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REVIEW OF THE ENERGY SITUATION IN JORDAN AND RECOMMENDED STRATEGIC PRIORITIES

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Disclaimer

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List of Acronyms

AFD	Agence Française Développement
BTU	British Thermal Unit
DISCOs	electric distribution companies
DSM	demand-side management
EBRD	European Bank for Reconstruction and Development
EE	energy efficiency
ERC	Electricity Regulatory Commission
ESG	Energy and Security Group
EU	European Union
GAM	Greater Amman Municipality
GDP	Gross Domestic Product
GFP	Gender Focal Points
GEF	Global Environment Facility
GIZ	German International Development Agency
GOJ	Government of Jordan
IPP	independent power plants
JD	Jordanian Dinars
JEPCO	Jordan Electric Power Company
JFBPW	Jordan Forum for Business and Professional Women
JIB	Jordan Investment Board
JNCW	Jordan National Commission for Women
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
JSMO	Jordan Standards and Metrology Organization
KfW	German Development Bank
KW	kilowatt
KwH	kilowatt-hour
LNG	liquid natural gas
MEMR	Ministry of Energy and Mineral Resources
MIT	Ministry of Industry and Trade
MOE	Ministry of Environment
MOF	Ministry of Finance
MOL	Ministry of Labor
MOPIC	Ministry of Planning and International Cooperation
MOU	Memorandum of Understanding
MPWH	Ministry of Public Works and Housing
m/s	Meters per sec
MW	megawatt
NEPCO	National Electric Power Company
NERC	National Energy Research Center
NGO	non-government organization
OPIC	Overseas Private Investment Corporation
PAP	USAID Project - Public Action for Water, Energy and Environment
PPP	public private partnership
PV	photovoltaic
QA	Quality Assurance
RE	renewable energy
RFP	Request for Proposal
SABEQ	Sustainable Achievement of Business Expansion and Quality Project
SME	small and medium enterprises
SWH	solar water heater
TA	technical assistance
UNDP	United Nations Development Programme
USAID	U.S. Agency for International Development
USDOE	U.S. Department of Energy
WB	World Bank

Executive Summary

In preparation for USAID/Jordan's new five-year strategy, Winrock International and the Energy Security Group were tasked with providing an independent assessment for planning new work in the energy sector. A team was deployed in February 2012 to conduct this analysis and develop a set of priority recommendations for USAID in this area. The four key recommendations are:

Energy Sector Capacity Building for government ministries, regulators, transmission and distribution utilities, and private companies and individuals. Some specific capacity-building needs are identified in this report, many of which are addressed in the draft Statement of Work (SOW) for the Energy Sector Capacity Building Project that was publically released by USAID/Amman for comment in early 2011. Thus, we recommend that USAID proceed with implementation of this program, or a program that contains many of the capacity building tasks in the draft SOW. Further, the Electricity Distribution and Transmission Utilities Partnership and the Electricity Regulatory Commissions Partnership supported by USAID/Amman through the United States Energy Association (USEA) effectively supports needed capacity building.

Technical Assistance in Energy Policy, Regulation, and Attracting Private Investment. Jordan has made significant progress in creating the basis for renewable energy (RE) and energy efficiency (EE) development, including passing the RE/EE law, developing the Jordan Renewable Energy and Energy Efficiency (JREEEF) program, and issuing independent power plant (IPP) solicitations for private firms to develop wind and solar generation plants under the Build-Own-Operate (BOO) model. Further work is required on the implementing rules, regulations, and mechanisms before the RE/EE law can begin to have an effect. USAID should consider assisting Jordan through this process. Support should also be provided for helping Jordan refine and launch the JREEEF, if the USG's concerns over the decision to locate the Fund under the direct control of the Minister of Energy and Mineral Resources (MEMR) can be addressed, and for strengthening and streamlining programs and mechanisms for attracting private investment.

RE/EE Communications, Outreach, Consultation Promotion, and Awareness-Building. The most immediate need in this area is support to MEMR, the Electricity Regulatory Commission (ERC), and the National Electric Power Company (NEPCO) on communications related to the need to reduce electricity subsidies and increase rates. The Government recently (March 12-13) had to rescind/rollback recent increases in electricity rates, due to strong opposition from consumers and businesses that resulted in opposition in the Parliament. The Government has little choice, and must attempt again to reduce electricity subsidies, probably later this year. An effective communications and outreach strategy could be instrumental in supporting this effort. Assistance in this area will also be important for EE activities, including short-term conservation measures to reduce peak energy demand, particularly as EE programs ramp up and improved EE products and new incentives become available. Support for increased awareness-building could be provided under the existing USAID Project—Public Action for Water, Energy, and Environment (PAP). It is much more effective for the Government of Jordan (GOJ) to implement awareness programs stressing the need for price increases, if they can be linked to programs and government support for efficiency measures that can be implemented at the same time, to reduce the impact on consumer bills.

RE/EE Project Development. A number of opportunities exist for high penetration RE/EE in the Jordanian power system. These include both technical/technology and project-related activities that could make a significant contribution in the near- and long-term and provide concrete results. Suggested activities include: 1) work with NEPCO to incorporate intermittent wind and solar power generation into the grid; 2) support to MEMR, ERC, and NEPCO to develop a least-cost strategy for expanding RE generation; 3) work with MEMR to launch the RE independent power plants (IPPs), including consultation with key stakeholders like ERC, electric distribution companies (DISCOs), and NEPCO; 4) conduct RE resource assessments, including wind, solar, and possibly geothermal, building upon work that has been done in this area to date; 5) implement and enforce a comprehensive solar water heater (SWH) program, as required by the newly updated national building codes, to include industry strengthening and expansion in areas such as quality improvement, testing and certification, and design of effective incentive programs; 6) promote cooling- and heating-related EE activities for existing buildings, including

insulation and other passive measures; 7) demonstrate “Green Building” potential by showcasing Leadership in Energy and Environmental Design (LEED) projects in new buildings; and 8) stimulate local RE/EE industry development to maximize a cost-effective, local role in RE/EE supply chains (e.g., energy audit/needs assessment, system integration and installation, maintenance) and analysis to identify systems, components, and materials that can be locally produced on a competitive basis.

Background

Over the last few years, the energy sector in Jordan has experienced significant variability and USAID has been there to help:

- In 2003-4, Jordan lost access to subsidized oil from Iraq, with the U.S. invasion of this country and the destruction of much of Iraq's oil production capacity;
- In 2007, Jordan prepared its National Strategy that identified ways to diversify energy supply and thus to be less vulnerable to disruptions in supply from a single source;
- In 2008, King Abdullah II approached the U.S. Ambassador seeking assistance to help Jordan cope with the emerging crisis in the energy sector. An Activity Approval Memorandum was signed that launched the U.S. Agency for International Development (USAID/Jordan) intervention in the energy sector. The USAID/Jordan Energy Program (JEP) has helped establish the potential for energy efficiency improvements and barriers that must be overcome through:
 - an assessment of the availability of energy efficient end use products and services in the Jordanian market;
 - estimation of the savings potential in electricity end uses by sector;
 - analysis of the disincentives to energy efficiency in existing financial regulation of electricity transmission and distribution companies in Jordan; and
 - recommendations for regulatory changes and capacity building to overcome the financial regulatory barriers.

The JEP has also supported capacity building for energy efficiency and renewable energy in the electricity sector of Jordan through partnerships with counterpart organizations in the US.

- To advance Jordan’s ambitious goal of connecting up to 1,800 megawatts (MW) of renewable power by 2020, NEPCO partnered with USEA to conduct information exchanges. US utility executives, including Arizona Public Service, have provided technical and executive leadership to their counterparts and have discussed best practices around energy efficiency and conservation, safety, distribution system operations, and transmission planning procedures.
- The ERC entered into an energy regulatory partnership with the National Association of Regulatory Utility Commissioners (NARUC) and member state electricity regulatory commissions in 2009. The Partnership is designed as a vehicle for the exchange of experience and information between U.S. and Jordanian regulatory bodies with the goal of improving market-based regulatory practices and fostering long-term sustainable relations.

- Nexant has performed several in depth studies focused on increasing energy efficiency through market assessments, including an energy efficiency mechanisms and analysis of technical assistance needs. Nexant also worked with local energy service companies (ESCOs) to perform energy audits on a group of public buildings and finalized “model” audits for a Government administrative building and a typical K-12 school.
- The program also strengthened capacity in the commercial building sector by supporting and documenting the pre-certification by the US Green Buildings Council of a Leadership in Energy and Environmental Design (LEED) Gold commercial building in Amman.
- Finally, the JEP has played a lead role in the activities of the Jordan Donor Committee on Energy and USAID has supported the GOJ in developing the Jordan Energy Efficiency Roadmap.

Additional compounding factors to Jordanian energy variability:

- The financial crisis in 2009 diverted attention away from energy and further delayed needed investments.
- Most recently, repeated disruptions of the supply of Egyptian gas since February 2011 and the huge energy debt that resulted from use of costly oil to generate electricity.

Today, Jordan relies on imports to meet at least 96 percent of its energy needs, at a cost of roughly \$5 billion per year. Its national credit rating has fallen to BB+, which makes foreign investment very difficult to obtain.

Yet, there are positives. For example, foreign investors have demonstrated interest in developing IPP projects in Jordan, including projects based on wind power and solar energy. Several Memorandum of Understanding (MOUs) have been signed between the GOJ and project developers to explore Jordan’s indigenous energy resources.

The challenge for USAID is to identify strategic areas of support for GOJ as the country seeks to diversify its energy sources based on locally-available renewable energy, energy efficiency, and fossil fuels and assist the country to enhance energy security, protect the environment, and advance economic and social development.

Approach

USAID/Jordan is preparing a new five-year strategy. In order to provide an independent basis for planning new work in the energy sector, a consultant team from Winrock International and the Energy and Security Group (ESG) was deployed to Jordan for two weeks in February 2012 to assess the status of the sector. The team was tasked with preparing recommendations for USAID based on: 1) the mission's manageable interest in energy and related sectors; 2) comparative advantages of USAID vis-à-vis government, donor, and other relevant activities in the country—current and planned; and 3) consistency and synergies with USAID Forward (see Annex A). The assessment team met with more than 60 individuals from USAID project offices, GOJ organizations, foreign donors, investment capital companies, private sector companies/organizations, energy service companies, non-government organizations (NGOs), and Women in Development organizations (see Annex B); and undertook an extensive literature review (see Annex C). A summary of meetings held is provided in Annex D.

The GOJ Response to Date

The Jordan National Energy Strategy, updated in 2007, identified an energy mix in 2020 to achieve energy security by increasing reliance on renewable energy, improving energy efficiency, and expanding options for additional power generation. These initiatives would require an estimated \$13.3 to \$17.3 billion in capital investments between 2008 and 2020 for implementing programs across all energy sectors. Among its goals are providing seven percent of power generation from renewable energy resources (solar and wind) by 2015, and ten percent by 2020. Since that time, 63 Expressions of Interest for new renewable energy generating facilities have been submitted. To date, however, these EOIs are still under review; none have been pursued by the Ministry of Energy and Mineral Resources. A promising indication for improvement in the Jordanian energy sector occurred when the temporary Renewable Energy and Energy Efficiency Law (passed by Parliament in 2010) was made permanent in February 2012. MEMR is now preparing by-laws and regulations to implement the law.

The Minister of MEMR initiated the Energy Efficiency Working Group, consisting of relevant stakeholders, including: donors, lenders, governmental entities, regulatory agencies, utilities, non-profit organizations, and the private sector. Additionally, the National Centre for Research and Development--funded by the Euro-Mediterranean Energy Market Integration Project (EU MED-EMIP)--is developing a Biogas Roadmap. The GOJ continues to explore the logistics and economic feasibility of a terminal to off-load liquid natural gas (LNG) at the Gulf of Aqaba and a pipeline for transporting the fuel to power plants. Two independent agencies have been established to study the need for a 1,000 megawatt (MW) nuclear power plant. Finally, as specified in the recently passed Renewable Energy and Energy Efficiency Law, the GOJ will create JREEEF through which multilateral and bilateral donors may be able to support RE/EE projects.

In summary, Jordan has great potential to achieve energy security if it properly uses its renewable energy resources; in particular it's solar and wind energy, and possibly

geothermal resources. The daily load curve of the Jordanian network has two peak periods, in midday and evening hours. A large sector of the Jordanian electrical load can benefit greatly from the combination of wind and the high solar irradiance and long sunny days whether these loads are grid connected or stand alone. Promoting renewable energy is one of the key elements in a power generation mix for Jordan to solve its energy crisis. Jordan has a significant wind resource especially on the Northern and Western sides of the country where annual average wind speed exceeds 7 meters/second (m/s). Jordan also has abundant supplies of solar energy, with a relatively high average daily solar radiation of 5.5 kWh/m²/day. The annual sunshine duration is around 2,900 hours, which is sufficient for a range of solar applications to be economically feasible – solar water heaters, photovoltaic and concentrated solar power plants, solar heating and cooling, etc. Nevertheless, solar energy technologies are not yet used extensively, except for residential solar water heaters and some industrial process heat applications.

Recommended USAID Initiatives

Jordan faces an energy sector crisis that threatens to provoke social, economic, and political instability if not addressed immediately. To identify and prioritize possible interventions for USAID, the assessment team used the three criteria below to sort through the list of possible interventions to mitigate energy sector problems identified. The assessment also considered synergies with *USAID Forward* (Annex A).

- *Is the activity consistent with USAID's comparative advantage?*
- *Does the activity address energy security in Jordan directly or indirectly?*
- *Can activity objectives be achieved without significant government or third-party action outside the manageable interest of USAID programming?*

The assessment identified 29 interventions for USAID to consider, with 20 considered a “high” priority for immediate implementation and nine considered of “medium” priority. Exhibit ES-1 lists the high-priority interventions.

