the activities are indicative can be revised in the framework of the preparation of the contract between twinned institutions.

1.4. Assisting to prepare study with the technical staff on the interconnected points for renewable energy resources at different locations

1.5. Assisting to Conduct stability studies concerning the dynamic and transient behaviour during grid disturbances and disruptions to guide the technical staff in understanding the technical effects of RET generated electricity into the system (Simulation)

1.6. Discuss and study the Wind Turbine generator types model (Wind Power Plant dynamic Modelling Type) and the PV Solar Generation modelling "PV System Modelling"

1.7. Conduct a 3 day workshop and train NEPCO in best practice on RE Harmonization in power system (in terms of planning and optimization of the generation-expansion plans based RE integration)

1.8. Support the setting up of a roadmap for renewable energy Integration for NEPCO's management, operational and regulatory procedures

1.9. Assist in upgrading the capacity and skills of the technical staff of NEPCO in order to implement the developed strategy of energy mix including energy produced from RE;

1.10. Assist in the upgrade of the knowledge and skills of NEPCO on integrated RE such as PV and wind, while and bring their capacity to the level necessary for clear implementation on the following

- EU internal energy market and corresponding requirements for regulatory authorities
- best practice procedures on load management and energy produced from RE as applied in regulatory authorities in the EU Member States

1.11. Prepare study visits for the technical staff in European member states advanced in RE interconnection to Grid. It would be prepared for 3 staff from each departments (4 Departments) concerned , using the modalities of 4X3 study visits

Departments involved are power system planning, Operation, Studies and Research and production planning.

Result 2: Enhanced capacity of NEPCO's staff to establish best approaches to strategic planning and management, including but not limited to economic dispatch and schedule dispatch.

'Dispatch schedule' is prepared to consider the economic advantage in the first place. And if there was any difference between anticipated and actual load, the System Operator loads the available generating units according to the 'Merit of Order' or 'Priority List'. Operators load the available generating units to maintain the equation: Generation = (Load + Losses). Based on 'Daily Dispatch Schedule' which is an hourly based schedule prepared ahead of time, showing the forecasted system load and suggested generation loading to meet such load.

2.1. Support the planning operators, production planning and dispatch staff in setting production planning schedule **(**switching the unit, batching, min load etc.)

2.2. Introduce staff to the EU best practice, including the Cooperate Energy Management practice in operations, maintenance and load management to enables real-time "energy management", discover wasteful energy, saving money, reference is made to unit commitment

2.3 Assist the staff in transforming raw energy data into actionable information; understand consumption, history, patterns and costs

2.4 Review and assist the staff in the use of detailed transmission model of NEPCO's power system[7], as it appears it does not utilize a production simulation program to estimate magnitude, duration, time and location of transmission congestion. In addition, estimates of lowest cost of dispatch of the system that accounts for the T. and effects on production costs in case of expansion or removal of transmission facilities

2.5 Assist NEPCO to assure reliable supplies at predictable costs, increase energy efficiency and thus reduce cost (during the mix of energy resources which is to be dispatch, the combined cycle percentage is around 60% over the total system generation, this has a negative impact while load the unit during the minimum load. This matter will increase even more during the generation from RE)

2.6 Review and assess the tariff structure based on Load managements as currently it maintain a ceiling for usage during the morning and evening time

2.7 Develop Standard Energy Purchase Agreement (EPA) for respective Renewable Energy Technologies[8]

2.8 Guide the staff and management in setting tariff structure for Small and Medium Industries

2.9 Organize in cooperation with other entities workshop to promote and encourage the public private partnership in developing investment schemes and IPP

2.10 Design and prepare study visits for the technical staff to EU member states to train and upgrade their skills within the mandate (7 persons, split into two trips)

Result 3: Upgraded skills and capacity of the technical staff in the usage, designing and operation of Simulators

In order for Jordan to be able to address the needs for energy of its most vulnerable population, while also maintaining fiscal discipline and investing in longer term growth and successful duties, efforts must be made to increase the efficiency of the technical staff at this point in time by using simulators. The company had acquired a simulator from ABB[9]and the staffs need to be trained to run the system more effectively and efficiently.

3.1 Support to develop the capacities of trainers at NEPCO on forecasting and load management to the best practice of EU member states, using the Simulator (20 technical staff in the control room)

3.2 Gain practical skills through exercises and prepare case studies to advance the knowledge on Simulator designing and operation

3.3 Prepare curricula and manuals for training of trainers (20 staff from the Operation-Dept.)

3.4 Support to expand and build up the capacity of the staff to manage specific software platforms and utilize various technological tools for responding to and managing crisis of electricity supply by considering scenarios and alternatives solutions using Simulators

3.5 Assist the company to develop the best own approach to realize energy opportunities using simulators (workshop of two days).

[7] WASP-IV model is existing within NEPCO's software facilities, other software might be required. Therefore, up to Euro 10,000 can be requested for buying software and Tools

[8] Often known as Power Purchase Agreement (PPA)

[9] ABB is a Swedish power equipment manufacturer, who supplied NEPCO's new dispatch control centre and training simulator.

3.6 Organize a study tour to similar EU setup/organization for increasing the capacity and gaining knowledge of Simulators use (7-staff, split into two visits)

Result 4: Enhanced transmission planning procedure and management to maximize efficiency, reduce cost and environmental impacts.

Making the transmission system reliable enough to meet not only today`s demands, but also future demands, is a big challenge. This is especially true in today`s environment where utilities have little incentive to invest their money in transmission system upgrades since they may be required to turnover transmission system operation to an independent organization in the near future. In addition, little new transmission capacity has been installed, mainly because of the high cost of such lines. Not only are the demands on the power grid increasing due to increases in loads, but also the loads themselves are changing.

4.1.1. Assess the transmission planning procedure and skill the staff on the implementation of best practice according to European member states through {e.g. Grid Code[10] and consider system analysis for (Voltage stability[11] and study generation scenarios), as well as installation of power system stabilizers (PSS) on the generators}.

4.1.2. Review NEPCO's load forecasting methodologies and account for extreme temperatures by studying the correlation between temperature and demands

4.1.3. Review and assess the microprocessor based technologies and other equipment to make the power more reliable and deliver good quality (model voltage oscillations.

4.1.4. Assist NEPCO in making effective use of its existing transmission systems as obtaining new rights of way is becoming quite difficult due to the opposition from the friends of environment.

4.1.5. Guide and assist in identifying protected paths of transmission lines to avoid environmental damages.

4.1.6. Assist to prepare new ways for rehabilitation and upgrading of transmission systems, e.g. (tower's problems) as currently NEPCO is looking for ways to reduce expenditures. Value for services (VoS) and Expected Unserved Energy (EUE) could be used to determine the upgrade and mitigate a transmission overload or voltage problem for N-1 condition.

4.1.7. Assess and review the Using of poles instead of huge towers (design of poles with simulators design software)

4.1.8. Train of trainers in identify protection systems and sensors to reduce the thefts of tone galvanized steel lost every now and then (in this year almost 200 tones were stolen).

Result 5: Enhanced capacity and capabilities for systematic maintenance ad Control System (Balancing between demands and increased supply with limited capacity).

[10] The current grid code is assuming that supply interruption to any customer should not occur following a N1 Conditions, but as such the Grid Code needs to be modified to reflect the interruptions.

[11] Risk of voltage collapse could increase if generation for Amman is replaced by distant generation, consider system Analysis for Voltage stability and study generation scenarios

Maintenance: System generators are so many, almost about 30 units and currently the maintenance is done manually and needs to be done systematically. As the available units are combined cycles and that is affecting the system.

Substation maintenance: Due to the high load and stationary substations, NECPO had scheduled a 20 minutes cut-off of electricity to maintain the supply.

4.2.1. Assess and critically review NEPCO's setup for maintenance, control system operation and protection schemes, while guiding the staff to develop alternatives and improve its procedural setup

4.2.2. Support the transfer of best practice maintenance operation in Europe as currently the maintenance is done manually by opening, which complicate the operation.

4.2.3. Advising and guiding on the know how availability and high tech equipments to identify the problem before it comes.

4.2.4. Support and prepare the staff on the effectiveness of mobile substation, to reduce and manage the load in an efficient manner. And promote its use within NEPCO's management.

4.2.5. Train and evaluate the current Substation Control System (SCS) for 400 KV as currently no support system is available for operating SCS (3-4 SCS are available[12]).This system is shared with other departments and therefore, there is a high need to upgrade the skills of the 3 units concerned on it;

4.2.6. Assist in identifying and acquiring software for the new maintenance schedule and tools for training in Live line maintenance (132 KV)[13]

4.2.7. Training and advising on Live-line maintenance for the transmission lines and substation a 400 KV and 132 KV,

4.2.8. Organize a workshop and provide training and upgrading of the Staff's skills in Cables/Jointers Maintenance. There are more than 50 substations with 400 KV and 132 KV. This part represents an essential element in maintenance operation, in particular accidents (no experience and no training is received yet)

4.2.9. Organize ad prepare study visits to similar EU setup to gain knowledge and advance their skills in procedural maintenance and control system operations (5 BC experts may be involved in this activity)

Result 6: Reduced power system vulnerability to shocks in an interconnected areas (Egypt and Syria)

The EDP emphasizes the need for an improved enabling environment for business and investment with the objective of enhancing the competitiveness of the economy. In the short to medium-term, the government's key challenge, in addition to implementing the political reform agenda is to create fiscal space in order to protect against external shocks and to safeguard growth-enhancing energy sector. The region is moved towards an integrated approach on energy and electricity production, and a policy instrument to European Countries on Energy and Electricity production.