This assessment validates and strongly supports the USAID/Jordan initiative resulting from the 2008 assessment, i.e., the USAID/Jordan Energy Program. This stated GOJ must:

- reduce demand via energy efficiency measures;
- ensure that the legal/regulatory climate for energy sector development supports energy efficiency development, integrates renewable energy sources, and is attractive to private sector investors;
- seek private sector investment in the energy sector aggressively, particularly in renewable energy development; and
- facilitate consumer and business access to knowledge of efficient energy use practices and energy efficient technologies.

Four priority areas for USAID Support are outlined below and discussed in more detail in the remainder of this report.

Energy Sector Capacity Building. There is a vital need to strengthen Jordanian energy sector related institutions and improve the services provided by public and private sector entities. Both public and private sector organizations in Jordan have an immediate opportunity to meet energy demands by implementing the actions of the existing National Energy Strategy and Jordan Energy Efficiency Roadmap, and maximizing use of Jordan's exceptional renewable energy resources (solar and wind). The GOJ should also continue to explore the potential of indigenous fossil energy resources for power generation (i.e., oil shale), and expand electricity interconnection with neighboring countries to enhance energy security.

Energy sector capacity building should be targeted for government ministries, regulators, transmission and distribution utilities, and private companies and individuals. This should include improving communications among various branches of government to require that already approved policies and action plans be implemented by responsible governments and ministries, with capacity support to accomplish this as needed. A steering committee should be established within the MEMR to provide timetables for implementation and oversight, to include representation from the Ministry of Planning. Additionally, capacity support is needed for MEMR to address shortcomings of the organization, to include provision of: long-term, high-level in-house consultants to strengthen institutional capacity on technical and managerial issues; short-term experts at MEMR to strengthen EE and RE departments; and support to assist in facilitating policy implementation across the agencies.

Some specific capacity-building needs are identified in this report, many of which are addressed in the draft Statement of Work (SOW) for the Energy Sector Capacity Building Project that was publically released by USAID/Amman for comment in early 2011. Thus, we recommend that USAID proceed with implementation of this program, or a program that contains many of the capacity building tasks in the draft SOW. We believe that the Electricity Distribution and Transmission Utilities Partnership and the Electricity Regulatory Commissions Partnership supported by USAID/Amman through the United States Energy Association (USEA) also effectively supports needed capacity building.

Technical Assistance in Energy Policy, Regulation, and Attracting Private Investment. Jordan has made significant progress in creating the basis for renewable energy and energy efficiency development, including passing the RE/EE law, the establishment of the JREEEF, and issuing IPP solicitations for private firms to develop wind and solar generation plants under the build-own-operate model

For the GOJ to effectively implement required broad policies and programs in the energy sector, procedural, institutional, and technical capacity deficiencies must be addressed in a range of organizations within and outside government. Policies and broad program directions can only be effectively implemented if the supporting institutions, such as the Energy Regulatory Commission (ERC), the Jordan Standards and Metrology Organization (JSMO), the National Building Council (JNBC), the National Energy Research Center (NERC) among others can bring to bear the necessary technical and

institutional capacity to design, communicate, coordinate, enforce, and monitor these activities. Procedures for rule-making and other decisions need to be transparent, open, and accessible to civil society organizations and interested public. Recommended activities include:

- Strengthen technical capacity in organizations that support by-laws and regulations, and program design/implementation – especially EE and RE;
- Support capacity development and implementation of programs to ensure that markets for energy technology (EE/RE) and services are well-regulated, incentivized, and sustainable; and
- Assist the GOJ in implementing clear and consistent procedures for development of bylaws and regulations, and other key decisions needed to implement energy sector, policies, programs, and investments.

Support should also be provided to help Jordan refine and launch the JREEF—if the USG’s concerns over the decision to locate the Fund under the direct control of the Minister of Energy and Mineral Resources can be addressed—and to strengthen and streamline programs and mechanisms for attracting private investment.

RE/EE Communications, Outreach, Consultation Promotion, and Awareness-Building. The most immediate need in this area is support to MEMR, the ERC, and NEPCO on communications related to the need to reduce electricity subsidies and increase rates. The Government recently (March 12-13) had to rescind/rollback recent increases in electricity rates, due to strong opposition from consumers and businesses, and the consequential opposition in the Parliament. The Government has little choice, and must attempt again to reduce electricity subsidies; probably later this year. An effective communications and outreach strategy could be instrumental in informing consumers of what they can expect and what alternatives they have. For example, making consumers aware of EE activities they can take in the short-term to reduce peak energy demand would be useful, particularly as EE programs ramp up and improved EE products and new incentives become available. Providing information on “quality” products such as efficient lighting and appliances and solar water heating systems, and service providers to include installers, energy auditors, energy service providers, and greener building designers will be important. (This implies that government is regulating the markets to eliminate substandard products and services in the activity above.) Information on existing/planned financial incentives and other programs to assist consumers to purchase energy efficiency products and improve the energy performance of their homes and businesses through product labeling and standards, building codes, energy service companies, retrofit of solar water heating, etc., will stimulate penetration of new products and services. It is much more effective for the GOJ to implement awareness programs stressing the need for price increases, if they can be linked to programs and government support for measures that can be implemented at the same time to reduce the impact on consumer bills.

USAID should assist the GOJ and its partners to design and implement a major consumer education campaign to explain the current energy situation, describe the benefits of clean

energy services, document the reasons for increased costs, and provide a menu of actions and support that consumers can utilize to adapt to the new energy sector realities. This effort should also involve development of a consumer-focused Demand-Side Management (DSM) strategy for large consumers of electricity and fuels. Finally, a USAID campaign should include work with the Ministry of Education to raise the awareness of school children on both the importance of energy saving and renewable energy, and the actions that individuals, families, and organizations can take to achieve these objectives. Support for this activity could be provided under the existing USAID Project—Public Action for Water, Energy, and Environment (PAP).

RE/EE Project Development. With expected increases in energy demand, USAID should help Jordan maximize the use of RE/EE technologies as there exist a number of opportunities exist for high penetration of these technologies in the Jordanian power system. A program is recommended to support several activities that will enhance the knowledge and experience base of RE/EE for critical applications in the country. These include both technical/technology and project-related activities that could make a significant contribution in the near- and long-term, and provide concrete results. They could be conducted either as part of a multi-faceted Clean Energy Program, as stand-alone activities, or incorporated into existing or already planned programs. Suggested activities are: 1) work with NEPCO to incorporate intermittent wind and solar power generation into the grid; 2) support MEMR, ERC, and NEPCO on development of a least-cost strategy for expanding RE generation; 3) work with MEMR to launch the RE IPPs, including consultation with key stakeholders like ERC, DISCOs, and NEPCO; 4) conduct RE resource assessments, including wind, solar, and possibly geothermal, building upon work that has been done in this area to date; 5) implement and enforce a comprehensive solar water heater program, as required by the newly updated national building codes, to include industry strengthening and expansion in areas such as quality improvement, testing and certification, and design of effective incentive programs; 6) cooling- and heating-related EE activities for existing buildings, including insulation and other passive measures; 7) demonstrate “Green Building” potential by showcasing LEED projects in new buildings; and 8) stimulate local RE/EE industry development to maximize a cost-effective, local role in RE/EE supply chains, (e.g., energy audit/needs assessment, system integration and installation, maintenance) and analysis to identify systems, components, and materials that can be locally produced on a competitive basis.

Other important activities include:

Donor Coordination. USAID/Jordan has implemented several partnerships and activities that provide input and support to GOJ’s initiatives, including coordination with other donor activities in the energy sector. For example, under the Global Environment Facility (GEF) program, the United Nations Development Program (UNDP) has sponsored a standards and labeling project for several major types of equipment and a washing machine testing laboratory. The World Bank International Finance Corporation has funded studies on feed-in tariffs, bylaws, grid capacity/smart grid, and wind farm independent power producers. France’s Agence Francaise Developpement (AFD) has supported programs in street lighting and is considering loans to finance EE/RE projects

under specified criteria. Germany's international development agency (GIZ) has installed several energy efficiency water pumps. The German development bank (KfW) has proposed financing and technical assistance to implement energy efficiency improvements in public buildings. Also, the European Union (EU) has initiated grants for energy sector budget support and funded capacity building projects.

USAID has initiated periodic meetings of foreign donors to facilitate coordination of their energy-related activities. This initiative has received high praise from all donors contacted as a positive step for all of them to leverage their specific technical and financial resources. USAID's "value added" in this coordination initiative is the high-level focus on government energy sector strategies and policies. However, USAID should broaden its involvement in the energy sector to include cooperation with other donors in a broader range of on-the-ground energy sector interventions to include community-based activities, consumer awareness, appliance standards/labeling, etc., bringing its extensive global experience, knowledge, and partner base on these issues to enhance the energy sector in Jordan. USAID could expand the impact of donor activities via joint collaboration on existing projects; implementation of USAID-led projects such as testing laboratories for refrigerators, and air conditioners; and facilitation of USAID government-level capacity building, consumer energy awareness, and other possible activities identified in this assessment.

Gender and Energy. Jordan's middle class is becoming smaller; highly educated youth and a high unemployment rate are increasing income inequality and poverty. The economic participation of women in Jordan remains low relative to international experience. Discrimination against women in the private sector is higher than in the public sector. Women working in the private sector earn less than men.

The women's NGO sector is particularly active in Jordan and has strong support from the government, the royal family, and international community donors. For example, the Ministries of Agriculture, Planning, Labor, Education and Health have established gender units or divisions. The gender focal points (GFP) of these ministries have received a variety of training courses to be able to mainstream gender in the substantive work plan of each institution, across departments. However, this initiative is not effective because GFPs find great difficulty in handling different departments' work processes, and do not have any time allocated for this task.

Several Jordanian NGOs have national level mandates to advocate for women's issues and/or implement development programs at the grassroots level. The Jordan National Commission for Women (JNCW), Jordan Women's Union, the Jordan Forum for Business and Professional Women, and the Jordan River Foundation are among the most active and recognized women's NGOs. Empowerment of communities, particularly women, youth, and vulnerable groups, is one of the most powerful tools to combat discrimination and achieve participatory and equal society. No sustainable development can be achieved if concurrent social development is lacking.

To improve the effectiveness of gender mainstreaming efforts in ministries, including MEMR, USAID should support efforts to assess organizational culture within these

entities. As noted above, several ministries already have gender offices; MEMR may want to consider creating a comparable unit/division on gender and energy.

Energy is essential to expand economic and social opportunities for women. Because women are household energy managers, energy users, suppliers, and potentially energy-consuming entrepreneurs, factoring them into energy decisions that affect them, their children, and families can help to ensure improved lives and livelihoods for all.

The Gender Division of the Ministry of Labor has stated that labor laws must be improved and enforced to avoid employers' preference to hire men. Private enterprise in Jordan is male-dominated and women's entrepreneurship is markedly under-developed as it operates mainly along traditional gender roles. Microfinance is available by law for women entrepreneurs; although the effectiveness must be investigated. USAID should support the creation of a platform to develop income generation opportunities for youth and women to promote EE and RE. Capacity building in these areas should be provided, to include women's NGOs and youth through vocational training centers.

Gender issues should be considered upfront as a priority for any project or strategy design phase, to include capacity building activities at community level. Women are often the primary energy users in households, so a successful EE/RE technology dissemination and economic development program needs to include them. The appropriate application of sustainable energy technologies has great potential for empowering women by supporting many women's activities and stimulating economic and social development.

Strengthening Private Sector Investment. Any effective measure for energy efficiency and renewable energy requires the involvement of the private sector. Initiatives considered the highest priority are:

- Provide training/lessons learned on technical issues related to public private partnerships (PPPs), independent power producers, and other contracts between GOJ and private parties;
- Promote regional and international interconnection with neighboring countries;
- Encourage distribution companies to promote EE and consumer-level RE as a new business opportunity;
- Support the establishment of local supply chains for manufacture, assembly, installation, and servicing of photovoltaics (PV), solar water heater systems, and EE technologies, including quality strengthening and assurance.¹

¹ Local manufacturing of PV cells and modules themselves are unlikely to be competitive given the cost advantages of international manufacturers from China, India, Europe, and US, so focus for PV should be on other elements in the supply chain/value chain.

Table ES-1. Recommended USAID Interventions

HIGH PRIORITY
<i>Capacity Building</i>
Implement Energy Sector Capacity Building Program such as that laid out in 2011 draft Statement of Work.
Improve communications among various branches of government to encourage implementation of existing, approved government policies and action plans by successive governments and ministries, possibly involving the creation of an agency that effectively can impose schedules for implementation and enforce them.
Provide MEMR with an in-house long-term consultant.
Provide MEMR with short-term consultants in-place at MEMR to strengthen EE and RE departments
<i>Technical Assistance in Energy Policy, Regulation, and Attracting Private Investment</i>
Provide technical assistance on implementing rules, regulations and mechanism for RE/EE law.
Assist in refining and launching the JREEF.
Provide technical assistance for program implementation to ensure that markets for EE/RE systems and services are well regulated, incentivized, and sustainable, and private sector investment is encouraged.
<i>Consumer Outreach</i>
Support EE/RE awareness campaigns by enhancing the engagement and capacity of civil society organizations to effectively participate in EE/RE implementation decisions and to communicate results to stakeholders and the public.
Develop a consumer focused DSM strategy for large consumers of electricity and fuels.
Promote curricula strengthening by including EE and RE topics at elementary school and start a “National Watt Watchers” Program.
<i>RE/EE Development Activities</i>
Work with NEPCO to incorporate intermittent wind and solar power generation into the grid.
Support MEMR, ERC, and NEPCO to develop a least-cost strategy for expanding RE generation.
Work with MEMR to launch the RE IPPs, including consultation with key stakeholders like ERC, the DISCOs, and NEPCO.
Conduct RE resource assessments, including wind, solar, and possibly geothermal, building upon work that has been done in this area to date.
Implement and enforce a comprehensive solar water heater program, to include industry strengthening and expansion in areas such as quality improvement, testing and certification, and design of effective incentive programs.
Conduct cooling- and heating-related EE activities for existing buildings.
Demonstrate “Green Building” potential by showcasing Leadership in Energy and Environmental Design (LEED) projects in new buildings.
Stimulate local RE/EE industry development to maximize a cost-effective, local role in RE/EE supply chains, (e.g., energy audit/needs assessment, system integration and installation, maintenance) and analysis to identify systems, components, and materials that can be locally produced on a competitive basis.
<i>Donor Coordination</i>
Expand and strengthen donor coordination initiatives to maximize coordination, focus on specific organizational strengths, and leverage funding resources.
<i>Gender and Energy</i>
Support creation of a Gender Unit at the MEMR and provide technical assistance to the Jordan National Commission for Women to include energy in its strategy.
Medium Priority

<i>Private Sector Initiatives</i>
Train judges on the technical issues associated with PPPs, IPPs, and other contracts between the GOJ and private parties.
Promote strengthened regional and international interconnection for electricity exchanges with neighboring countries.
Assist the Ministry of Finance to create and implement a PPP unit by providing administrative and technical assistance to prepare the rules and regulations according to international best practices.
Prepare a study of “lessons learned” from IPP and PPP transactions and examine compliance with Jordanian and international legal standards.
Encourage DISCOs to promote installation of EE and consumer level RE systems as a new business opportunity.
Encourage the establishment of local industries to manufacture, assemble, install, and service PV and SWH systems, and EE technologies.
Support creation of a micro-loan facility to be administered by DISCOs and qualified ESCOs to finance residential level EE appliances, SWH systems, and small RE systems.
Support implementation by DISCOs of a billing format for electricity bills that shows actual cost-of-service versus regulated payment for service.
<i>Gender and Energy</i>
Design and implement a vocational program through NGOs and existing community organizations to train women and youth in EE and RE technologies and systems.

Overview

Background

King Abdullah II of Jordan approached the U.S. Ambassador in early 2008 seeking U.S. assistance to help Jordan cope with the emerging crisis in the energy sector.

USAID/Jordan requested support from the USAID Economic Growth, Agriculture, and Trade Bureau's Office of Infrastructure and Engineering to assess the energy situation in Jordan and map out possible USAID support for longer-term energy sector reform and economic development in Jordan. The Energy Assessment Team recommended that USAID/Jordan consider intervention to assist the GOJ in implementing its Energy Strategy and National Energy Master Plan in four strategic areas: energy efficiency, regulatory reform, public-private partnerships, and access to credit. As a result, in November 2008, an "Activity Approval Memorandum" approved the USAID/Jordan Energy Program that launched the Mission's intervention in the energy sector.

Jordan National Energy Strategy

Jordan updated its National Energy Strategy in 2007. The National Energy Strategy identified an energy mix in 2020 to achieve energy security by increasing reliance on renewable energy, improving energy efficiency, and expanding options for additional power generation. These initiatives would require an estimated \$13.3 to \$17.3 billion in capital investments between 2008 and 2020 for implementing programs in all energy sectors. Unfortunately, Jordan's BB+ credit rating (brought on in part by its expanding energy debt) makes foreign investment very difficult, if not impossible, to obtain.

Among Jordan's National Energy Strategy goals are the provision of seven percent of power generation from renewable energy resources (solar and wind) by 2015 and ten percent by 2020. Since that time, 63 Expressions of Interest for new renewable energy generating facilities have been submitted. However, to date all of these EOIs are still under review; none have been pursued by MEMR.

The Minister of Energy and Mineral Resources (MEMR) initiated the Energy Efficiency Working Group, consisting of donors, lenders, governmental entities, regulatory agencies, utilities, non-profit organizations, and the private sector. As its main task—and with the support of USAID—a Jordan Energy Efficiency Roadmap was prepared and was subsequently followed by the legislation of the Renewable Energy and Efficiency Law. A National Energy Efficiency Action Plan (NEEAP) is under development to support implementation of the Roadmap and new law. The National Center for Research and Development, with funding by the Euro-Mediterranean Energy Market Integration Project (EU MED-EMIP), is preparing a roadmap for the development of biogas projects in Jordan by 2020.

The GOJ continues to explore the logistics and economic feasibility for a terminal to off-load LNG at the Gulf of Aqaba and a pipeline to transport the fuel to power plants.

Additionally, MEMR is pursuing a deal to build a 1,000 megawatt nuclear power plant, the first such project in the kingdom, however delays have ensued.²

A promising indicator for improvement in the Jordanian energy sector occurred when the temporary Renewable Energy and Energy Efficiency Law (that was approved by the Cabinet in 2010) was made permanent by Parliament in February 2012. MEMR is now preparing by-laws and supportive legislation to implement the law. As specified in the Law, the GOJ will establish the Jordan Energy Efficiency and Renewable Energy Fund (JREEF) through which foreign investors may be able to support RE/EE projects. Although originally designed as an independent, NGO, the Parliament located the fund in MEMR, which has raised some concerns among potential investors and donors. Several donors have indicated that they will wait and see how the rules and regulations for the fund are written before decided whether to commit resources to it.

A summary of the National Energy Strategy, prepared with the support of the World Bank, is shown in Table 1.

USAID Activities to Date

Since the USAID/Jordan energy program was launched, substantial progress has been made. USAID has helped establish the potential for energy efficiency improvements and barriers that must be overcome through:

- assessment of the availability of energy efficient end use products and services in the Jordanian market;
- estimation of end-user electricity savings potential by sector;
- analysis of the disincentives to energy efficiency in existing financial regulation of electricity transmission and distribution companies in Jordan; and
- recommendations for regulatory changes and capacity building to overcome the financial regulatory barriers.

The JEP has also supported capacity building for energy efficiency and renewable energy in the electricity sector of Jordan through partnerships with counterpart organizations in the US.

- The National Electric Power Company (NEPCO) of Jordan is partnered with the US Energy Association (USEA) and Arizona Public Service (APS), a US utility company.
- The Energy Regulatory Commission (ERC) of Jordan entered into an Energy Regulatory Partnership with the National Association of Regulatory Utility Commissioners (NARUC) and member state electricity regulatory commissions.

The program has strengthened capacity in the commercial building sector by supporting and documenting the pre-certification by the US Green Buildings Council of a

² H. Hafidh, Dow News Wire, *Jordan Seen Awarding 1st Nuclear Power Plant Soon*, March 14, 2012.

Leadership in Energy and Environmental Design (LEED) Gold commercial building in Amman.

Finally, the JEP has played a lead role in the activities of the Jordan Donor Committee on Energy Jordan Donor Committee on Energy. USAID has supported the Government of Jordan (GOJ) in developing the Jordan Energy Efficiency Roadmap. The energy program has also collaborated with other USAID programs including energy aspects of the Sustainable Achievement of Business Expansion and Quality (SABEQ) project, the Public Action for Water, Energy, and Environment project, and supporting the Queen Alia Competition for Social Responsibility 2009.

Building a New USAID/Jordan Five-Year Energy Strategy

Despite the collective efforts of the government, donors, private sector, and others, Jordan’s energy sector crisis has gotten worse in the last few years. Since 2008, Jordan has endured the global financial crisis, the end of subsidized oil from Iraq, and the loss of below-market Egyptian natural gas because of repeated terrorist bombings of the pipeline in the Sinai. Jordan imports at least 96 percent of its energy and in 2011 incurred a debt of about \$5 billion³ in fuel cost alone. In addition, the Jordanian response to the “Arab Spring” has been a paralysis in decision-making that has stagnated vitally needed development in the energy sector and the economy as a whole. Finally, Jordan’s national credit rating has fallen to BB+, which makes foreign investment difficult to obtain.

There is no economic development without reliable, affordable energy!

Like all USAID Missions throughout the Middle East, USAID/Jordan is preparing a new five-year energy strategy. This provides an opportunity to support Jordan in the vital area of energy. In order to provide an independent basis for planning a new work program, a consultant team from Winrock International and Energy and Security Group was deployed to Jordan in February 2012 to assess sector status. The team was tasked with preparing recommendations for USAID, drawing upon its “manageable interest” in the energy sector and comparative advantages. The assessment team met with more than 60 individuals from USAID project offices, Government of Jordan Ministries or organizations, foreign donors, investment capital companies, private sector companies/organizations, energy service companies, and Women in Development organizations. A list of these contacts is included as Annex B. The assessment team also reviewed existing documents and other materials relevant to the assessment. A listing of these documents is provided in Annex C.

³ Ibid, Hafidh

Table 1. 2007 Jordan Energy Strategy Summary

1. The Petroleum Sub-sector
– Expand Jordan Petroleum Refining Company’s capacity through involving a strategic partner
– Conduct feasibility analysis of building additional refineries in Jordan
– Diversify crude oil sources
– Liberalize downstream petroleum market
– Upgrade petroleum transportation and storage infrastructure
2. The Electricity Sub-sector
– Implement additional natural gas-based IPPs
– Apply oil shale in electricity generation
– Provide on-going capacity-building of the Electricity Regulatory Commission
3. Natural Gas Procurement and Usage
– Optimize natural gas usage in electricity generation
– Further develop the Risha gas field
– Diversify natural gas sources, including potential sourcing from Saudi Arabia and Iraq
4. Renewable Energy
– Implement a targeted 300 MW wind power IPPs by 2015
– Conduct feasibility analysis of a pilot concentrating solar power project. If promising, implement commercial size projects (100-150 MW) by 2020
– Promote the photovoltaic industry
– Execute a waste to energy project in coordination with the Greater Amman Municipality by 2015
– Investigate the potential of biofuels for the industrial and transport sectors
– Establish the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF)
5. Oil and Gas Exploration
– Execute new production sharing agreements with prospective investors
– Restructure the Natural Resources Authority
6. Energy Efficiency
– Implement the National Energy Efficiency Strategy, focusing on scaling up EE measures, increasing penetration of EE technologies and energy conservation practices, attracting financing of EE investments
7. Oil Shale
– Execute MOUs with prospective investors to explore and commercialize oil shale
– Establish the Center of Excellence for Oil Shale in Jordan

Foreign Investment in Jordan's Energy Sector

Foreign donors are very active in helping the GOJ address the needs for moving forward to solve the current energy crisis. USAID/Jordan has implemented several partnerships and activities that provide input and support to GOJ's initiatives including:

- *Electricity Distribution and Transmission Utilities Partnership*: to promote more efficient, sustainable, and environmentally sound supply and use of energy through transferring market-based approaches and "best practices" for energy system operation;
- *Electricity Regulatory Commissions (ERC) Partnership*: between Jordan's ERC and Colorado Public Utilities Commission, which trains, shares experience, and cooperates with the ERC to strengthen the capacity of the Jordanian regulators, enhance the overall institutional capacity of the ERC, improve its oversight of the electricity market and facilitate the development of a competitive market;
- *Energy Efficiency Incentives Framework*: Assess the possibility of developing an energy efficiency incentive mechanism to encourage fast deployment of energy efficiency measures in the electricity distribution sector, and identify the needed technical assistance support to the ERC and the electricity distribution companies to implement and monitor such a mechanism (Phases I, II, and III);
- *Building Green in Jordan*: Pilot the Green Energy Efficient Building concept, develop replicable models for implementing energy efficiency audits to reduce energy consumption and encourage private sector investment;
- *Support to Queen Alia Competition for Social Responsibility 2009*: Support the preparation of materials to inform the public on energy conservation and renewable energy resources. Support activities including a competition among universities students to design a green building, exhibitions in universities, television and radio spots, an educational cartoon film and song, and an awareness campaign in commercial markets and malls on energy saving devices;
- *Public Action for Water, Energy and Environment project*: Initiates and establishes clear and identifiable behavioral changes amongst the Jordanian public and decision makers in how they address water, solid waste and energy. These behavioral changes must lead to increased efficiency in the use of water and energy, proper solid waste handling practices, and the introduction and adoption of much needed policy changes.

USAID is preparing a Request for Proposal for a capacity building project that comprehensively addresses many of Jordan's energy sector needs by providing a very broad programmatic approach to Jordan's entire energy sector and address ways to meet Jordan's energy and development challenges. The project's main objectives, with which this assessment concurs are a priority, are to:

- Develop incentive mechanisms for the National Electric Power Company (NEPCO) and distribution companies to promote energy efficiency;
- Build the capacity of the GOJ and energy sector partners' staff and institutes;
- Provide laboratory testing equipment for measuring the energy efficiency of building materials and selected electrical appliances and fixtures;

- Review the current state of energy efficiency labeling in Jordan and, where appropriate, develop labels for use with building materials and electrical equipment;
- Develop the workforce in the building and energy sectors with a focus on women and youth;
- Certify energy services companies (ESCOs) and support the creation of energy services association(s) to promote the best use of energy resources in the built environment and to inform members about training opportunities and certifications.

Other foreign donors have also funded specific activities in support of GOJ initiatives. For example, under the Global Environment Facility program, the UNDP has sponsored a standards and labeling project for several major types of equipment and a washing machine testing laboratory. The World Bank International Finance Corporation has funded studies on feed-in tariffs, bylaws, grid capacity/smart grid, wind farm IPPs, etc. France has funded programs in street lighting and is considering loans to finance EE/RE projects under specified criteria. Germany's Development Cooperation Program GIZ is working to promote energy efficiency, including support of several energy efficient water pumps. KfW is proposing to provide financing and technical assistance to the GOJ to implement energy efficiency improvements in public buildings. Also, the EU has initiated grants for energy sector budget support and funded many capacity building projects.