[12] SCS are currently in Aqaba,, Amman North, Samara Substation, and Qatarna (400 KV) Note Aqaba and Amman North are connected with Syria

[13] Tools for training in Live-Line Maintenance (132KV) can be considered under this project within a few (Euro 5,000-10,000)

5.1. Assist NEPCO's staff to critically analyze both the opportunities and the pitfalls that emerge when working within interconnected neighbourhood energy supply system and technology to respond to crises

5.2. Assist NEPCO in establishing guidelines for power system analysis data to help assure consistency and accuracy of data required for power flow and dynamic stability analysis in interconnected neighbouring countries (e.g. Load flow and contingency analysis through modelling of short circuits & dynamic analysis etc.)

5.3 Train the staff in the departments concerned on information overload: verification, analysis, and decision making in Real-Time (2 days workshop)

5.4 Prepare harmonized regional interconnected planning criteria in an integrated market including standards and quality improvements (EU criteria for level of interconnection capacity).

5.5 Assist NEPCO to extend the guidelines/simulation results to other interconnected neighbouring countries[14], on predications of realistic market based scenarios

5.6 Assist NEPCO in the implementation of the developed guidance/ law for regional regulation, standardization and accreditation…

5.7 Study visits to 8 staff , as defined in the specific component/activities concerned

The departments involved will be the Studies and Research, Operation and Power System Planning.

3.5 Means/Input from the MS Partner Administration

The means of the present Twinning Project is basically the manpower capacity made available by the MS organisation for the duration of 24 months.

The MS support consists of the Project Leader (PL), the Resident Twinning Advisor (RTA) and Short Term Experts (STE):

- The Member State Project Leader is an high ranking civil servant , operating mainly from the home base of the MS Twinning organisation,
- The Resident Twinning Adviser (RTA) stays in the BC during the full duration of the Twinning Project activities, the RTA is responsible for the day to day implementation of the project ,
- The RTA Assistant will support the RTA in implementing his/her daily tasks,
- The STEs are civil servant experts in a number of selected fields.

3.5.1 Profile and tasks of the MS Project Leader (PL)

The MS **Project Leader (PL)** will be responsible for the overall planning and implementation of the thrust of the MS inputs in this Twinning project. The PL is expected to devote a minimum of 3 days per month to the project progress in addition to one visit to the beneficiary country (BC) every 3 months.
Profile:

The MS PL should have a University degree or higher in one of the fields of energy, science or public administration, and should have proven experience in coordinating MS public administration

[14] Technical analysis is based on power flows, power losses, security and maximum transits.

structures' in the field of energy, preferably in the specific fields of renewable energy, transmission and operation.

Management Capacity

- Inter-personal and leadership skills;
- Working level of the English language.

Previous Project Management Experience

- High ranking official within the Twin Member State public administration, commensurate with an operational dialogue at the political level, having proven experience as civil servant from a MS in the field of energy, preferably in the specific fields of renewable energy, transmission and operation.
- Knowledge of EU legislative and operational activities related to the various components of the project;

Tasks:

- The overall direction of the Project in cooperation with the BC PL ;
- The achievement of the mandatory results;
- Oversee project implementation;
- Mediate in the events of conflict;
- Oversee financial management of the project;
- Supervise the Resident Twinning Adviser (RTA) job;
- Prepare with the assistance of the RTA interim quarterly and final reports;

3.5.2 Profile and tasks of the Resident Twinning Advisor (RTA)

She or he will stay in the country for the full duration of the project (24 months) and be a civil servant or equivalent in his /her country

Tasks of the RTA

The RTA is in charge of the day to day coordination of the Twinning project.

Key Qualifications

- More than 10 years' experience in the public sector, including experience in electric energy supply system, operation and procedural planning, corporate energy management, RET integrated energy supply system, relationship management, project management, and personnel and resource management
- An MBA or related advanced degree will be an asset
- A keen interest in EU partnership including most or all of the following: Energy supply and demand side management, RET, Transmission system operation and Load problems, Cooperate Energy Management, applied to electricity sector, SMEs tariff structure, load management, and/or energy interconnections legislations& interconnected electricity supply etc..
- Must be an energetic self-starter,

- Must be decisive and resource conscious
- Must be a team player, able to build and maintain collegial working relationships with staff members at all levels
- Must have excellent skills in verbal and written communication in English

3.5.3 Profiles and Tasks of the Short Term Experts

The short terms experts should be practitioners in the MS Administration of the themes indicated in the twinning fiche.

<u>Component 1</u>: Expert on RE integration

- Commitment and dedication to Energy Power Supply.
- At least 7 years working experience in the Public sector in the specific area.

Preferred Skills:

Familiarity with international development agenda on sustainable development and green electricity, utilities operation, legislation of Electric Energy Supply, power produced from Renewable Energy Technologies integrated into transmission lines

Qualifications

- At least 7 years experience in the public sector, including experience in energy produced from RETs connected to the national grid.
- An degree related to the subject matter
- A keen interest in green electricity, transmission line, load management, risks and crisis of RE connections to grid, models and testing facilities, including most or all of the following: Energy supply and demand, RET, Transmission system operation, supply analysis, tariff structure, load management, and/or interconnected energy
- A working knowledge of English.

<u>Component 2</u>

<u>Short term expert 1</u>: Enhance capabilities in Load management and practice of Cooperate Energy Management best practice

- An advanced university degree in related field
- Good knowledge of the relevant EU Electric Energy Supply System and best practices in the area of load management and Cooperate Energy Management (e.g. Enables real-time "energy management" – discover wasteful energy situations, saving money .etc..) to the best practice – EU practice
- Advanced experience in strategic energy management and planning procedures;

- Experience in conducting workshop and guide technical staff in Economic dispatch, scheduled dispatch and Unit commitment.
- Minimum of 7 professional expertise in the relevant fields, including the development of capacities for the technical staff and training of trainers on transmission models focusing on congestions, locations and data transformation (e.g. patterns, costs estimate , forecast) using simulations/ models to the best practice of EU member states
- Experienced in training and capacity building using case studies, curricula development and manuals
- Strong written, verbal and inter-personal communication skills in English

Short term experts 2: Support the development of Standard Energy Purchase Agreement (EPA) for respective Renewable Energy Technologies and Tariff Structure for different subsectors

- An advanced university degree in related field
- Good knowledge of the relevant EU Electric Energy Supply System and best practices in the area of Power Purchase Agreement and Tariff Structure
- Experience in reviewing and assessment of different tariff setup for SMEs and different ceiling
- Minimum of 7 professional expertise in the field of developing the capacities of staff/trainers on best practice of EU member states
- Experienced in training and capacity building
- Experience in conducting workshop and guide technical staff in setting structure
- Strong written, verbal and inter-personal communication skills in English

Short term expert 3: Promotion of Public Private Partnership and Investment Schemes
Be fully conversant with the relevant EU best practice in the area of Electric Energy Supply System and opportunities to increase capacity and building of partnership

- Minimum of 7 years of professional experience in the relevant field, preferably at the policy and Investment level as well as the field making level
- Experience in conducting training/Seminars on Energy Supply from Renewable Energy Technologies, while having good knowledge of the various mechanisms for developing the public private partnership and investment schemes for RE
- Experience on enhancing institutions and strengthening performance, using capacity building tools
- Ability to organize in cooperation with other entities workshops on enabling environment for Independent Power Producers IPP, mechanism of operations, legislation etc.
- Strong written, verbal and inter-personal communication skills in English

Component 3

Short term expert 1: Strengthen capacity of NEPCO control room and operation staff in the use and operation of simulation, using the simulator (20 technical staff in the control room). Good knowledge of the relevant EU Electric Energy Supply System and best practices in the area of programming and simulation use

- Experience in managing specific software platforms and utilize various technological tools for responding and managing crisis of electricity supply by considering scenarios and alternatives solutions using Simulators
- Minimum of 7 years professional expertise in the field of developing the capacities of staff/trainers on forecasting and load management to the best practice of EU member states

Short Term Expert 2, Environmental Specialist

The Environmental Specialist's responsibilities and qualifications include but are not limited to the following:

Responsibilities:

- Provide guidance and input into value chain assessments, transmission systems, environmental impacts assessment, and other technical reports, regarding environmental impacts of proposed interventions
- Provide input into the design and implementation of environmentally sound and sustainable practices for project interventions, such as renewable resource based interconnection points, output and impacts of transmission lines/Types including (Towers, Poles and underground) expansion in the region.
- Provide recommendations on steps to be considered to address immediate environmental issues.