The Jordan Energy Sector and Economic Development Challenges

Jordan imports 96 percent of its oil and gas at global market prices while striving to expand energy services to keep its economy growing. The current energy situation is critical and is causing a severe debt crisis. Until recently Jordan purchased below-market price natural gas from Egypt. Jordan's dependence on Egyptian natural gas and its unreliable supply since February of 2011 are a major cause for a reduction in Jordan's economic growth. The pipeline from Egypt was damaged in the Sinai Peninsula 13 times since February 2011, each time resulting in significant outages. Because 80 percent of Jordan's electricity has been generated from natural gas, Jordan has had to substitute diesel or heavy fuel oil that it obtains at market prices from Saudi Arabia on an emergency basis.

To maintain consumer electric rates at current levels the government is forcing NEPCO to pay subsidies, which currently run between JD 3.5 and JD 5 million (\$4.9 to \$7 million) per interruption day. The subsidies are the costs that NEPCO must pay independent power producers for the difference in cost for diesel and heavy fuel oil, as natural gas is not available.⁴ This has depleted NEPCO's capital account and driven it into technical bankruptcy. In addition, the new regime in Egypt wants to raise natural gas prices to world market levels. Hence, even if disruptions of the pipeline could be prevented, Jordan would still be in a position where retail tariffs for electricity do not meet generation, transportation, and distribution costs.

Also, the Iraqi oil that had previously been supplied at below-market prices now has to be purchased at market prices. As a result of these changes, in 2011 the fuel import bill for Jordan was JD 3.46 billion (\$4.95 billion). The outlook for 2012 looks even worse. This dependence on imports has assumed immense political and economic importance now that international market prices for petroleum are a reality. In response, the GOJ will begin raising the price of electricity in April. These prices will be significantly higher than prices faced by Jordanian consumers in the recent past. Consequently, Jordan faces an energy sector crisis that threatens to provoke social, economic, and political instability if not addressed immediately.

The assessment team identified a wide range of energy sector problems throughout the government, NGO, private sector, and public sector communities. Each stakeholder group problems are discussed below together with possible interventions to solve the problems.

Government, Quasi-government, and Non-Government Initiatives

In order for the government to effectively implement energy sector policies and programs, procedural, institutional, and technical capacity deficiencies must be addressed in a range of organizations within and outside government. The broad energy strategy,

⁴ Jordan Times, December 21, 2011.

in place since 2007, has been unevenly implemented, and for EE and RE portions, hardly implemented at all. Policies and broad program directions can only be effectively implemented if the supporting institutions, such as the Energy Regulatory Commission (ERC), the Jordan Standards and Metrology Organization (JSMO), the National Building Council (JNBC), the National Energy Research Center (NERC) among others in government can bring to bear the necessary technical and institutional capacity to design, communicate, coordinate, enforce, and monitor progress towards goals. This requires clear procedures for decision-making, roles and responsibilities for technical institutions, allocation of sufficient resources, and development of appropriate capacity.

Procedures for rule-making and other decisions must be transparent, open, and accessible to civil society organizations and the public. Special procedures are needed to expedite decisions on energy pricing, and RE and EE projects because they are difficult and urgently needed. The GOJ is on record with instructions to all government bodies requiring public notice and comment periods to increase consultation in the formulation of proposed legislation and draft regulations. Yet in late February 2012, the Electricity Regulatory Commission announced a major increase in electricity tariffs with very little initial discussion, causing a major public and media backlash suggesting that effective public consultation or discussion had not occurred prior to the decision. Those reactions may ultimately be far more costly in both time and government credibility.

To resolve the current problems of the energy sector, actions are needed at the implementation levels to ensure that:

- Capacity is enhanced in technical bureaus of government ministries and supporting organizations as well as in non-profit scientific and technical support organizations;
- Authority, accountability, resources, and capacity are established to ensure that markets for energy related products and services for end-use consumers are well regulated and stimulated to promote rapid growth in EE and RE products and services;
- Procedures for rule-making and other decisions are established and applied consistently to ensure involvement of relevant technical institutions, stakeholders, and civil society organizations;
- Support is provided to stakeholders and civil society organizations to ensure that they have the capacity to understand and engage constructively in energy rule-making and implementation; and
- Where needed, information must be developed and provided to all parties to allow for a common basis for discussions and implementation of energy policies and programs.

Governments in Jordan do not generally remain in power for more than a few years. Prime Ministers have an average tenure of two years; Ministers an average of 11 months. There is a lack of consistency in the implementation of policies, poor communication among government agencies, lack of transparency and public engagement in decision-making and weak enforcement of existing laws, regulations, rules, and codes. These factors, combined with political pressures of the Arab Spring in surrounding countries,

have resulted in a sort of "decision paralysis" adversely affecting the implementation of energy policies and programs.

To combat these problems, the MEMR should create a steering committee, to include the Ministry of Planning, responsible for developing (and ensuring compliance with) implementation plans, schedules, and budgets. This committee would guarantee continuity in government policies and predictability to potential investors.

There is a need for training on the legal complexities of public-private partnerships in the country. In particular, training and technical assistance is required by the legal community on PPPs, IPPs, and other contracts between the GOJ and private parties.

To promote energy security, Jordan needs to establish additional external sources of electricity. Currently Jordan has only one international electricity interconnection with Syria, and it is used infrequently. Jordan plans to expand its high voltage transmission system (400 kilovolt system) to accommodate larger size international connections. In addition, the GOJ needs to promote regional and international interconnection for electricity exchanges with neighboring countries. Regional interconnection and harmonization of electrical transmission systems would benefit all countries in the region by providing additional sources of electricity in case of specific shortages. This would increase supply reliability in each of the affected countries because of larger, more technically diversified systems. It is also cheaper for Jordan to build electric power lines than oil and gas supply pipelines, i.e., it is cheaper to import electricity than to import fuels for in-country power generation.

MEMR is understaffed, unsure of which policies to implement, and lacks technical capacity for sound decision-making. Under the SABEQ project, USAID previously provided MEMR an in-house consultant for a period of nine months. This model should be reinstated and extended over a longer period of time. A consultant can provide advice on policy issues, assist with the review of laws, by-laws, regulations and rules, provide international best practices input, and provide in-house impromptu training.

MEMR's EE and RE departments are very understaffed. In May 2011, MEMR called for investors to submit expressions of interest (EOIs) for installing 1,800 MWs of renewable energy plants. EOIs were due by June 30, 2011 and the agency received 63 responses. To date interested parties have not received a response and are reportedly losing interest⁵. The department lacks technical expertise to review proposals in a timely fashion. The ministry needs short-term technical assistance. Direct training should be provided to RE and EE staff in the implementation of projects, but only if the ministry is able to hire additional competent staff. It would also be useful to explore ways in which the EE and RE departments could utilize specialized consultants or contractors to assist in project review. While half of the MEMR department directors are women, there is also an opportunity to employ additional university trained female engineers.

⁵ Renewable Energy in Jordan, February 2012.

The GOJ has recognized that it does not have the financial resources to provide infrastructure and other services traditionally provided by governments to its people. In other countries, governments have allowed the private sector to provide these services on its behalf by creating PPPs. The GOJ has identified the Ministry of Finance as the agency to host a PPP Unit but as yet has not established the office. Locating the PPP Unit in the Ministry of Finance is appropriate because any sovereign guarantees will affect the country's budget and sovereign credit rating. Jordan understands that PPP arrangements are financial transactions unlike other procurement actions. In most PPP transactions, the host government is asked to provide guarantees, e.g., bring sufficient revenue to the project for it to be able to pay for ongoing operations, be able to repay loans, recapture investment, and provide a risk adjusted profit to the investors. Jordan is new to the PPPs concept and requires administrative and technical assistance to prepare the rules and regulations according to international best practices.

Jordan has successfully implemented two IPPs, a project with a Korean firm and the AES Corporation-developed Amman East Project. While this was a significant accomplishment, closer examination reveals that future investors may not be willing to accept all the risks that the developers agreed to in these first projects, because they would have an uncertain outcome if tested under Jordanian law. If Jordan cannot attract private investment into its energy sector by addressing outstanding legal issues, it will be difficult to alleviate the current energy crisis and to initiate positive economic growth.

Technical capacity needs strengthening in key government and non-profit institutions to support by-laws and regulations and design and carry out effective implementation – especially EE/RE. In most countries, government or quasi-governmental technical institutions provide a major source of continuity and institutional memory in design and implementation of energy sector programs. This is particularly true for renewable energy and energy efficiency initiatives. In fact, most countries that have successful EE and RE programs also have dedicated technical/research centers, laboratories, other institutions, and private firms and individual experts that support the relevant ministries and other government authorities. For example in the United States, critical support is provided to the U.S. Department of Energy and other energy agencies through the national laboratories such as the National Renewable Energy Laboratory and the Lawrence Berkeley National Laboratory, and through private contractors. These institutions provide much of the technical expertise needed to draft regulations and design programs, but also to coordinate day-to-day implementation of many programs. Jordan has many high quality governmental, quasi-governmental, and non-profit technical institutions that could currently support technical decisions and implementation of policies and programs in the energy sector. These organizations need to expand staff and upgrade capabilities in several specific areas in order to support effective new programs in the energy sector, particularly energy efficiency and renewable energy.

Several other organizations in Jordan need enhanced technical capacity to play important roles in the design and implementation of energy sector programs.

The *Electricity Regulatory Commission* has benefited from the USAID-sponsored Electricity Regulatory Commissions Partnership—an exchange program with Colorado Public Utilities Commission—and from significant consultation support funded by the World Bank. Based on this input, the ERC recently reached out to the public and interested stakeholders to solicit comments on the new renewable energy and energy efficiency law. ERC needs to exercise more independence and exert influence over the industry especially in determining appropriate tariffs and conditions for promotion and licensing of renewable energy projects. Foreign donors should coordinate support and encourage an independent and influential ERC, while considering further technical and capacity development support.

The *National Electric Power Company (NEPCO)* is at the center of the energy crisis, and on paper it is bankrupt, only continuing to operate because it is borrowing with sovereign guarantees. Despite this situation, NEPCO appears to be a relatively well-managed public company. However, it is a wholly state-owned company that has been required to accumulate all of the extra debt caused by the disruption of fuel supply. NEPCO has benefitted from the U.S. Energy Association (USEA) partnership supported by USAID as well as by the support of the World Bank, AFD, and other donors, but still needs enhanced capacity to face unprecedented current challenges. Participating donors should coordinate interventions and consider gap-filling capacity enhancements in areas such as:

- Organization and management, e.g., implementation of a balanced score card approach;
- Public communication— educating consumers on the nature of its current situation caused by external forces, and its plans for avoiding such problems in the future; and
- Overcoming technical barriers to expand the use of renewable energy and other domestic resources, and diversify sources and types of energy imports including through continued transmission system improvements to accommodate future new forms of generation, and a change in the geographic distribution of generating capacity within the national grid.

The former *National Energy Research Center (NERC)*, now officially the National Center for Research and Development, Energy Research Program, is generally perceived as a likely organization to play a central coordinating role under MEMR, for major new energy efficiency and renewable energy programs. NERC believes that it will be returned to its original status soon; others questioned whether this would happen. The uncertainty has had a negative effect on the organization, but it still contains significant technical capacity and is being supported and assisted in further development by several other donors including the EU, and UNDP. Capacity development should be supported at NERC, as a premiere technical institution, in coordination with other donors and GOJ partners. Its involvement as a technical resource in energy sector decision-making, and in design and implementation of new EE and RE programs, should be encouraged.

Capacity should also be strengthened in *other government and non-governmental organizations* that support energy sector decision-making and design and implementation of energy efficiency and renewable energy programs. The Jordan Standards and

Metrology Organization (JSMO), the Royal Scientific Society (RSS), EDAMA and its Jordan Energy Chapter of engineers and the Jordan Green Building Council are potential candidates for further support.

Capacity and implementation of programs to ensure that markets for energy technology (EE/RE) and services are well regulated, incentivized, and sustainable should be enhanced. The markets for energy related products and services provided to end-use consumers are poorly regulated in Jordan. Sustainable long-term growth requires development of competitive, commercial markets for these products and services. Initially, these products – efficient lighting and appliances, solar water heating systems, and services – as well as technology installers, energy auditors, energy service providers, greener building design, etc. are unfamiliar to most consumers. Public education is needed for their widespread implementation, often combined initially with financial incentives to stimulate penetration of new products and services. However, it is critical to also regulate the markets to eliminate substandard products and service providers. Cheap products, such as compact fluorescent lights (CFLs) and electronic ballasts are entering the market at lower prices, underselling the established quality products, then failing quickly or performing poorly leading consumers to reject the new technologies completely.

For the desired energy efficiency and renewable energy technologies and services to gain market share, the GOJ and supporting institutions must provide information, promotion, and incentives. At the same time, the organizations must regulate the market to ensure that quality products and qualified companies and personnel are identifiable and accessible, and that substandard and unqualified products/services are discouraged and ultimately eliminated. These initiatives should be supported in several ways, including:

- Encourage the GOJ to enforce laws, regulations, rules, and codes already in place for energy performance, e.g., through policy reform objectives associated with annual cash transfers, and support capacity enhancements in organizations such as the JSMO, the Jordan National Building Council, and others to make this feasible.
- Support the development, promulgation, and enforcement of revised building codes with energy measures such as mandatory SWHs for certain new building types, insulation requirements, passive solar design, and materials and equipment specifications, and others.
- Work with NERC, RSS, JISM, the UNDP/GEF project and others to strengthen capacity and support development and implementation of a robust and effective program of energy performance testing, standards, and labeling for energy related equipment, products and materials.
- Work with the Center for Accreditation and Quality Assurance, MEMR, Ministry of Public Works and Housing (MPWH), NERC, and technical, academic, industry and scientific organizations to support development and implementation of training and certification for technical professionals including, energy auditors, energy managers for major facilities, SWH installers; and certification, listing and monitoring of companies providing energy services including energy savings performance contracting and SWH installation.