Qualifications:

- Minimum 7 years of environmental assessment experience for Transmission system and in particular operation and design of towers.
- Familiarity with guidelines on environmental assessment and mitigation requirements for electricity production sector.
- Knowledge of office systems, including experience with computer applications (e.g. Word, Excel, E-mail, Spreadsheets, database management) is required.
- Working knowledge of English

Short Term Expert 3, Maintenance and Control System Specialist

The maintenance and control system specialist responsibilities include but are not limited to the following:

Responsibilities:

- ❖ Provide guidance and input for systematic maintenance and train the staff on the best practice in EU member states
- ❖ Assist in the capacity building of technical staff on Control System (Balancing between demands and increased supply with limited capacity)
- ❖ Training of trainers on systematic maintenance technique, SCS and mobile substations etc.
- ❖ Develop curricula, manuals, assessment reports for decision making

- ❖ Promotion of mobile substations use based its effectiveness[15]
- ❖ Software and some tools (132 KV) for Live Line Maintenance training
- ❖ Provide recommendations on steps to be considered to address immediate systematic maintenance to safe cost and energy.

Qualifications:

- Minimum 7 years of environmental assessment experience for Transmission system and in particular operation and design of towers.
- Familiarity with guidelines on systematic maintenance and live Line M.
- Knowledge of control system
- Knowledge of office systems, including experience with computer applications (e.g. Word, Excel, E-mail, Spreadsheets, database management) is required.
- Proficiency in English.

4. INSTITUTIONAL FRAMEWORK

The main beneficiaries of this project will be the NEPCO, since this institution plays a key role in the operation and transmission of Electricity (and particularly of Electric Energy) in Jordan. As Beneficiary administration, the NEPCO will be committed to assign relevant staff to cooperate and work closely with their MS counterparts. They will work together in achieving the mandatory results of this project.

The NEPCO is committed to make available the necessary office space and equipment for the MS RTA and STEs to carry the project's activities. This includes access to the Internet as well as computer/s and necessary equipment (printer, photocopier, telephone, fax, etc.). It also includes the provision of suitable venues/material/equipment for training, meetings and conferences in the BC. During the implementation period, the RTA and RTA's assistant will be accommodated with an appropriate office space and communication tools.

Most of the Twinning activities will be undertaken within the NEPCO, apart from study visits which will be implemented by Jordan experts in the Twinning MS Country. NEPCO's main office is located in Amman, with the possibility to implement pilots under some components in selected districts. All relevant Divisions related to the project components of the NEPCO will be involved, according to the specific indications contained in activities' description.

5. BUDGET

The budget of the project is EUR 1.700.000.

[15] Substations are key installations in the power Grid that transform voltage levels and facilitate the safe and efficient transmission and distribution of electricity. They include equipment that protects and controls the flow of electric power

6. IMPLEMENTATION ARRANGEMENTS

6.1 Implementing Agency responsible for tendering, contracting and accounting

The Programme Administration Office (PAO) is in charge of the coordination of all the activities and the administrative management of the Support to the Action Plan Programme. The PAO will be the responsible institution for the management of this twinning project.

Contact details of PAO responsible of the contract:

Ministry of Planning and International Cooperation
Mr. Marwan Al-Refai
Programme Administration Office
Support to the implementation of the EU-Jordan Association Agreement
P.O. Box 555 Amman, 11118 Jordan
Fax: 00 962 6 464 9024
Marwan.r@mop.gov.jo

6.2 Main counterpart in the Beneficiary Country

Jordan Project Leader

The Jordan Project Leader (PL) is a senior civil servant at decision-making level. He will act as the counterpart of the Member State PL. He will ensure the overall steering and coordination of the project from the Jordan side, including proper policy dialogue and political support. The PL's seniority will ensure his ability to mobilise the necessary staff in support of the efficient implementation of the project.

He will lead/coordinate Project Steering Committee (PSC) from the Jordan side.

RTA Counterpart

The RTA Counterpart is a senior civil servant who will work with the RTA on a daily basis to ensure proper coordination and implementation of all activities of the project and achieve an efficient transfer of knowledge and information.

BC Project Leader

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RTA counterpart

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6.3 Contracts

There will be one twinning contract with a selected Member State or consortium of Member States.

7. INDICATIVE IMPLEMENTATION SCHEDULE

7.1 Launching of the call for proposals: November, 2012

7.2 Start of project activities: June, 2013

7.3 Project completion: May-, 2015

7.4 Duration of the execution period: 24 + 3 months

8. SUSTAINABILITY

The Project purpose and the defined activities are based on the real development needs of NEPCO. The identified components of the project are not additional tasks to NEPCO, but form an integral part of the long term system planning for enhancing the capacity and ensuring long competitiveness and sustainability Nevertheless, special attention is made to ensure that activities will be pursued and outputs will be maintained after the end of the twinning project – ensuring thus long-term impact and sustainability. The twinning projects key outputs (organisational development plan, training programmes/curricula, standard operating procedures, Agreements) and related mandatory results are indeed of vital importance for the NEPCO.

The sustainability of the Project will be thus achieved through a suitable implementation of the project activities. It will be promoted by introduction of the project results into NEPCO resolutions and decisions. The workshops, seminars, on-the-job coaching and mentoring should take into account an opportunity for train-the-trainer approach, since it may entail a multiplier effect and ensure the sustainability of methodologies developed. It is necessary to apply a training approach characterised by focusing on cases in the local context. Direct peer-to-peer and expert-to-expert working relations should be established as well. Constant monitoring of developments shall be ensured through provision of short evaluation sheets (or questionnaires) surveying how Jordan participants appreciate of the content, method, applicability and transferability of the delivered topics.

9. CROSSCUTTING ISSUES

The forging of twinning partnerships for such a sector, with a focus on strengthening the institutional capacity and development, while enabling the enhancement of renewable energy sources and promoting energy efficiency and conservation, is one of the priorities areas nationally, regionally and globally.

Therefore, the project has a direct link to environmental issues and focusing on best practice in compliances with Environmental and Safety Standards of the EU in electricity system. Environmental

awareness raising and environment friendly decision making, in the energy sector is of high importance; in particular the electricity operation is a task of continuously growing importance.

It was noted that one-eighth of Jordanians live in poverty, mainly in urban settings. EU's Twining instrument is a new cross-sector poverty reduction initiative aims to ensure that the most disadvantaged can benefit from economic growth, access better social services and improve family/community support system

The project will ensure equal opportunities for women and men during the implementation of its activities – contributing thus to the promotion of gender equality.

10. CONDITIONALITY AND SEQUENCING

NEPCO by endorsing the Twinning Fiche, commits itself to provide the contributions stated in the Fiche. They, among others, include:

- Strong commitment and support of NEPCO management to the Project implementation;
- Strong involvement/ commitment of NEPCO staff at all levels;
- Assigning indispensable personnel to activities connected with the Project;
- Ensuring co-ordination between departments and institutions connected with the Project;
- Ensuring access to indispensable information and documents;
- Ensuring sufficient development of computerization/software and modelling within NEPCO's entities/concerned;
- Supply office rooms for the RTA and the RTA assistant for the entire duration of the project, including access to computers, telephone, internet access, printer, photocopier, etc.
- Adequate conditions for the STEs to perform their work while on mission to the BC;
- Providing suitable venues and equipment for training sessions and meetings that will be held under the Project;
- Designating counterparts for the MS short term experts
- Ensure full visibility of the project outcome

Significant changes in the NEPCO staff could be of a significant risk for successful implementation of the Project. This primarily refers to professional staff having participated in the project design and those having a good knowledge of the English language.

NEPCO is highly committed to this project and will take all the necessary measures from NEPCO's side to make the project successful.

ANNEXES

I. Logical framework planning matrix

II. Organisational Chart of NEPCO and description on Energy system in Jordan

III. Energy Portfolio & Projects

Annex I: logical framework matrix

Institutional Building for the Electric Power System (NEPCO)		ENPI annual programme 2012 Support to the Implementation of the Action Plan Programme - SAPP II-Article 48 and Article 49	
Beneficiary Country/ Institution: Hashemite Kingdom of Jordan/ National Electric Power Company (NEPCO)		Total budget: € 1,7 M	
Overall Objective	**Objectively Verifiable Indicators**	**Sources of Verification**	**Assumptions**
To improvement the performance, operation and maintenance of the transmission network to meet the current challenges of demand and supply, while developing the internal and the Mediterranean electricity market	Evidence of competition in the production and supply of electricity	Jordan Governmental reports Analyses of International Organisations Comparisons with baseline assessments carried out in the beginning of the Project	
Project purpose	**Objectively Verifiable Indicators**	**Sources of Verification**	**Assumptions**
To strengthen the institutional and operative capacities of NEPCO by assessing, developing/advising, evaluating and implementing training sessions, common work and study tours to EU member States, focusing on the following areas: -. Integrating Renewable Energy Technologies (RET) into the power system and capacity planning -. Strategic planning and Energy Management best practice (Economic dispatch etc.) -. Using DTS (Dispatch Training Simulator for Operation -. Improving transmission system	Increased capabilities and skills of the NEPCO staff in electricity sector operations - core staff trained and institutional / organisational structure is strengthened for development and implementation of the updated tariff methodology and other linked aspects of NEPCO's tasks. Cooperation is enhanced among the NEPCO's departments on one side and with the Government of Jordan on the other. Further progress achieved towards competitive electricity system in terms of efficiency and reductions of the losses.	Analyses of International Organisations (IO) Jordan Governmental Reports NEPCO Annual Reports Acts and Minutes of the Project Steering Committee (PSC). EU Monitoring Reports Final Report of the Project. Independent publications and reviews. Articles in newspaper and/or websites Monitoring and Evaluation Reports	-. NEPCO management remains committed to strengthening professional and institutional standing. -. Economic conditions in Jordan do not create obstacles to the implementation of cost effective operations principles. -. Institutional impediments do not hinder NEPCO's actions in the accomplishment of its operational duties in harmony with EU acquis and best practices. -. Financing of NEPCO is adequate to enable it to take necessary steps for professional

planning and operation	Institutional visibility of NEPCO is enhanced within the time scale of the Twinning project		development and deliver its regulatory duties effectively. -. There is sufficient capacity within the NEPCO and companies to absorb the assistance provided
Results	**Objectively Verifiable Indicators**	**Sources of Verification**	**Assumptions**
1. Strengthened system capacity to integrate energy produced from renewable energy into the Transmission lines load management.	Best practice procedures on RE harmonization in power system is in place; regulatory framework and grid codes; No of people trained; operationalization through tested models for RE integration is in place	- Twinning Project reports - Developed materials (organisational set up, training plan, training curricula, standard operation procedures, communication strategy, etc) -. Report containing Data collected and tested models -. Implemented Road Map for RE	-. Staff able and motivated to attend Training Workshops -. Time & Resources commitments are properly managed -. Staff shows active interest in improving technical & management skills & knowledge -. Financing of NEPCO is adequate to enable it to take necessary steps for professional development and deliver its regulatory duties effectively. -. NEPCO management remains committed to strengthening professional and institutional standing. -. Economic conditions in Jordan do not create obstacles to the implementation of cost effective operations principles. -. Supplying the data in a timely and reliable way for the update of the data evaluation,
2. Enhanced capacity of NEPCO's staff to establish best approaches to strategic planning and management, with a focus on economic dispatch and schedule dispatch	Roadmap for strategic energy management and planning procedures; Simulation program and model is in place to predict transmission, congestions and costs; No of staff trained and skilled in economic dispatch, schedule dispatch and unit commitment based	-. Developed Road Map for strategic energy management -. Report containing Data collected and simulation model -. Training curricula, Operational Manuals, training materials (including TOT material), minutes of the meetings, and attendance lists	

	on EU best practice in; Manuals and training of trainers program is in place	-. Developed Energy Purchase Agreement	monitoring, and quality of service system Adequate staff within NEPCO (in terms of number of involved skilled persons) participating to the activities of training and TOT
3. Upgraded skills and capacity of the technical staff in the usage, designing and operation of Simulators	Training of trainers in the use and operation of the Simulator No of staff upgraded skills in Operation department Case studies Manuals and materials for training Simulator is used for prediction of RETs operation (models developed)	-. Training curricula, Operational Manuals, training materials (including TOT material), case studies -. minutes of the meetings, and training participants' attendance lists	
4.1 Enhanced transmission planning procedure and management to maximize efficiency, reduce cost and environmental impacts	Training of trainers on modem forecasting methodologies, rehabilitation and upgrading of transmission lines, protection schemes, maintenance and control systems Prepared report on identified ways to reduce expenditure	-. Training curricula, Operational Manuals, training materials (including TOT material), case studies -. Developed Assessment report and report on identified ways to reduce expenditure containing best practices	
4.2 Enhanced capacity and capabilities for systematic maintenance ad Control System (Balancing between demands and increased supply with limited capacity)	Workshops (Training of trainers on systematic maintenance technique, SCS and mobile substations etc. No of people trained Software and some tools (132 KV) for Live Line Maintenance training are in place[16]	-. minutes of the meetings, and training participants' attendance lists -. Training curricula, Operational Manuals, training materials (including TOT material), case studies -. Purchased software	

[16] Some tools for training on live line maintenance (while the line energized) for NEPCO 132 kV overhead transmission lines are needed to avoid interruption of supply.

5. Reduced power system vulnerability to shocks in an interconnected areas (Egypt and Syria)	Report on opportunities and consequences of interconnected power supply system Data collection methodology is in place Guidelines for power system analysis data is developed (power flow and voltage stability) Procedure for harmonization of interconnected systems, regulation, standard, accreditation procedure is in place Workshop and No of staff attending	-. Developed report containing indication on opportunities and consequences of interconnected power supply system -. Developed guidelines and procedures -. minutes of the meetings, and training participants' attendance lists	
Activities	**Means**	**Costs**	**Pre-conditions**
Component 1: Strengthen the system capacity to integrate energy produced from renewable energy technologies 1.1 Data collection, review, assess the load flow considering the two scenarios of maximum and minimum load (e.g. PV system integrated power supply) and support the intergradations of RE in to the system generated capacity based on EU member States best practice (Simulation and computerization).. 1.2 Examine and identify the transmission impacts as the MW output from renewable resources will vary depending on resources type, location and time of the day, and would not be dispatch during the peak model. While conducting screening level study to be tested and scenarios should be developed 1.3 Prepare study on short circuit analysis (to check the system strength in handling large variations of generation – RETS and its impact on power quality such as flickering and harmonics; 1.4 Prepare study with the technical staff on the interconnected points for renewable energy resources at different locations 1.5 Conduct stability studies concerning the dynamic and transient behaviour during grid disturbances and disruptions to guide the technical staff in understanding the technical effects of RET generated electricity into the system (Simulation)			NEPCO management remain committed to developing and strengthening use of Incentive Based Regulation Staff able / committed to attend Training Workshops Time & Resources commitments are properly managed NEPCO experts show active interest and is motivated in improving skills & knowledge

1.6 Discuss and study the Wind Turbine generator types model (Wind Power Plant dynamic Modelling Type) and the PV Solar Generation modelling "PV System Modelling" 1.7 Conduct a 3 days workshop and train NEPCO in best practice on RE Harmonization in power system (in terms of planning and optimization of the generation-expansion plans based RE integration) 1.8 Setting up of a roadmap for renewable energy Integration for NEPCO's management, operational and regulatory procedures 1.8 Assist in upgrading the capacity and skills of the technical staff of NEPCO in order to implement the developed strategy of energy mix including energy produced from RE; 1.9 Upgrade the Knowledge and skills of NEPCO on integrated RE such as PV and wind, while and bring their capacity to the level necessary for clear implementation on the following - EU internal energy market and corresponding requirements for regulatory authorities - best practice procedures on load management and energy produced from RE as applied in regulatory authorities in the EU Member States; 1.10 Prepare study tours and visits for the technical staff in European member states advanced in RE interconnection to Grid (3 from each department concerned)	
Component 2: Institutional strengthening and capacity building of NEPCO in load management and Cooperate Energy Management Practice (Economic dispatch, scheduled dispatch and Unit commitment). 2.1. Support the planning operators, production planning and dispatch staff in setting production planning schedule (switching the unit, batching, min load etc.) 2.2. Introduce staff to the best practice, including the Cooperate Energy Management practice in operations, maintenance and load management to enables real-time "energy management", discover wasteful energy, saving money, reference is made to unit commitment 2.3 Assist the staff in transforming raw energy data into actionable information; understand consumption, history, patterns and costs. 2.4 Review and assist the staff in the use of detailed transmission model of NEPCO's power system, as it appears it does not utilize a production simulation program to estimate magnitude, duration, time and location of transmission congestion. In addition, estimates of lowest cost of dispatch of the system that accounts for the T. and effects on production costs in case of expansion or removal of transmission facilities. 2.5 Assist NEPCO to assure reliable supplies at predictable costs, increase energy efficiency and thus reduce cost	NEPCO management remain committed to developing and strengthening use of Incentive Based Regulation Staff able / committed to attend Training Workshops Time & Resources commitments are properly managed NEPCO experts show active interest and is motivated in improving skills & knowledge

(during the mix of energy resources which is to be dispatch, the combined cycle percentage is around 60% over the total system generation, this has a negative impact while load the unit during the minimum load.. This matter will increase even more during the generation from RE). 2.6 Review and assess the tariff structure based on Load managements as currently it maintain a ceiling for usage during the morning and evening time 2.7 Develop Standard Energy Purchase Agreement (EPA) for respective Renewable Energy Technologies 2.8 Guide the staff and management in setting tariff structure for Small and Medium Industries. 2.9 Organize in cooperation with other entities workshop to promote and encourage the public private partnership in developing investment schemes and IPP. 2.10 Design and prepare study tours and visits to the technical staff to EU member states to train and upgrade their skills within the mandate (7 persons)	
Component 3: Institutional strengthening and capacity building of NEPCO in usage, design and operation of Simulators 3.1 Develop the capacities of trainers at NEPCO on forecasting and load management to the best practice of EU member states, using the Simulator (20 technical staff in the control room) 3.2 Gain practical skills through exercises and prepare case studies to advance the knowledge on Simulator designing and operation 3.3 Prepare curricula ad manuals for training of trainers (20 staff from the Operation-Dept.) 3.4 Expand and build up the capacity of the staff to manage specific software platforms and utilize various technological tools for responding to and managing crisis of electricity supply by considering scenarios and alternatives solutions using Simulators 3.5 Assist the company to develop the best own approach to realize energy opportunities using simulators (workshop of two days). 3.6 Organize a study tour to similar EU setup/organization for increasing the capacity and gaining knowledge of Simulators use (7-staff)	NEPCO management remain committed to developing and strengthening use of Incentive Based Regulation Staff able / committed to attend Training Workshops Time & Resources commitments are properly managed NEPCO experts show active interest and is motivated in improving skills & knowledge
Component 4: Maximizing efficiency to reduce use, cost and environmental impact –Transmission System and Maintenance (Balancing between increasing demands and limited capacity) 4.1.1 Assess the transmission planning procedure and train the staff on the implementation of best practice	NEPCO management remain committed to developing and strengthening use of Incentive