- Support, in cooperation with KfW and other donors, the development of capacity in NERC, MEMR, MPWH, Jordan National Building Council, and other partners to design and implement a program of government energy management that will assist and eventually require government organizations to purchase energy efficient products and to install energy efficient and renewable energy technology in its facilities using energy performance contracts. The program should be coordinated with the energy labeling and standards program, and utilize certified technical professionals and energy service companies.
- Support a coordinated consumer education and communication campaign, with partner institutions and other donors that will raise awareness of the importance of energy performance and educate consumers about the labels, certifications, websites, and other tools that can help guide these choices. This could also include materials to be used in schools to reach consumers by raising energy and environmental consciousness of school children.

USAID has already provided some support in these areas through the SABEQ and the PAP and has supported the Jordan Green Building Council and Jordan National Building Council. Support should be greatly expanded in close coordination with other donors.

Ideally, there should be established administrative procedures for decision-making in the energy sector that identify roles for technical institutions within and outside of government, and specify the mechanisms for engaging stakeholders, civil society organizations, and the general public. The development of technical policies, procedures, by-laws, etc., within the MEMR, the ERC, and related organizations, lacks clear and consistent procedures. However, recently ERC has been reaching out to the interested public stakeholders to provide comments prior to final decisions.

Foreign donors should encourage and support the GOJ to improve, institutionalize, and adhere to procedures for rule-making, tariff setting, and other key program implementation decisions in the energy sector. Actions could include:

- Incentives, e.g., as policy reform objectives associated with annual cash transfer programs. In fact, the issue of public consultation in drafting of laws and regulations has been addressed broadly across all government bodies in previous cash transfer policy reform objectives. The current problems in the energy sector are so serious, and so tied to economic growth and effective governance, that specific program objectives for decision-making in the energy sector may be warranted.
- Technical assistance and capacity building for the establishment and implementation of transparent procedures, based on international best practices, that define roles for key technical institutions, systematically incorporate technical information, and engage a range of stakeholders, civil society organizations and the general public.

Support is lacking for the engagement and capacity development of civil society organizations to effectively participate in implementation decisions and to help communicate the nature of problems and necessary solutions to stakeholders and the public at large. There are no solutions for the energy sector crisis that do not involve

significant increases in revenues from consumers. Jordanian public expectations for energy prices have been conditioned by years of external subsidies. The long sequence of international subsidies is now coming to an end, but the general public in Jordan is ill prepared to understand and respond constructively. Foreign donors should work with the GOJ and other partners to proactively engage stakeholders and civil society organizations and strengthen technical capacity to understand the nature of the “energy crisis” in Jordan and the roles that energy efficiency and renewable energy can play in helping solve this. This may involve developing better information such as:

- Clear documentation of the damaging history of subsidies and show how this has led to technology and behavior choices that have made the problems worse.
- A consumer “energy affordability study” to document the burden that energy costs place on various segments of society and types of consumers.
- Information on programs under development to assist consumers in deciding to purchase higher energy efficiency of products and to improve the energy performance of their homes and businesses. The GOJ through the Ministry of Education should be supported to design and implement a major consumer education campaign to explain the current situation, document the reasons for increased costs that consumers must face, and provide a menu of actions and support that consumers can use to adapt to the new energy price realities.

Private Sector Initiatives

A consumer focused demand side management strategy for large consumers of electricity and fuels must be developed. DSM not only reduces the demand for electricity, but will also defer the need to construct new generating capacity and is usually implemented relatively quickly. An effective DSM program will identify large consumers, perform energy audits to identify potential savings, and perform a feasibility study comparing cost of implementation versus savings in the cost of electricity. Reducing commercial/industrial energy consumption would have the macro economic benefit of reducing Jordan's energy density (high cost of energy per unit of GDP output) and make the country more competitive on world markets. In addition to aiding economic growth, reduced energy consumption reduces the amount of fuel burned and thus has a positive effect on climate change.

Electric distribution companies (DISCOs) often do not promote energy efficiency and consumer level renewable energy systems. DISCOs usually do not have an incentive to promote EE and RE with their customers, because it will reduce their sales. This can be changed if DISCOs are allowed to engage in these activities as an unregulated activity run through a separate subsidiary or at a higher regulated rate of return. This would give them the opportunity to make up for lost profits from electricity sales. DISCOs are uniquely qualified to engage in this business, because they already have a relationship with the consumer, can bill for the services through their normal billing and collection methods, and also have the ability to shut off electric supply to non-paying customers. This would beneficially increase their business activities and thus contribute to economic growth and have a positive effect on climate change.

Jordan does not have enough strong local RE or EE industries involved in the manufacturing, assembly, installation, and servicing of RE systems such as solar PV, solar water heaters, and energy efficiency technologies. Foreign donors should effectively support the creation and strengthening of the RE and EE industry by encouraging existing businesses to expand into these markets and create new small and medium businesses specializing in these activities. The previous recommendation for DISCOs (promote installation of PV solar systems, SWHs, and a range of EE measures) is an opportunity for local businesses to cooperate and coordinate with DISCOs who could use them as subcontractors. A condition for such subcontracting should be that the companies and their products are certified as competent and reliable by a trustworthy organization. This is discussed in more detail below, specifically for solar water heaters. This is an opportunity to create vocational training opportunities for women and young unemployed technicians, because installation of these systems would have to take place during daylight hours when only women are at home.

A small- and micro-loan facility would be a great asset to finance household level EE and RE implementation, where savings in electricity expense would pay for the installation loan. Foreign donors could help create a commercially administered revolving credit fund to be administered by DISCOs and qualified energy services companies. Customers who are unable to pay for small solar generating systems and solar water heaters could apply for financing of their systems through the fund and have their payments billed through their DISCO's billing system. Monthly payments should roughly equal the savings the customer will realize by using these systems, and thus should not present an additional financial burden.

In the water sector, consumer invoices show both the full, unsubsidized cost of water supply and the costs actually charged the customer. A similar system is lacking for electricity customers. Because most consumers have no idea of what it really costs to supply them with electricity or water, this measure would help them understand the level of subsidization and sensitize them to future price increases.

Renewable Energy and Energy Efficiency Development Activities

Jordan has the potential to rapidly add significant quantities of RE-based power generation capacity, once current barriers are addressed. Based on already bid or currently planned projects, existing financial commitments to Jordan (e.g., \$112 million from Climate Investment Funds and the Clean Technology Fund for solar generation), and other factors, Jordan could quickly add several hundred megawatts of wind power and solar power generation, with each exceeding 10 percent penetration of the grid (i.e., constituting 10 percent of total generation capacity), with 20 percent penetration by these intermittent RE generation sources and prospects for much greater penetration rates. High penetration rates by intermittent technologies will require sophisticated operation of the power grid to effectively dispatch power and maintain power quality while reducing fossil fuel required for power generation. Better understanding of the interaction of different generation sources and the transmission and dispatch system will be required to

plan the most cost-effective scenarios for RE capacity additions (i.e., which technologies and which plants to implement, and in which order).

Cost-effective planning/selection of RE capacity additions and integration of RE generation with the grid will be enhanced by better access to high quality RE resource data. While there are existing sources of information on solar and wind resources in Jordan, the data is incomplete and not well integrated. For example, although a rough wind resource map was produced during the 1990s, Jordan would be well served by creation of a more detailed wind resource atlas using more advanced techniques developed over the past decade. Jordan also has extensive geothermal resources, primarily low and medium temperature. There is significant potential for increased direct use of low temperature geothermal heat, drawing on recent technology advances.⁶ While we lack sufficient information to determine whether a USAID investment in geothermal resource assessment is warranted, it would be useful to conduct a modest activity to gather existing geothermal resource data, meet with Jordanian geothermal experts, and discuss with Jordanian Government counterparts the merits of pursuing a geothermal resource assessment.

There is an opportunity for collaboration with the Jordanian military to increase the deployment of renewable energy technologies. Through strategic planning of renewable projects, USAID can help strengthen Jordan's national security interests through increased resiliency, reduced dependence upon imported fossil fuels and form key partnerships to promote education.

One of the most straightforward and simple energy demand reduction options for Jordan—after compact fluorescent light bulbs—are solar water heaters for commercial and residential buildings. There is now a law in Jordan that mandates their use for new buildings and they are already in general use in the country, with about 12 percent of homes deploying them. These systems can provide 50 to 75 percent of a family's hot water needs, which accounts for about 20 percent of residential energy use. The technology has been proven for decades and systems are used extensively throughout the region. There are about 200,000 systems in Jordan, but it is clear that there are quality and reliability problems stemming from low quality systems and in some cases poor installation practices.

There are several activities that USAID could support to address these weaknesses, help strengthen the SWH industry, and increase adoption of SWH in existing commercial and residential buildings. The first of these would be TA on SWH testing and certification, based on programs in the U.S. and other countries, in order to address the problem of poor system quality. The second would be TA for design of training and certification programs for SWH installers and system integrators. The third would be TA in the development of incentive and financing programs. In order to be effective, it would be essential that incentives and favorable financing are only made available for SWH

⁶ Due to recent advances in binary geothermal systems using organic rankine cycle or kalina cycle technologies, it is now possible to generate geothermal power—baseload power—using medium temperature geothermal resources of 85c to 150c.

systems that are certified (i.e., meet quality standards) and which are installed by certified installers.

Air conditioning/space cooling is a major load, particularly in warmer months. This may be an area where focused information activities and TA can support introduction of technology options for reducing cooling loads and shifting some cooling loads to off-peak periods. Options that USAID could help explore include: 1) evaporative cooling—that can reduce energy for cooling by 70 percent and that are most suitable in arid regions such as Jordan; 2) thermal energy (cold) storage for commercial buildings (i.e. freezing water during off-peak periods), to reduce daytime and evening energy requirements; 3) geothermal heat pumps; and 4) RE thermal-based cooling options, including solar thermal and geothermal low temperature systems.

Communication and capacity building among energy sector stakeholders (government, NGO, private sector, and institutional) are two key needs identified during this assessment. The USAID/Jordan Energy Office initiative that established the Jordan Donor Committee on Energy was praised by all the donors interviewed. Similar efforts should be initiated wherever possible with all Jordanian public institutions, NGOs, and private sector companies to increase communication and maximize leverage of energy sector funding.

Vocational programs through NGOs and existing community organizations needs to be expanded. Jordanian universities are producing many well educated citizens in fields related to jobs in the energy sector. Jordan has more engineers per capita than any of its neighboring countries. However, Jordan has a significant “brain drain” as many of its college graduates leave to work in other countries and send earnings home. In fact one of Jordan’s largest gross domestic product items is repatriated income from abroad. At the same time, Jordan’s unemployment is high while foreign workers immigrate to the country for jobs. This appears to be a “cultural” issue where many Jordanians refuse to do the lower-paid, less prestigious jobs that are available. Private sector companies and ESCOs interviewed expressed a need for skilled installers of solar water heaters and energy efficiency equipment and materials. Vocational programs specifically designed to train such skilled workers offers a promising initiative for Jordan with its high unemployment, young population, and lack of women in the labor force.

A key activity required to prioritize renewable energy development in Jordan is the development of a comprehensive strategy that examines technical, financial, capacity, organizational, management, integration and other key barriers and opportunities for advancement of these technologies in the country’s power sector.

Opportunities for small loans to finance EE and RE installations are lacking. A meeting was held with the EBRD facility manager who was on a first “fact finding mission” to Jordan to assess the potential for the bank to establish a renewable energy and energy efficiency credit line to local banks for small loans to consumers. EBRD has similar

credit lines in many countries in the region—Bulgaria, Serbia, Georgia, and Kazakhstan. They are well managed, well received, and provide beneficial incentives to implement energy sector projects. As one initiative under the credit line, EBRD is considering small loans for solar water heaters that would be a significant incentive for system installations that under the recently revised national building code are now required on all new, large buildings in the country. Support for this effort is encouraged to leverage other foreign donor initiatives.

Recommendations for USAID Intervention

To identify and prioritize possible interventions for USAID, the assessment team used the following criteria to sort through the list of possible interventions to mitigate the problems identified in the previous section:

- *Is the activity consistent with USAID's comparative advantage?*
The energy sector in Jordan has the support of several foreign donors. USAID can work with them to capitalize on its flexibility to work with multiple stakeholders to improve institutional capacity and develop concrete projects to leverage additional financing.
- *Does the activity directly or indirectly address energy security in Jordan?*
This is a top priority for Jordan. The current lack of diversity in energy supply is severely constraining economic growth and threatens to provoke social, economic, and political unrest if left unaddressed.
- *Can activity objectives be achieved without significant government or third-party action outside the manageable interest of USAID programming?*
Without a sustainable and affordable energy supply, significant economic development in Jordan is not possible. Jordan's energy/fuel supply situation is critical and must be immediately addressed if the Jordanian economy is to recover to its past levels. Addressing all four of the assistance themes (energy efficiency, regulatory reform, public-private partnerships, and access to credit) identified in the 2008 USAID assessment is more critical now than ever to help solve Jordan's current energy crisis. In addition, with the uncertainty and high cost of fuel for electricity power generation, the use of indigenous energy resources is now equally critical for Jordan.

This report identified 29 items for USAID to consider. Twenty are considered as high-priority for immediate implementation and nine are considered of "medium" priority. Table ES-1 in the Executive Summary lists these interventions.