according to European member states (e.g. Grid Code and consider system analysis for Voltage stability and study generation scenarios. 4.1.2 Review NEPCO's load forecasting methodologies and account for extreme temperatures by study the correlation between temperature and demands 4.1.3 Review and assess the microprocessor based technologies and other equipment to make the power more reliable and deliver good quality 4.1.4. Assist NEPCO in making effective use of its existing transmission systems as obtaining new rights of way is becoming quite difficult due to the opposition from the friends of environment. 4.1.5 Guide and assist in identifying protected paths of transmission lines to avoid environmental damages. 4.1.6. Prepare new ways for rehabilitation and upgrading of transmission systems, e.g. (tower's problems) as currently NEPCO is looking for ways to reduce expenditures. Value for services (VoS) and Expected Unserved Energy (EUE) could be used to determine the upgrade and mitigate a transmission overload or voltage problem for N-1 condition. 4.1.7 Assess and review the Using of poles instead of huge towers (design of poles with simulators design software) 4.1.8 Train of trainers in identify protection systems and sensors to reduce the thefts of tone galvanized steel lost every now and then (in this year almost 200 tones were stolen) 4.2.1 Assess and critically review NEPCO's setup for maintenance, control system operation and protection schemes, while guiding the staff to develop alternatives and improve its procedural setup 4.2.2 Support the transfer of best practice maintenance operation in Europe as currently the maintenance is done manually by opening, which complicate the operation. 4.2.3 Advising and guiding on the know how availability and high tech equipments to identify the problem before it comes. 4.2.4 Support and prepare the staff on the effectiveness of mobile substation, to reduce ad manage the load in an efficient manner. And promote its use within NEPCO's management. 4.2.5 Train and evaluate the current Substation Control System (SCS) for 400 KV as currently no support system is available for operating SCS (3-4 SCS are available).This system is shared with other departments and therefore, there is a high need to upgrade the skills of the 3 units concerned on it, 4.2.6 Assist in identifying and acquiring software for the new maintenance schedule and tools for training in Live	Based Regulation Staff able / committed to attend Training Workshops Time & Resources commitments are properly managed NEPCO experts show active interest and is motivated in improving skills & knowledge

line maintenance (132 KV) 4.2.7 Training and advising on Live-line maintenance for the transmission lines and substation a 400 KV and 132 KV, 4.2.8 Organize a workshop and provide training and upgrading of the Staff's skills in Cables/Jointers Maintenance. There are more than 50 substations with 400 KV and 132 KV. This part represents an essential element in maintenance operation, in particular accidents (no experience and no training is received yet) 4.2.9 Organize ad prepare study tour to similar EU setup to gain knowledge and advance their skills in procedural maintenance and control system operations (5 may be possible for the planned training)	
Component 5: Reduce System vulnerability to external shocks, in interconnected neighbourhood countries (Area with Egypt and Syria import of electricity) 5.1 Assist NEPCO's staff to critically analyze both the opportunities and the pitfalls that emerge when working within interconnected neighbourhood energy supply system and technology to respond to crises 5.2 Assist NEPCO in establishing guidelines for power system analysis data to help assure consistency and accuracy of data required for power flow and dynamic stability analysis in interconnected neighbouring countries (e.g., generation and load management) 5.3 Train the staff in the departments concerned on information overload: verification, analysis, and decision making in Real-Time (2 days workshop) 5.4 Prepare harmonized regional regulations, code of practice and accreditation procedures in an integrated market including standards and quality improvements. 5.5 Assist NEPCO to extend the guidelines to other interconnected neighbouring countries. 5.6 Assist NEPCO in the implementation of the developed guidance/ law for regional regulation, standardization and accreditation 5.7 Study visits to MS for 7 NEPCO experts, as defined in the specific component/activities concerned	NEPCO management remain committed to developing and strengthening use of Incentive Based Regulation Staff able / committed to attend Training Workshops Time & Resources commitments are properly managed NEPCO experts show active interest and is motivated in improving skills & knowledge

Annex II Organisational Chart and description of NEPCO and energy system in Jordan

NEPCO – Tasks and Duties

- Planning, Construction, Development, Operation & Maintenance of the National Electric Transmission Grid.
- Purchase the electricity generated by generation companies & IPP's and sell this energy to distribution companies and big consumers.
- Power exchange with neighbouring countries through interconnection tie lines.
- Purchase of Natural Gas from sellers and supplying it to the power generation companies.
- System Operation.
- Independent Power Producers (IPP).
- Investigate new competitive markets, in order to attract and embark upon new energy projects including rural electrification and the renewable energy projects at a larger scale
- Manage development projects and/or provide specialized services as needed.
- The above does include: selecting and providing project personal, organizing and implement capacity building training programs in technical operations, safety & quality assurance, financial matters, accounting & auditing, procurement & contracting, logistics, warehouse management and administrative fields.

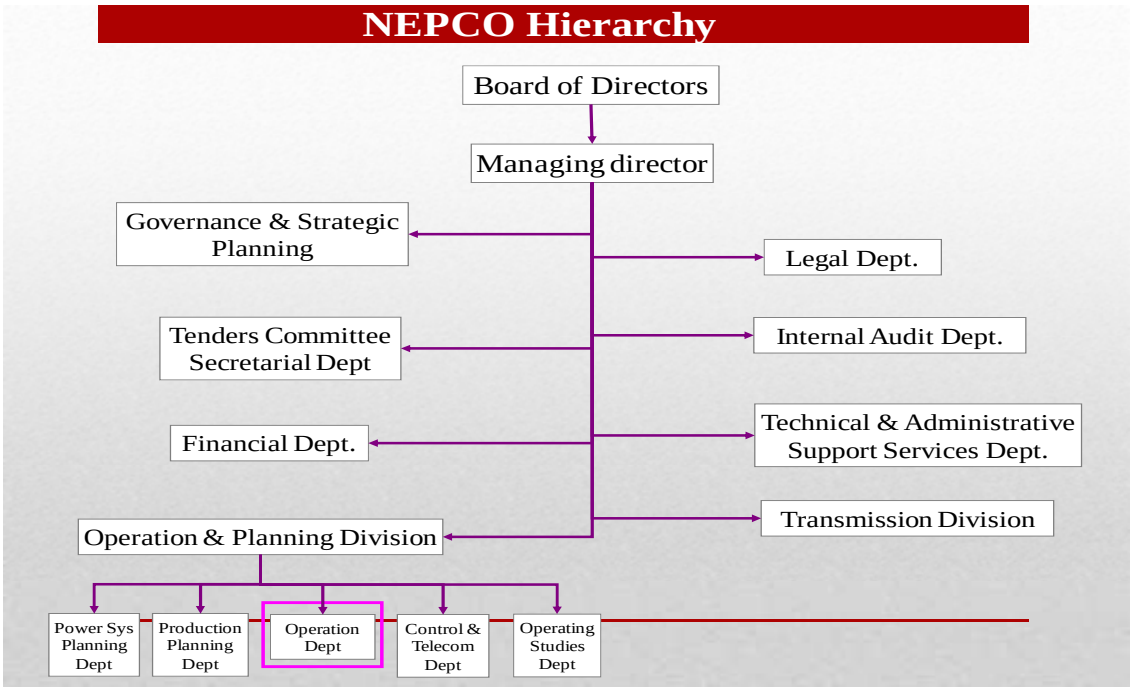

Figure (..) Organizational Chart for the Institution of NEPCO

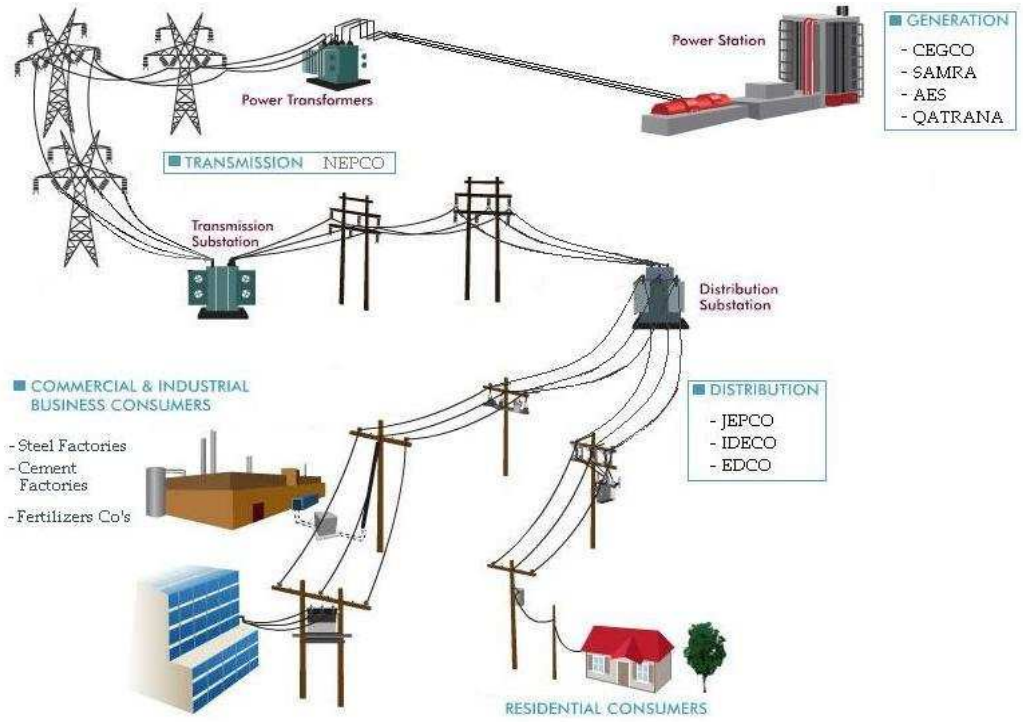

Figure (2.) Organizational chart for Energy System in Jordan

NEPCO's valuable Facilities:

-. An Executive Information System (EIS).

-. Geographical Information System (GIS).

- Computer operation room.
- Aided drafting and design facilities (CADD).
- Electrical workshop for configuration, testing and repairing of protection relays and electrical meters.
- Electronic workshop for repairing of electronic cards.
- Insulation oil tests laboratory for doing all necessary tests by a qualified staff for the electrical insulating oil in accordance to the IEC standards to ensure a long service life for transformers.
- Training centre, including software tools and Simulators
- Power Line software of overhead transmission lines.

- In order for Jordan to be able to address the needs for energy of its most vulnerable population, while also maintaining fiscal discipline and investing in longer term growth and successful duties, efforts must be made to increase the efficiency of the technical staff at this point in time and to run the system more effectively and efficiently.
- In this regard, NEPCO is exploring the potential for a more targeted technical assistance and twinning programs, while at the same time examining ways to ensure that the benefits of green economic development, including the generation of power from renewable energy, reach people in the less privileged areas of the country.
- Along these lines, the EDP emphasizes the need for an improved enabling environment for business and investment with the objective of enhancing the competitiveness of the economy, starting with energy. In the short to medium-term, the government's key challenge, in addition to implementing the political reform agenda is to create fiscal space in order to protect against external shocks and to safeguard growth-enhancing capital spending while also enhancing the efficiency and effectiveness of social protection systems.
- The strategy is urging a need for additional investment for the period 2012-2020: it is estimated at between 13,268 and 17,335 million US dollars, i.e. one billion dollars annually, distributed as follows: 3,399 for oil upstream and downstream, 4,817-5,808 for electricity, 2,461 for natural gas, 1,415-2,115 for RE (mainly for electricity generation), 76-152 for energy efficiency, and 1,400-3,800 for oil shale. The major part of these investments is expected to be financed by the private sector. And in that contexts the Risha gas field is considered to be further developed with foreign partners.
- However, crude oil, oil products and natural gas have now to be purchased at prices which gradually become close to global market prices. To meet this new challenge, the Government has developed a draft energy sector strategy, as explained above; two important goals have been announced: RE should reach 10% of primary energy supply in 2020 and 20% energy savings should be obtained the same year, compared to current trends.
- The table below represents the numbers of interruptions recorded in different years.

Indicator	2011	2010	2009
# Interruptions*	71	57	47
Avg Interruption duration (Min/Intr)	18.3	28	22

Introduction to Management Energy System in Jordan

Three generating companies:

Central Electricity Generating Company (CEGCO), originally fully government owned, was partly privatised in September 2007. Samra Electric Power Generation Company (SEPGCo) is planned to be privatised during 2010, but not yet and Amman East Power Plant (AES) is the first IPP, with a capacity of 370 MW; this project is in commercial operation since September 2009. A second IPP (373 MW) at Al-Qatrana is under construction since March 2010. In 2009, total generation split into steam turbines 46%, combined cycles 40.3%, gas turbines 13.3%, and renewable energy (mostly hydro) 0.5%. Net imports were 244 GWh. More details on the generation, see figure no (2) below.

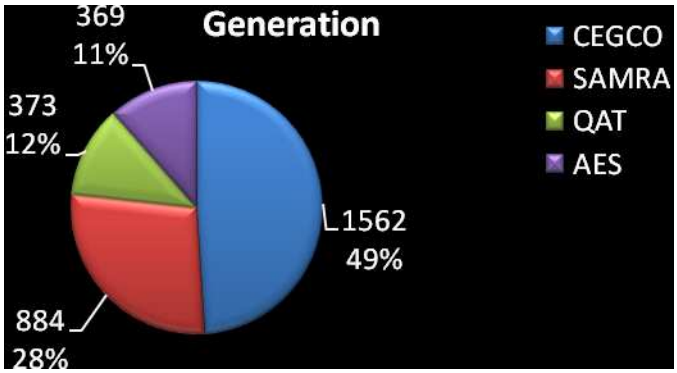

Fig (3)-Generation

Total fuel consumed by power plants in 2008 was 3.16 million toe, splitting into natural gas 2,705 thousand toe (82.2%), heavy fuel oil 573,000 toe (17.4%) and diesel oil 16,000 toe (0.4%). The average cost of generation was 43.4 fils/kWh in 2008 (of which fuel 35.4, i.e. average of natural gas and HFO), + transmission 4.4 fils/kWh. This is an indication of the cost of energy with which electricity from renewable energy will have to compete, and energy management practice has to be enforced. While in 2011[17], the natural gas imports had reach 848.5 toe , heavy fuel 1284.2 toe, and diesel oil is 960,000 toe. This explains the crisis of energy in the country.

Figure (4) represents yearly. Weekly and daily load distribution during the day from 2008-2011.

[17] These figures had been taken from NEPCO Annual Report -2011 provided by the technical staff.

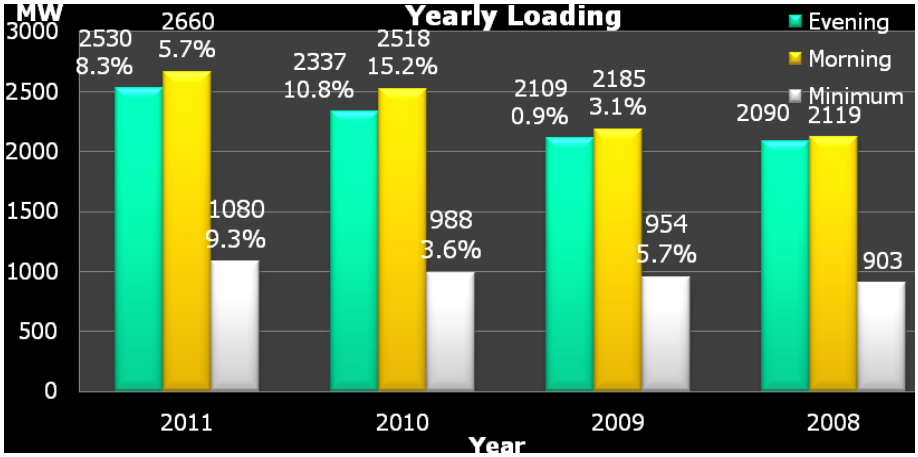

Fig.(4)a

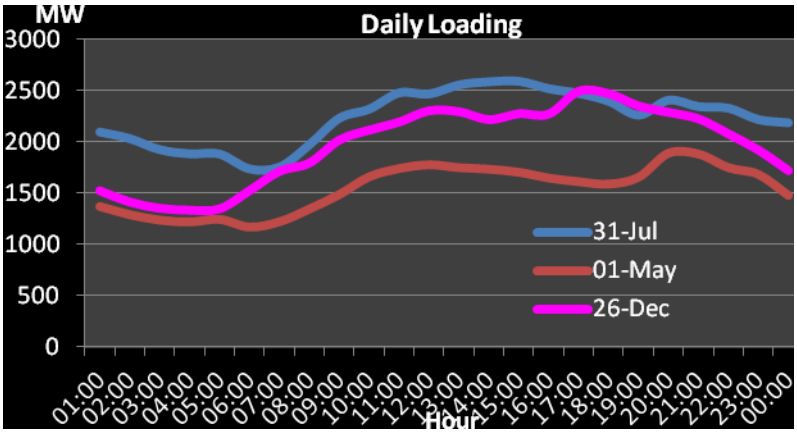

Fig.(4)b

The above represnets the peak at summer and winter. Take note that the daily load between 11:30 am and 8:30 pm in summer and winter is almost the same .