Annex A: Synergies with USAID Forward

In alignment with the new *USAID Forward* policy, the assessment team explored options to recommend high-priority activities to create the conditions whereby, one day, aid will no longer be necessary to Jordan. The recommendations focus on strengthening local actors and institutions that are ultimately responsible for transforming Jordan's energy sector. The recommendations outlined below are intended to illustrate activities that should increase the impact of USAID's foreign assistance efforts in accordance with the strategic guidance of President Obama and Secretary Clinton, as well as the principles of the Paris Declaration on Aid Effectiveness and the Accra Agenda for Action. The recommendations provide guidance on how USAID can enhance competition, build local leadership and capacity, and achieve greater long term sustainable impact in a cost effective manner. Open and frequent communication across stakeholders is encouraged to create the best possible result.

- **Grants to more local partners**
 - Work through the Jordan Green Building Council to build increased awareness around energy efficiency opportunities, on educational outreach for the construction industry on passive energy saving systems, and to develop a consumer-focused "Best Management Practices Guide" for large energy consumers.
 - Work with a targeted local partner to develop a coordination council convening regularly (monthly or quarterly) to enhance energy sector stakeholder outreach and communication.
 - Support the development of an ESCO association to promote energy demand reduction to all customers through workshops, training, and case studies. Sponsor a rigorous accreditation program for ESCOs and energy efficiency contractors and establish industry standards and best practices through an accreditation program.
- **Use Host Country Systems**
 - Build technical capacity at NERC and the ERC to improve the continuity and sustainability of RE/EE initiatives in Jordan. Support the development of sound policies, enforcement of laws, regulations and RE/EE codes.
 - Support Royal Scientific Society Testing Laboratories for testing and labeling energy efficient appliances such as refrigerators, freezers, and air conditioners.
 - Support youth school clubs focusing on energy, water, and environment to create environmentally aware communities from a young age. Build upon clubs to develop vocational training schools and create a green economy culture and jobs for youth.
- **Monitoring Performance/Evaluation**
 - Build capacity to collect baseline energy data. Sectoral energy baselines and modeled projections can influence decision-making and should inform the development of comprehensive carbon management action plans to reduce emissions and add value to Nationally Appropriate Mitigation Actions.

- Consistent, adequate, and quality data will provide Jordan with evidenced-based performance information to communicate results.
- Support the development of training and certification programs for suppliers and installers of EE and RE systems.
- **Build Scientific and Technological Capacity**
 - Provide technical assistance to enhance capacity on energy sector strategic analysis and planning, conducting quantitative cost-benefit analysis of various energy policy options and their impacts and implications on economic development, energy sector development, and GHG emissions.
 - Support RE and EE workshops and environmentally conscious train the trainer activities, and facilitate coordination of cooperative research between the University of Jordan, Jordan University of Science and Technology, and other public Jordanian universities.

Annex B: List of Contacts, Jordan, February 12-29, 2012

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Annex C: List of Reference Documents

- Activity Approval Memorandum for Jordan Energy Program, dated November 2008.
- Energy Sector Portfolio Review, December 2011.
- Jordan Energy Efficiency Roadmap.
- Temporary Law on Renewable Energy and Energy Efficiency.
- Jordan Energy Strategy (as updated in 2007).
- Energy Efficiency Framework for Jordan, May 2009.
- Urban Energy Services Program - Sustainable Municipal Energy Services
 - Electric Demand-Side Efficiency Potential in Jordan through 2022, USAID, February 2011
 - Energy Efficiency Incentive Mechanism for Jordan, August 2010
 - Proposed Energy Efficiency Incentive Mechanism for Jordan's Electricity Sector, USAID, November 2010
 - Technical Assistance Needs for the Energy Efficiency Incentive Mechanism for Jordan, USAID, August 2010
 - Supply Side Assessment of the Energy Efficiency Market in Jordan, USAID, August 2010
 - Green Buildings and LEED Initiative Core Study, October 2010.
- The Nexus Between Energy Sector Reform and Democracy & Governance, USAID, March 2005.
- Energy Prospects for Jordan: Markets, Technologies, and Political Considerations, prepared by Master in Public Policy Candidates at the Harvard Kennedy School of Government in 2011, and based upon a series of interviews conducted in Jordan, Syria, and with senior government officials, private sector investors, experts, and civil society leaders.
- UNFCCC Second National Communications— Jordan.
- Status of Jordan Renewable Energy Sector: Problems, Needs and Challenges (2002).
- USAID/PAP Survey for NGOs' Youth Programs.
- Survey Finding of Young People's Knowledge Attitudes & Behaviors: Gaps in Environmental Education Curricula and Teachers' Competencies. Formal Sector. Final Report.
- Energy Analysis of Jordan's Urban Residential Sector.
- Energy Analysis of Jordan's Rural Residential Sector.
- Technical Assistance Needs for the Energy Efficiency Incentive Mechanism for Jordan.
- Energy Efficiency Incentive Mechanism for Jordan.
- Impact of the Removal of the Fuel Subsidies on the Manufacturing Industry in Jordan.
- USAID/Jordan Country Gender Analysis and Assessment Report.
- USAID/Jordan Strategic Statement—2007 to 2011.
- Electric Demand-Side Efficiency Potential in Jordan through 2022.
- Energy Efficiency Framework for Jordan.
- Green Buildings and LEED Initiative Case Study in Jordan.
- Supply Side Assessment of the Energy Efficiency Market in Jordan.

- Jordan Energy Assessment and Recommendations for the USAID/Jordan Energy Program.
- Draft Energy Sector Capacity Building Statement of Work, located at <https://www.fbo.gov/index?s=opportunity&mode=form&id=18910ac7db3466a6d737887c44510eab&ab=core&cvview=0>

Annex D: Team Meeting Summaries

USAID/Jordan: Sunday, 12 February 2012

Meeting with: *Cheryl Jennings, Director, Energy Office*
Ramzi Sabella, Project Management Specialist, Energy Office

USAID staff provided comments on the draft Workplan. They were minimal and basically cleared up some changes made to the previously mentioned organizations. USAID staff emphasized that we need to assess ‘women in development/gender’ issues and ‘democracy and governance’ in all our meetings and data gathering, and consider ways to apply USAID Forward directives.

We reviewed the documents that USAID had listed in the TOR. The following documents were identified as priorities for our review:

- *Energy Sector Portfolio Review*, December 2011 (A partial copy was provided, with internal budget and management information removed)
- Jordan Energy Efficiency Roadmap
- *Energy Efficiency Framework for Jordan*, May 2009: (WB/Nexant document)
 - *Urban Energy Services Program - Sustainable Municipal Energy Services*
 - *Electric Demand-Side Efficiency Potential in Jordan through 2022*, USAID, February 2011
 - *Energy Efficiency Incentive Mechanism for Jordan*, August 2010
 - *Proposed Energy Efficiency Incentive Mechanism for Jordan’s Electricity Sector*, USAID, November 2010
 - *Technical Assistance Needs for the Energy Efficiency Incentive Mechanism for Jordan*, USAID, August 2010
 - *Supply Side Assessment of the Energy Efficiency Market in Jordan*, USAID, August 2010
- *The Nexus Between Energy Sector Reform and Democracy & Governance*, USAID, March 2005
- Nexant Study for NEPCO on integrating renewables into the grid (obtained from NEPCO)
- *Energy Prospects for Jordan: Markets, Technologies, and Political Considerations*, prepared by Master in Public Policy Candidates at the Harvard Kennedy School of Government in 2011, and based upon a series of interviews conducted in Jordan, Syria, with senior government officials, private sector investors, experts, and civil society leaders
- Temporary Law on Renewable Energy and Energy Efficiency (The law was made

permanent by the Jordanian Parliament 10-days ago. It will be published in the Gazette and translated into English after being signed by the King. We reviewed the “Temporary Law”)

The Law establishes the **Jordanian Renewable Energy and Energy Efficiency Fund (JREEF)**. USAID supported the autonomous structure included in the “Temporary Law”. USAID was informed that this provision was changed in Parliament before passage of the “Permanent Law,” placing the fund within the MEMR and under control of a committee chaired by MEMR Secretary General, with two private sector members, and representatives of other Ministries. USAID has advised MEMR that it would be very difficult for USAID and potentially other donors to contribute to such a fund because it lacked independence and autonomy.

USAID/Jordan Energy Office has been established for about 1.5 years with Cheryl Jennings as its Director. Previously energy was a high priority in the USAID/Jordan Mission, but progress has been slowed because of government priorities in the wake of the “Arab Spring,” and steady change of Ministers (the average term of a Minister in Jordan is 11 months). USAID staff noted GOJ interest in development of oil shale, nuclear power and construction of an LNG terminal at Aqaba, but do not see these as likely areas for the Energy Office to allocate resources.

The team was asked to consider and comment on the possibilities of work at the community level as well as the country level. USAID staff discussed the suggested informal Jordan Energy Donor Committee and identified the other potential members. The team was invited to send one representative to the EDAMA “Power Breakfast” meeting on Wednesday. (**see attached agenda**).

Cheryl scheduled a ‘courtesy meeting’ with the Mission Director and Deputy Mission Director for Wednesday, 15 February at 4PM.

The first ‘interim briefing’ for the Energy Office was scheduled for Sunday, 19 February 2012 at 10AM.

The ‘Outbriefing’ was scheduled at USAID/Jordan on 29 February at 10AM.

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Ministry of Energy and Mineral Resources, Monday, 13 February, 2012

Meeting with: *Mohammed Dabbas, Director of Energy Efficiency and Energy Conservation Department*

Mohammed gave us a brief description of the goal for energy efficiency and energy conservation (EC) in the national strategy and other aspects of the current energy situation in Jordan:

- Energy efficiency goal is a 1 percent reduction in electricity demand for each of the next 10 years. The goal for overall energy reduction is 20 percent by 2020;
- Electricity tariff increase from 1 fils/kWh to 4 fils/kWh for consumers using >600 kWh/month. The tariff increase is designed to compensate NEPCO for increased cost of fuel due to disruption of Natural Gas pipeline from Egypt;
- The goals of the national strategy were reasonable and achievable for energy conservation.

Mohammed indicated support for the upcoming USAID project for Energy Sector Capacity Building. He identified some needs:

- Support for a Public Awareness (PA) Program. The Cabinet asked for a PA Plan and Mohammed requested \$70,000 to \$75,000 from the Ministry of Planning to make 2-3 minute educational TV spots;
- A program for training students in schools. He said that his department had done some and that a ‘training’ CD was made. More is needed;
- Need for technical assistance, especially if provided through local experts.



European Union, Monday, 13 February, 2012

Meeting with: *Omar Abu-Eid, Program Manager – Environment and Energy, Delegation of the European Union to the Hashemite Kingdom of Jordan*

Jordan was the one of the first Mediterranean countries to sign an Association Agreement with the European Commission (EC). A plan for development assistance was developed for 2007-2013 and sub-divided into two plans ‘2007-2010’ and ‘2011-2013’. The current plan has four areas of support: democracy and human rights, investment and economic growth, sustainable development (energy, water, environment, youth, health, etc.), and support of ‘action plans’.

Jordan is considered a part of the ‘Mediterranean Region’ by the EU. In 2007, Jordan signed a joint declaration with the EC to continue as part of the European energy group network, develop green sources of energy, and work on nuclear safety and security issues.

Support for renewable energy and energy efficiency has included:

- Support of the Renewable Energy and Energy Efficiency Department (MEMR), started with 800,000 Euros in 2007. In 2009 they received funding of 10 million euros for projects in wind energy and solar PV and energy efficiency;
- Support to the National Energy Research Center (NERC – now Energy Research Program of the National Center for Research and Development) including a twinning agreement with the Center for Renewable Energy Sources and Saving (CRES) in Greece;

- In 2011 funding of 35 million Euros allocated for “sector budget support” provided as grants through 2014. The sector budget support agreement includes objectives, schedules, measures of merit, and results monitoring. Jordan has flexibility in how the funds are spent, and is evaluated only on the results achieved. Budget indicators are scored by a third-party verification contractor prior to the release of the next tranche of funds. Proposals require a clear strategy and measures for reform of the energy sector;
 - Current plans include support for energy efficiency in buildings--a guarantee fund--with the new Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) for EE and RE project financing, upgrades to the electricity transmission grid, partnerships on green energy education, and vocational training and certification of energy professionals (e.g., energy auditors). Grant funds can be used to support the hiring of 5-6 new staff.
- The EU also supports Jordan through regional programs dealing with a range of issues in the energy sector including
 - 1) MED-REG, cooperation among regulatory officials;
 - 2) EAMGM, looking at harmonizing systems, harmonizing gas transmission systems with the Arab pipeline regarding possible future interconnection with the EU network;
 - 3) MED-ENEC Energy Efficiency and Solar Energy in the Construction Sector; and
 - 4) MED-EMIP Energy Cooperation, energy policy dialogue and exchange of experiences, leading to enhanced euro-Med cooperation, integration of the energy markets and improved security, including sharing the oil shale experience in Estonia with Jordan initiatives.

Omar noted that Jordan was the region’s “solar leader” in the 1980s. Now the leaders are Tunisia and Israel. He believes that the institutional and financial capacity in the Ministry to manage these grants is low and that there is a lack of staff. In general, policy and project documentation are well defined but project implementation has been lacking.

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United Nations Development Program, Tuesday, 14 February, 2012

Meeting with: *Mohammed Alatoom, Environment Programme Associate*
Mohammed Maaytah, National Project Manager, Energy Efficiency Labeling & Standards
Robert Kelly, Regional Technical Advisor, Climate Change Mitigation (based in Bratislava)

Robert Kelly of the UNDP Regional Office in Bratislava stated that his climate change portfolio had 20 GEF projects across the Arab states; one related to climate change mitigation is in Jordan.

The GEF project for appliances objective is to reduce GHG by promoting greater penetration of energy efficient appliances in Jordan. It has the following objectives:

- Development of EE standards and labels;
- Development of improved market strategies for EE appliances;
- Support for manufacturers for enhanced EE for four appliances – A/C, refrigerators, freezers, and washing machines;
- Support a testing laboratories for washing machine testing at the Royal Scientific Society;
- Develop ANSI-type laws for testing of appliances– the law is currently in Parliament.

UNDP expects that USAID will support three other measurement laboratories for air conditioners, refrigerators, and freezers. There is a great need for coordination of public awareness activities. Mohammad Maaytah, National Project Manager for the UNDP/GEF project indicated that his project had agreed to develop its public awareness program through the USAID-funded Public Action for Water, Energy and Environment project.

The GOJ has stated that it intends to adopt EU standards for EE appliances.

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Meeting with Electricity Regulatory Commission, Tuesday, 14 February, 2012

Meeting with: *Ahmad Hiasat, Chair and CEO*

The Chair/CEO has been in this office for less than one year. From 2006 – 2010, he was the Chair/CEO of the telecomm regulatory commission. In 2011 the natural gas supply was on 78 million cubic feet/day instead of the expected 200 mcf/day. This caused a loss of \$1.4 billion to NEPCO. NEPCO has to pay for any increase in fuel price to IPPs. In 2012, NEPCO will lose another \$1 billion if the natural gas supply is below 100 million cubic feet/day. NEPCO borrowing--with sovereign guarantees provided by the GOJ--to cover these losses.

Tariffs are being raised for high-energy customers to pay allow NEPCO to pay off the debt. Last July tariffs were raised high-energy customers using over 750 kWh/mo. In February 2012 tariffs are raised again and now apply to customers using over 600 kWh/mo. The ERC estimates that 92% of households use less that 600 kWh/mo and will not be affected. The increased revenues are expected to be sufficient to retire the existing NEPCO debt in 6 years.

Chair Hiasat believes the country needs to find alternatives to Egyptian gas. A priority is constructing a terminal for Liquefied Natural Gas LNG in Aqaba and importing LNG from Qatar as LPG from Iraq. He also believes that the current goals for RE power generation are too low.

Chair Hiasat was cautious on use of oil shale. He said the technology was not proven and that the Jordanian oil shale deposits have not been seriously looked at because of cheap Egyptian natural gas. That has all changed now, and talks with Estonia are underway to

test direct burn technology on Jordanian oil shale. He said that the Estonian proposal was expensive.

He thought that USAID could help draft by-laws on EE for the new RE/EE law. The RE/EE law is not specific on who drafts by-laws, either ERC or MEMR. He said that the WB was providing support for RE by-laws and tariff issues but not EE issues.

EDAMA ‘Power Breakfast’ Meeting, Wednesday, 15 February 2012

ENDAMA is a private sector association of companies that are involved with RE/EE issues. The presentations provided some insight into issues in Jordan:

- No stability in Ministries. New Ministers (which change on average change about every 11 months) each have their own agenda. Minister Khaled Irani was good for RE/EE. The next Minister Khaled Toukan was “nuclear oriented”. Statement was made that, “2020 will come and Jordan will still be in the same place as now”;
- The “key to success” is to work both the “top” (donors and investors) and the “bottom” (private sector) with strong support for the “middle” (government policy);
- Regulators need to allow utilities to recover losses from EE programs over time, i.e., decouple sales of kWhs from ‘return on investment’. Regulators must take an active role in determining what goes into the rate base, i.e., the design of a tariff structure;
- Many investors come to Jordan because of the large opportunities for solar and EE projects but then leave because of many obstacles. Perhaps the new RE/EE law will alleviate their concerns.

EDCO Electric Distribution Company, Wednesday, February 15, 2012

Meeting with: *EDCO: Ms. Reem Hamden, Director General Assistant for Regulation and Planning*

General Notes:

- Policy targets for energy conservation and RE were set in the National Energy Strategy of 2007-2020, but have not been followed, particular in regards to RE. There is a lack of capacity at the Ministry to do so;
- Implementation is also hampered with the different agendas of frequently changing ministers;
- The Energy Efficiency Roadmap for implementation was approved by the Prime Minister, but there has been no follow-up;
- Follow-through on policies, proposals and reports is seriously lacking - again because of lack of capacity and/or will;
- The RE and EE Law calls for the Ministry to accept bids/offers for the first 500MW of RE. NEPCO or distribution companies may be required to interconnect and buy

the power without any direct involvement in the negotiations, nor any say as to the location of RE projects. This may result in system bottlenecks. Only after the first 500MW have been allocated by the Ministry will distribution companies have the right to accept proposals;

- EDCO would like to work with the Ministry to distribute low cost CFLs. The Ministry is considering a plan to give CFLs to consumers in exchange for GLS lamps, but does not have the mechanism of reaching retail customers, and so far nothing is happening;
- The EE and RE fund has been incorporated into the EE and RE law, but to date the by-laws have not been completed, even though budget and donor funds have been committed;
- EDCO uses IAFR accounting. A consultant study is underway looking at the benchmarking performance;
- Annual system sales are 2,200 GWh, and they have 1,225 employees = 1.8 employees per GWh;
- EDCO is divided into regions with district offices;
- Meter readers also have the ability to collect cash. Most bills are paid at collection and bank centers.

Gender Issues Discussion;

- Ms. Hamdem is one of 75 women working at headquarters;
- She is at a level just below the General Manager, and does not expect to be able to advance further. She is the highest level women in the organization;
- There are no women at the district office level, mostly in the southern part of Jordan;
- Mentoring for women would help;
- At the major universities, there is a 50/50 ratio between men and women interested in scientific/engineering fields. Female engineers have trouble finding jobs.

Ministry of Energy and Mineral Resources, Wednesday, 15 February, 2012

Meeting with: *Ziad Jibril Sabra, Director of Renewable Energy Department*

- Jordan imported over 96 percent of its energy in 2011 – some sources say 98 percent. Goals are for that number to be 60 percent by 2020. Primary domestic energy sources will be 10 percent RE, 14 percent shale oil, and 6 percent nuclear.
- 13 percent of Jordan households have solar water heaters. That is expected to increase to 30 percent by 2020. Systems for poorer households should be subsidized by the Jordan RE and EE Fund (JREEF).
- Gulf Wars I and II and the war in Lebanon have delayed RE development in Jordan.
- Jordan currently has problems with poor quality light bulbs, solar water heaters, etc. – many are Chinese imports. USAID can provide support with monitoring the certification of suppliers and installers of RE systems and the establishment of a local industry to manufacture small PV systems.

- In Jordan, Laws are approved by the Cabinet, then passed by Parliament, and finally made into law by Royal Decree.
- By-laws to the law require only Cabinet approval.
- Instructions to the by-laws require only ministerial approval.

USAID could assist with capacity building by providing experts (9 months to one year) to help develop “roadmaps,” RE strategy, work with financial models, etc. They should be in-place at the Ministry and be able to answer questions on a daily basis.



USAID/Jordan, Wednesday, 15 February, 2012

Meeting with: *Beth Paige, USAID/Jordan Mission Director*
Douglas Ball, Deputy Mission Director

The meeting consisted of introductions and review of the plan and schedule for the study team.



USAID/Jordan Economic Development Program: Sustainable Achievement of Business Expansion and Quality (SABEQ), Thursday, 16 February 2012

Meeting with: *Laith Al-Qasem, Chief of Party, SABEQ*
Mark McCord, Deputy Chief of Party, Private Sector Pillar Lead, SABEQ

The biggest challenge for Jordan is the “movement of paradigms”. From 1980 to 2003, Jordan got used to oil from Iraq at subsidized prices. Natural gas from Egypt was also plentiful at subsidized prices. That is no longer the case and Jordan must get serious about RE/EE. However, the large up-front capital costs difficult for a cash-strapped government. The IPP model is preferred to mobilize private capital.

There is one manufacturer of PV systems in Jordan – the company Philadelphia Solar.

The SABEQ project started at the end of 2006. It will close in 5-weeks. It was to support job creation, export production, R&D in various technologies (i.e. clean technologies, training for solar water heaters, biomass - landfills, etc.), medical technologies, A&E, ITYT and others. The project established a clean tech ‘incubator’ to help get R&D results in labs (such as the RSS) to commercial products. One result was development of a solar charging station for electric vehicles at the University of Jordan.

SABEQ has worked with the Jordan Investment Board to structure RE investment, commercialize R&D, and structure joint ventures and thus provide a stable ‘location’ for businesses. SABEQ believes that there is an opportunity for USAID to fund small ‘pilot

RE projects', to help GOJ officials understand the benefits of distributed power generation.

SABEQ stressed that intervention should be at the 'technical level' in Ministries not at the 'Ministerial' level.

More information on SABEQ is at: www.sabeq-jordan.org.

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KfW, Thursday, 16 February, 2012

Meeting with: *Bettina Tewinkel, Director, KfW Development Bank, KfW Office Amman;*
Jan Wiegemann, Project Manager, Education and Sustainable Economic
Development, North Africa and Middle East

German development cooperation through both KfW and GIZ has in recent years been focused in the water sector and in education. Current KfW portfolio is 350 million Euros – 80% water and 20% education. They have worked on ‘energy efficiency’ in the context of water pumping by funding the replacement of very inefficient water pumps in cooperation with GIZ.

Through the German Development Ministry’s Climate Facility, KfW, has been able to access funds to work in areas outside of water/education. They have developed a project to finance EE in public buildings with ESCOs as the delivery mechanism, proposing to partner with the Ministry of Public Works and Housing, with cooperation of MEMR and possibly working through the JREEEF. However there was only limited progress in 2011.

The Minister of Planning and International Cooperation has been very supportive of funding for the energy sector, but the GOJ is reluctant to take on any more foreign debt. GOJ capacity for this sort of decision is weak and lines of responsibility are not clear. There is a clear need for streamlining communication as many projects require the attention of a broad range of Ministries.

Investments in Jordan are very time consuming. There are so many questions about energy sector ‘stability’ (e.g. uncertainties with the RE/EE law which was recently made permanent, the establishment of JREEEF, etc.). The decision by the Parliament of Jordan to place the JREEEF within MEMR is causing concerns about its independence and ability to attract donor finance.

MEMR split the RE and EE departments, which was a positive action, but there has been no real movement to date. Frequent changes in MEMR Minister are unsettling. Min. Khalid Irani was good for RE/EE, the next one was ‘pro-nuclear’, and the current one seems to be more ‘open-minded’.

KfW does not on-lend to local banks or to the private sector.

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Greater Amman Municipality, Thursday, 16 February, 2012

Meeting with: *Bashar Haddaden, Director, Special Projects Department*

70 percent of commercial activity in Jordan is in the Amman municipality (2.5 million people in 450,000 households). There has been a great “brain drain” in the Greater Amman Ministry (GAM) in the past 18-months. The previous Mayor of Amman was a true visionary but since his departure, the low pay and deteriorating environment caused many good professionals (both management and technical) to leave. Institutional memory is being lost to the extent that ongoing projects may stop.

The Special Projects Department (four-years old) has completed a PPP for a parking garage. Others, such as a PPP for a convention center, have gone to contract negotiation and then stalled due to the economic downturn. He suggested that USAID could help with programs to increase the public understanding of the benefits of public partnership with the private sector and to complete a ‘stakeholder analysis’ to assess the impact of what is being proposed.

In the energy sector, GAM has instituted the “Amman Green Growth Program,” funded by the WB. The project is to benefit from carbon credits in four sectors – waste, energy, transport, and urban forestry. GAM has two waste-to-energy projects at landfills. One (about 1-2 MW) is in operation and made its first profit in 2011. A project for a new landfill (about 6 MW) has stalled. It is to be a design, build, operate, transfer – BOOT – contract. GAM has a project for 140,000 more efficient street lights that they would like to go to an ESCO. Nothing has happened to date. One year ago a study was completed by the French aid group, AFD, evaluating CFL exchange potential. Low-to-middle income households were interested; higher income households didn’t support it.

GAM has investigated building energy efficiency projects, solar water heaters at the household level, commercial solar water heaters, CFLs, etc. GAM thought that these could be combined into one larger project which might attract investors easier. Distribution companies could be involved.

Another energy sector project that they have considered, but not too seriously, is ‘micro’ wind generation – household size wind turbines. This would require some sort of ‘net-metering’ program and might be expensive.

USAID should consider supporting work with utility companies because they are close to the people (consumers) and the GOJ Ministries. Follow through does not occur, projects are started but not finished or even continued.

At the municipality level, “simplicity is a blessing” – keep initiatives simple and local – prepare local people in advance and keep it informal. Options to prepare consumers include through schools, and possibly enlisting the support of women to contact other women with simple approaches to improving household tasks while saving energy.



Catalyst Private Equity, Sunday, 19 February 2012

Meeting with: *Ennis Rimawi, CEO*

Catalyst is a venture capital fund focused on water and energy technology. They have been approved by OPIC for \$35 million. They invest in SMEs that support larger companies in infrastructure projects. Jordan Pension fund is one of their investors. Catalyst was one of the co-founders of EDAMA. Mr. Rimawi provided the following comments and information:

- “Quick hits/quick wins” projects should be handled by the GOJ differently from longer-term “mega-projects” to enhance efficiency of implementation;
- The Royal Energy Commission waived the import tax on solar energy equipment. However, free VAT was only on solar equipment that is sold, not for leased systems which is a disincentive for ESCOs;
- Loan processes must be streamlined. It takes so long now that savings are lost in the time delay;
- USAID is building desalination plants and schools in Jordan. Why not build solar energy projects?
- There have been too many studies and too many consultants. What Jordan needs now is implementation of projects.