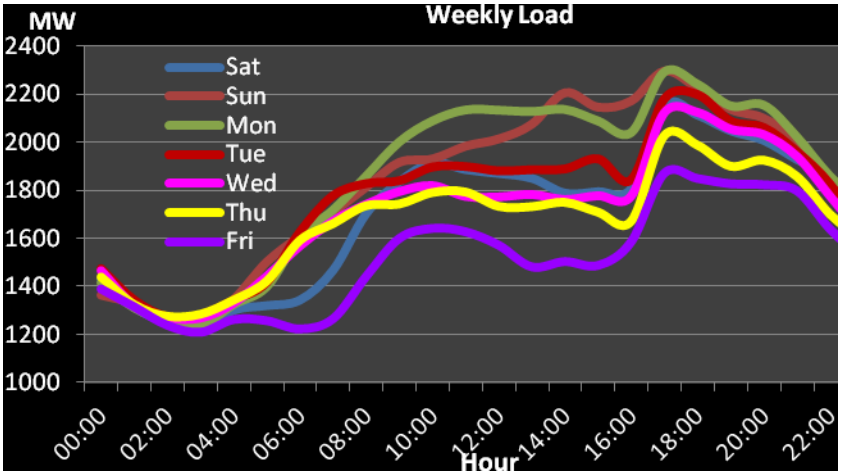

Fig.(4)c

Note: the morning peak from 11:00 am to 15:00, while the evening peak from 16:30 to 21:30 and a minimum load from 4:00 until 7:00 am (summer).

The maximum load of the system more than doubled in ten years (i.e. an average annual growth of 7.7%). Generating units have reached very good availability factors, e.g. close to 96% for steam turbines and 93.6% for gas turbines. But at the same time, the transmission and distribution networks losses have reached 15.9% in 2008.

***Three distribution companies*:**
Electricity Distribution Company (EDCO) in the south and east of the country, and Jordan valley (~75% of country): ~13% of total sales and owed by Government 100%. Jordan Electric Power Company (JEPCO) in Amman area (concession until 2012): 65% of sales; 100% private ownership. While Irbid District Electricity Company (IDECO) in the north of the country: (concession until 2011) ~23% of total sales; original ownership was 55% government, 27% municipalities, 18% private. See figure (5).

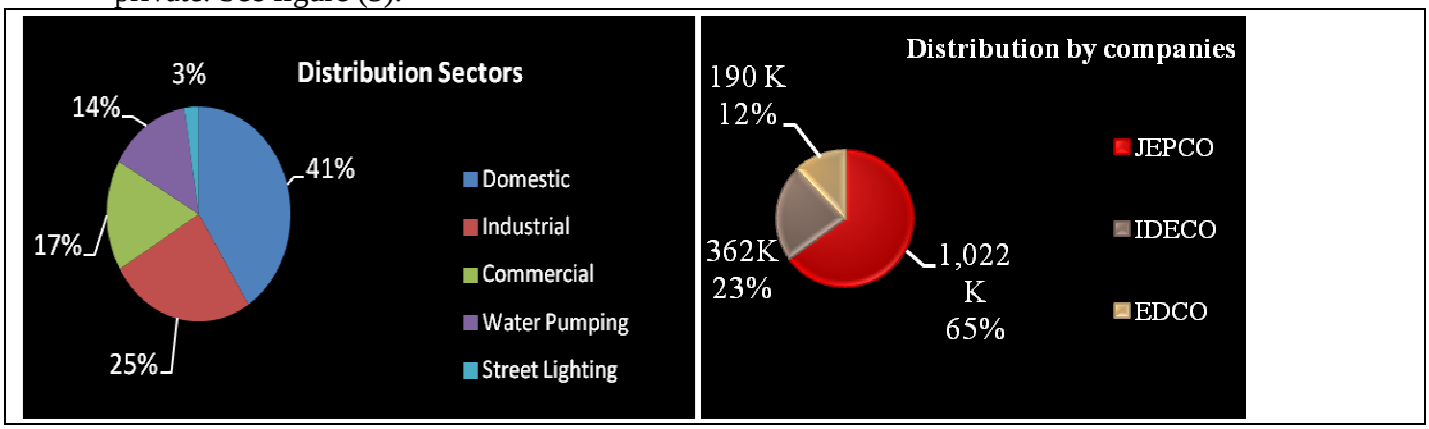

Figure (5) represents the distribution sectors and share of companies. Demand splits into households 31.5%, industry 27.7%, commercial 16.0%, water pumping 14.7%, government 6.9% and street lighting 2.5%.

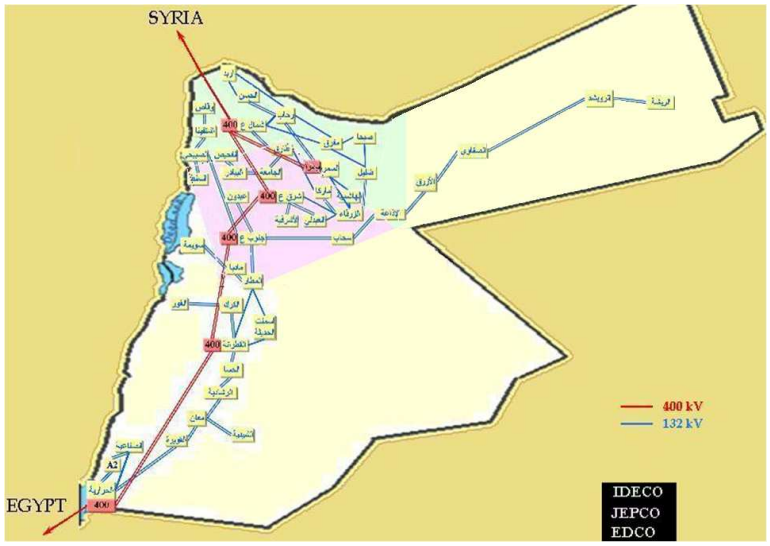

Figure (6) Interconnections Energy Systems

Following the publication of the renewable energy and energy efficiency law (n° 3, 2010), two important issues (among others) will be subject to discussion and possible decisions from the Government: The Government has not yet stated if and at what price electricity from wind and other RETs would be purchased at a fixed rate ("feed-in tariff"), for instance for direct proposals submitted by investors to the MEMR. A study has been commissioned by the MEMR and the ERC about indicative prices and their posting for future RE based IPP candidates. Therefore,
Interconnection studies about acceptable tolerance for variations of technical grid parameters caused by fluctuating power input to the grid have to be prepared, and standardized Energy Purchase Agreements [EPA] with Independent Power Providers [IPP] have to be developed for the different RETs. See figure (6) for more details on the interconnection schemes in Annex (1).

Natural gas

The National Petroleum Company (NPC) exploits the only domestic gas field at Risha, which supplies the nearby electric power plant, with a capacity of 150 MW. In 2009, an agreement has been signed between British Petroleum and the National Petroleum Company to further develop Al Rishah Field. The Al-Fajr Company was granted a 30 year concession to build and exploit the Jordanian section of the Arab Gas Pipeline (AGP). AGP now supplies 2.4 bcm per year, with plans to expand deliveries up to about 3.5 bcm/yr. Al-Fajr also has an 18 year exclusivity concession to directly supply gas to larger customers (power plants and industries). The present capacity of the AGP is sufficient to supply Jordan up to 10 bcm/y. Natural gas accounts for more than 80% of electricity generation. The AGP is now connected to the Syrian gas network, although it faces some challenges. Studies have been carried out to establish gas distribution networks in major cities, and for gas conversion of vehicles.

Petroleum

The National Resource Authority (NRA) is the public administration regulating the upstream sector based on the hydrocarbon code. The National Petroleum Company (NPC) is a fully state-owned company established in 1995 to carry out oil and gas research, exploration and production inside and outside Jordan. It has a concession area to the northeast of the Kingdom, which covers 7,000 km², including the Risha Gas Field (1,500 km²). The concession period is renewable and lasts for 50 years effective since 1996. Following a period of difficulties for Jordan to attract oil exploration companies in the years 2000-2005, concession rights have been granted for search, exploration and production to oil companies in six areas, under production sharing agreements in case of foreign companies. The majority of oil exploration areas has been marketed and promoted with the exception of Jafr area which is so far open.
In the field of Oil Shale, eight companies have signed memoranda of understanding with the government, represented by the Natural Resources Authority, to prepare feasibility studies for oil production from oil shale, using a surface distillation technology, in Al-Lajjun and Al-Atarat areas. Shell was also granted a concession for deep oil shale exploration (special law in the Official Gazette on 16/8/2009).
Jordan Petroleum Refinery Company (JPRC), a public shareholding company whose shares are owned by the Jordan Social Security Corporation and private Jordanian and foreign investors, owns and operates a 50-year old refinery at Zarka (total capacity 0.5 Mt/yr, effective at 0.45 Mt/yr). Zarka used to receive Iraqi crude by trucks and since 2003 is supplied by trucks from Aqaba; crude oil is purchased mainly from Saudi Arabia. The pipeline from Saudi Arabia (Tapline) has not been in operation since 1990, and no agreement has been reached with Saudi Arabia for its rehabilitation; the same happens with the former pipeline from Iraq. JPRC also owns storage and logistic facilities.

Renewable Energy

Present hydropower installed capacity (10 MW) is close to the total potential of available sites (except the Red Sea-Dead Sea project, which would offer a 400-800 MW capacity). But other forms of renewable energy have an attractive potential: For wind energy, the total potential of six sites assessed so far is estimated at 1,000-1,200 MW. 15 more sites are under assessment and investigation (while the existing wind energy installed capacity, operated by CEGCO, reaches 1.445 MW, with an annual production of only 3.2 GWh. The solar potential is estimated at 1,000-1,200 MW, for electricity generation only (only some 100 PV systems have been installed so far, with a total capacity of only 1 MW peak). In addition, solar hot water and heating systems could be developed under excellent economic conditions in all building categories, as well as for pre-heating water and steam in industry. Electricity generation based on urban solid waste now reaches a 3.5 MW capacity. Expansion is possible and planned. Hot and geothermal springs do exist, but their low enthalpy would not allow commercial power development. Deep drilling and investigations are envisaged. Using geothermal energy for air conditioning (heating & cooling) by heat pump technology would be a possibly viable option.

Energy Efficiency

Energy consumers in all economic sectors (industries, households, commercial sector, Government buildings, public and private transport, and agriculture) have made limited efforts to save energy and improve energy efficiency related productivity. In addition, virtually no investment to combine heat (steam) and electricity generation ["Co Generation"] has been undertaken, particularly in industry, because of low electricity tariffs and lack of other incentives. This situation is partly due to the ability of the Jordanian Government to have managed access to petroleum and natural gas resources from the Region (including Iraq) at below market prices, and habits taken by consumers (one significant example was the introducing of electrical heating at bad overall process efficiency, as prices of natural gas from Egypt were passed to the residential electricity tariffs in 2007).

A Renewable Energy and Energy Efficiency Temporary Law was passed in February 2010; this law deals with two issues: i) conditions under which electricity generating facilities based on RET can be financed, constructed and connected to the grid, and ii) the creation of a Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF); the Council of Ministers will issue by-laws necessary for the execution of the provisions of the REEE law, including "procedures and measures for energy conservation and energy efficiency in the various sectors" (Article 17), as well as other legislation necessary to support the development of RE and EE.

Annex III : Energy Portfolio & Projects

Energy Portfolio & Projects

No.	Project	Main objective	Progress made	Budget	Time frame
Bilateral projects					
1	Capacity Building for the National Energy Research Centre NERC (Twinning) EuropeAid/125624/C/A/ACT/JO Twinning prject:JO 07/AA/EY07	The project attempts to enhance NERC's overall administrative, operational and expert institutional capacity in order to meet the energy challenges facing Jordan in an economically, socially and environmentally sustainable way and to obtain Photovoltaic Systems Laboratory Accreditation inline with international and EU best practices in attempt to assist Jordan in meeting its commitments under the EU-Jordan Association Agreement and European Neighbourhood policy action plan	Project seems to be moving positively, and NERC is please with the TA provided by the CRES centre from Greece. The main components of this project touch on: 1: Institutional strengthening and capacity building for NERC 2: Provide assistance in the field of Energy Efficiency 3: Building the capacity of the NERC in Wind Energy field 4: To build the capacity of the Photovoltaic systems Division	800,000 €	01/04/2008 - 30/07/2009
2	Capacity-Building in Wind Energy and Concentrating Solar Power (CSP) in Jordan , CRIS no.: 2010/20479	to support the rational and sustainable use of alternative energy resources in Jordan, while The specific objective is to support the National Energy Research Centre to steer and facilitate the	Financing agreement signed on 31 May 2010, implementation will start in January 2011, with the Technical Assistance component.	10,000,000 €.	2010-2013

		implementation of the Renewable Energy section in the 2007-2020 energy strategy for Jordan			
3	Support to the Jordan Nuclear Regulatory Commission on Nuclear safety Project no. JO3.01/08 managed by HQ	To support Jordan's initiatives on safe use of nuclear energy	This is a centrally managed initiative under the Nuclear Safety unit in Brussels. The Delegation helped conduct a workshop in March 2008 on this topic followed by a mission in June to prepare an identification fiche for the propose project, Financing agreement signed in July 2009.	1,000,000 €.	Project no. MC2.01/08 is part of this financing agreement.
4	Renewable energy and Energy Efficiency programme in Jordan REEE	the general objective of the programme is to contribute to the development and implementation of effective policies so that Jordan is able to reach renewable energy and energy efficiency goals set by the Government for 2020. The programme has two complementary specific objectives: -Assist Jordan Government to complete already undertaken institutional and legislative reforms, with a view to create the best possible enabling environment to mobilise public and private actors to achieve goals of 10%	Financing Agreement signed in December 2011, and implementation started, under the guidance of the programme steering committee	35,000,000.0 €	Under the 2011-2013 NIP, and contains a sector budget support component for 29M Euro for the first time in the EU support to energy sector.

		renewable energy and 20% of energy savings in 2020. -Contribute to full scale implementation of activities to induce behavioural changes and to foster investments towards production and use of energy: regulations and standards; R&D; fiscal and financial incentives for demonstration and "full market" investments, duly prepared by studies and audits; information and public awareness; training; monitoring and strategy adjustment; and thereby demonstrate the feasibility, benefits and sustainability of new technical solutions.			
Regional Projects					
4	Euro Arab Mashreq Gas Market Project EAMGMP	To contribute to the integration of the gas markets of Egypt, Jordan, Lebanon and Syria in view of creating a regional internal gas market to be integrated with the EU internal gas market	The project has successfully managed to establish a centre in Damascus to work on elaborating a Gas Master Plan for the region and encourage network development, to accompany the legislative harmonisation and legislative preparatory actions for regulatory market reform in view of facilitating the	7,000,000 €	February 2006 - December 2009. Note: the 2nd phase was posed due to the political changes in Syria which hosts currently the programme centre.

			creation of a competitive and efficient Arab gas market to be integrated to the EU natural gas market when conditions permit and to transfer know-how and expertise to the beneficiary countries (currently, a second phase is being prepared)		
5	Energy Efficiency in the Construction Sector programme (MED- ENEC)	to give a boost to energy efficiency measures and to the use of solar energy in the construction sector, in order to reduce both energy supply requirements and the ever-growing impact on the environment of air-conditioning installations	The project worked on : - Regional and sub-regional information, communication and cooperation net-works in the construction and energy sectors among the MEDA countries and with the EU-member states are established. - Policy instruments, standards and incentive measures within an adequate regulatory framework orienting on the relevant topics and guidelines for energy efficiency in the construction and building sectors are available for adoption by policy makers.	4,000,000 €	January 2006 – October 2009 (Phase 1) January 2010 (Phase 2 start)

			- New services and businesses and technology cooperation between European and MEDA partners are established to support communities, real estate developers and building owners with comprehensive and cost effective services. - Best practices and new technologies as well as integrative approaches are demonstrated and documented through pilot projects. - Increased public awareness on and civil society participation in climate-oriented building techniques and EE/RE use in buildings. - Assured visibility of the EC-contribution to the Project and transparency in the information flow to EC - a second phase was approved and started in 2010 Support Jordan together with the League of Arab		Nov 2010-Nov 2013

			States and MED-EMIP & RCREEE to develop and implement a National Energy Efficiency Action Plan.		
6	MED-EMIP Energy market integration project	The overall objective of the project is to support the implementation of the Euro-Mediterranean Energy Partnership's on key energy policy and industry issues. The project will be at the core of the implementation of the EU-MPC energy cooperation, having a catalyst role with particular emphasis on enhancing energy security and sustainability. In conjunction with the activities of the MENA Regional Centre of Excellence for Renewable Energies and Energy Efficiency (RCREEE), MED-EMIP will help both parties to address the challenges of securing energy supply, promoting sustainable development and giving a boost to the regional integration	Help on preparations for workshop on oil shale in April 09, and then helped to establish the Oil Shale Regional Cooperation Centre OSCC in April 2010, including Jordan, Egypt, Syria, Morocco and Turkey Help Arab States on Energy Efficiency strategies and procedures Help Jordan on Renewable energy schemes, financial modelling, tariff structure, latest technologies, and awareness to Decision makers Support Jordan together with the League of Arab States and RCREEE & MED-ENEC to develop and implement a National Energy Efficiency Action Plan.		Nov 2010-Nov 2013
7	MSP Mediterranean	-Develop renewable	Help facilitate the		

	solar plan	energy (RE) generation in the region at a scale of implementation capable in the first place to contribute significantly to cope with the increasing energy demand in the Mediterranean Partner Countries (MPCs); - Contribute to developing an integrated "Euro-Mediterranean electricity market", both for satisfying the MPCs' own electricity needs with renewable energy sources (mainly solar), and potentially to export part of the electricity produced with renewable energy sources to consumers countries, including the EU	proposed identification mission in April 09 A new EU project named "Paving the way for MSP started in November 2010		Nov 2010-Nov 2013
8	RCREEE: Regional Centre for Renewable Energy and Energy Efficiency	With support from Germany, Denmark and EC, this centre is designed to foster cooperation and development of renewable energy and energy efficiency within the Euro-Med region.	Help Jordan develop RE and EE at large. Support Jordan together with the League of Arab States and MED-EMIP & MED-ENEC to develop and implement a National Energy Efficiency Action Plan.		2nd Half of 2010
9	Cleaner, energy - saving Mediterranean Cities	Enhance Local authorities in the Mediterranean region to develop and implement sustainable energy and C02 reduction policies as	Identification stage: ongoing		3rd Q 2010

		well as to participate in the Covenant of Mayors. It is also expected to increase awareness of the importance of fostering sustainable energy and C02 reduction policies, and of the Covenant of Mayors initiative among the local authorities of the cities in the Mediterranean region			