German International Development (GIZ), Sunday, 19 February 2012

Meeting with: *Dieter Rothenberger, Project Director*

GIZ is active mostly in the water sector – the GIZ project office is housed in the Ministry of Water.

- In 2008, 15% of Jordan’s electricity consumption was in the water sector, 35% of the operating cost in the water sector is for electricity, mostly pumping.
- GIZ has completed energy audits of pumping stations looking at technology and also maintenance procedures for energy efficient operation. Completed some “pilot projects” with ESCOs have resulted in a 35% energy savings and a payback of 2-years.
- GIZ has allocated about \$5 million for solar cooling projects that provide chilled water for A/C systems. Next month they hope to start the projects with the Ministry of Environment and the Ministry of Energy as ‘showcase’ projects. The local company Petra Engineering Industries Co. will be the contractor.
- They have looked at energy efficiency in wastewater treatment plants – the second largest consumer of electricity in the water sector.
- Treated wastewater is proposed for cooling of the Jordan nuclear power plant. However, this diverts water that is currently used for irrigation.

- They have considered RE projects in the “highlands”, the region bordering Syria and Iraq, i.e., “Energy farming in the Highlands”. Depletion of groundwater is a significant problem in these areas. They are looking at farmers putting in wind turbines and selling electricity rather than using up groundwater for crops to make a living. This raises the issue of “food vs. energy”. However, nothing has been initiated to date.

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Ministry of Environment, Monday, 20 February 2012

Meeting with: *Raouf Dabbas, Senior Technical Advisor*

Mr. Dabbas has been his position with the Ministry of the Environment for about five years. He came from the CEO position in a local NGO. He provided the following information, comments and insight:

- He was a member of the Inter-Ministerial working group that developed the RE and EE Law and advocated for Article 10– consumers who generate energy as private individuals can sell it to the grid at a good feed-in tariff;
- Jordan has had 11 Prime Ministers in the past 10-years. The GOJ asks the wrong questions. Not “We need energy, how do we get it?” They say “We need nuclear, how do we get it?” Jordan has a 5 million cubic meter per year deficit of water use. Nuclear power plants need 30 million cubic meters/year for cooling. This is not the best option for Jordan;
- Jordan is going backward on RE. To be taken seriously by the international community, Jordan should establish a RE agency just as it has a Nuclear Agency. The current small office in MEMR does not instill confidence in foreign investors that are “banging on the door”. It does not signal that Jordan is not serious about exploring sustainable energy generation;
- Most rural areas in Jordan are “on the grid” but many people cannot afford to pay for the service. In response to requests from rural Bedouin communities, Raouf Dabbas used a previous connection he had with environmental and social activist Bunker Roy in India. Roy has established a “barefoot university” to train poor and often illiterate people from around the world to install and maintain solar PV systems. Roy supported sending two women from Jordan to the university. They returned and have installed operational systems (worth \$20,000) donated by Bunker Roy. Dabbas has asked for \$100,000 from the Ministry of Finance to expand but has been unable to get any money from the GOJ to keep the project going;
- There was a rural electrification fund established in the 1990s with a small surcharge on kWh sold. Now about \$20 million remaining in that fund will be transferred to the JREEF. However, placing the JREEF within the Ministry of Energy is likely to deter potential investors because of concerns of transparency. Many investors will give to NGO funds but not government funds.
- Dabbas helped to initiate an “Eco-cities of the Mediterranean Forum” that had its first meeting at the Dead Sea in 2010. It explored Amman as a “sustainable green city”, with support from DANIDA, USAID, GAM, and the Ministry of the Environment. A

\$40,000 project called “Green Economy for Jordan” was started, but \$100,000 for a ‘Phase II’ has not yet been found by the Ministry of Planning.

- USAID could help Jordan by supporting establishment of a Renewable Energy Authority at the highest levels of the GOJ. Knowledgeable staff could be focused in such an agency and not scattered throughout several Ministries.
- Dabbas chairs an inter-ministerial ‘exemption committee’ to identify energy efficient and renewable energy products that should be exempt from VAT. In 5-years only a few have been approved.

Capital Bank Management, Monday, February 20, 2012

Meeting with: *Bassaem Khalil Al-Salem, Chair, former Minister of Finance*
Capital Bank is the 3rd largest bank in Jordan. It also owns 73% of the National Bank of Iraq and manages it. Capital Bank’s chairman is a former Minister of Finance.

The bank has been participating in clean energy finance through a Euro 40million credit line from AFD, of which the first tranche of Euro 7 Million has been disbursed to Capital Bank. The terms of the loans are: below market interest, normal bank mark-ups, 13 year tenor with a three year grace period. Three projects are being considered, but few details can be provided due to the need for confidentiality during negotiations.

Other points made during the meeting:

- RE project rules and regulations appear to be bankable;
- Project financing can be achieved and has been proved through the financing of the AES and a Korean owned power plants;
- There is a perception problem in that some segments of the public consider any privately developed project to be suspect, possibly corrupt, whereas government controlled projects do not seem to have that stigma;
- Jordanians should pay for the actual cost of their electricity as they did in 2008, after which, with rapidly rising prices, the government instituted subsidies;
- Jordan needs improved governance in the energy sector;
- Convertibility of the JD and foreign currency reserves are not a concern;
- Existing plans, i.e. the 2007 Sector Policy and the RE and EE Law, are good, and with some minor tweaking should be implemented;
- There are enough reports written for the energy sector--what's necessary now is implementation;
- There is a rich free-market tradition in Jordan. Government interference through subsidies is a more recent phenomenon. Subsidies create market distortions.

Meeting with the former COO of Capital Bank at e2e offices

Meeting with: *Ali Hausary, former COO*

Points made:

- The framework for bankable RE project is in place;
- PPAs are with NEPCO, which does not have the financial capacity to guarantee them. Thus, as the 100% owner of the corporatized NEPCO, the GOJ has to back those guarantees. With Jordan having reached its constitutional borrowing limits, the ability of the government to provide such guarantees is questionable;
- As a public corporation, NEPCO can self-finance. However, because the last two years' worth of heavy natural gas and oil subsidization was charged to the company, its net capital is under water, and from an accounting point of view, NEPCO is bankrupt;
- Again, the point was made that the energy sector has enough good reports. USAID should shift focus to implementation.

Electricity Regulatory Commission (ERC), Monday, 20 February 2012

Meeting with: *Wijdan Al Rabadi, Commissioner*

Ms. Al Rabadi provided the following information:

- The ERC is working on some selected by-laws to the RE/EE Law that was made permanent about 10 days ago. Article 9 Section b requires the Commission to issue instructions on allocating the cost of interconnection for a renewable energy facility that connects directly to a distribution network. Article 10 (referred to as “net metering”) requires the Commission to issue instructions regarding sales of power to the grid or distribution networks from small RE facilities and homes that have RE generation systems. Bylaws for other sections are being written by the MEMR. Commissioner Al Rabadi said it will take about one month to get all the necessary approvals for by-laws.
- The electricity tariffs are reviewed every 2-years.
- 14% of Jordan households have solar water heaters. They are trying to reach 20% of the households as part of the 20% reduction in electricity demand across all sectors of the economy by 2020.
- The ERC has conducted some awareness campaigns in schools.
- IPPs sign agreements with NEPCO for capacity additions. Any plant larger than 5MW must obtain a generating license from ERC to operate. The generating license deals with basic safe operating requirements. Power purchase agreements (PPAs) are made with NEPCO, though for early RE projects MEMR may negotiate the agreements. Details of PPAs are not made public.

- USAID could help by funding further awareness campaigns and by providing “lessons learned” from other countries on how to integrate RE into the grid.

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Public Action for Water, Energy and Environment Project (PAP), Monday, 20 February 2012

Meeting with: *Mona Greiser, Deputy COP for Technical Affairs*
Ghassan Naji, Senior Specialist/Energy

The PAP is a 5-year program that started 2-years ago. PAP uses a “behavior change” or “social marketing” approach, not just information dissemination. Their energy focus is at the residential level but water efforts include larger (e.g., commercial, utility) consumers as well. They are primarily involved with end-use by consumers and very little policy change, (e.g., standards and labeling, etc.) is pursued.

USAID requested a 15-year strategy. PAP met with 70 local groups to develop the strategy. They identified a 5-year implementation “communication strategy” to scope out what could be accomplished during the 5-year program. PAP completed 13 background research studies in the first year (see webpage – www.jordanpap.com). They are beginning to project implementation now.

PAP’s \$25 million funding is 75 percent water and solid waste, and 25 percent energy. Metrics have been developed with “customized and omnibus” surveys used to assess project success. They have about \$4.5 - \$6 million for grants to local NGOs and private sector firms. However, grants must use the U.S. approval process which takes a lot of time. 12 grants are in process now. For example, a recent grant of \$1.2 million was recently awarded to the Jordanian Children’s Museum to revamp their energy and water exhibits. PAP has included exhibits on two “PV villages” in rural Jordan to the Children’s Museum. They have asked NGOs to consider starting tours of “green buildings” in Amman. They have also done some work with changing school textbooks for grades 4 and 10.

The following further information was provided:

- A solar water study indicated that 8 liters of water was “wasted” before hot water was received due to plumbing practices that were not in compliance with established legal plumbing codes. Out of 160 homes only 6 were installed properly. A solar water heater costs about 500 JD. About 81,000 new homes are expected to be built in 2012.
- “Social media” is used for information dissemination. They target youth of marriage age because they are large consumers of appliances and homes. Home repairs/modifications and energy/water improvements are highlighted in TV spots.
- PAP has tried to get utility companies to become more “friendly” to consumers. They started with JEPCO but had little success. IDECO (Irbid area) has been more receptive.

- PAP believes that a lot could be done in “strategic communications” with utilities and in training solar installers, plumbers, etc. Try to reach building developers through their associations.
- USAID might help with establishing building codes, energy efficient construction materials, etc.
- PAP has tried to institute intervention in schools with limited success. The Ministry of Education is not very receptive to change. There are 27,000 teachers in the Jordan school system and PAP has worked with only about 200 of them. They have tried to start “environmental clubs” as extracurricular activities with limited success. They suggest that getting an “energy focus” in existing clubs might be a better idea.
- PAP believes that appeals to “national needs” to get people to engage in energy conservation do not work. Most consumers do not believe what the GOJ tells them. Peers and friends and relatives are better sources of information.
- One possible USAID opportunity is to initiate “youth camps” for focused messages about energy efficiency and RE. The National Youth Council puts together summer activities for children that USAID might dovetail with.

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French Development Agency (AFD), Monday, 20 February 2012

Meeting with: *Serge Perrin, Senior Project Officer*
Arthur Honore, Project Manager (Paris, France)

AFD is funding a small pilot project with NERC on energy efficient street lighting. Small pilots have been implemented and NERC is working on a design for a national program.

They have established a loan program with a local bank (Capital Bank). 40 million Euros have been allocated and the first tranche of 10 million has been transferred.

AFD shares the concern about the JREEF being housed within the MEMR. They are waiting to see who the Director of the fund will be, how the approval process will be established, etc. before they commit any funds. They have provided a grant of Euro 1.5 million to support setting up the JREEF.

In EE, AFD is working with MEMR and the Department of Statistics to assemble and improve an EE database that can provide a baseline for tracking progress of future programs.

With the World Bank, AFD has supported a feasibility study by Ernst and Young for a 50MW Concentrated Solar Power (CSP) plant. An internal draft was completed in Dec. 2011 and the final should be available very soon. MEMR will decide about releasing the report.

AFD is also considering financing investments to upgrade energy transmission and distribution systems.

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Economic Growth Office, USAID, Tuesday, 21 February 2012

Meeting with: *Paul Bruning, Director, Economic Growth Office*
Ruba Jaradat, Project Management Specialist

- King Abdulla was in Washington D.C. in January 2012. The U.S. government is now considering a loan guarantee to Jordan. The loan should not be used to pay for current debt but used for loans on long-term infrastructure improvements, like the Aqaba LNG terminal for instance.
- The IMF recently stated that Jordan’s debt would be 66% of GDP by the end of 2012. Parliament put a legal limit of 60% of GDP but has not done anything yet about the overage.
- The Ministry of Finance has said that subsidies for petrol and diesel (but not propane) will end on 1 April 2012. There are no plans for a further increase in electricity rates beyond the latest one on 1 February 2012, but it is likely that further increases will be required.
- After long experience under a targeted subsidy regime, the transition to full cost recovery pricing is difficult and takes time.
- A draft PPP law is in Parliament for approval, but it has stalled in Parliament—the legislation should be taken up again in the next session. USAID is ready to approve funding for a central PPP unit in the Ministry of Finance with satellite units in line ministries such as MEMR.
- The Ministry of Finance should be pushing MEMR to open up the process of power generation contracts.
- The Jordan Renewable Energy and Energy Efficiency may be a means of promoting PPP. It will have funds from the “rural fils” fund and is expected to seek funds from the sale of carbon credits.
- Under the new Jordan Competitiveness Project (JCP) USAID expects to continue work to support clean energy development in Jordan. This could include continued support to EDAMA, the “clean tech” cluster and the Jordan Energy Chapter of engineers.
- The Economic Growth program supported the “Eco-Cities of the Mediterranean Forum” process and felt this was a worthwhile program, but stopped support the mechanism for transferring support ended.

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Economic Section, U.S. Embassy, Tuesday, 21 February 2012

Meeting with: *Joyce Wong, Economic Counselor*

Adam Stern, Economic Officer

- 80 percent of Jordan’s electricity ordinarily comes from natural gas power plants fueled with Egyptian natural gas. There have been > 12 “disruptions” in the gas pipeline in the past 12-15 months, and this is costing Jordan about \$3 to \$5 million per day.
- BP is planning to expand Jordan’s only natural gas field (the Risha gas field near the Iraq border) but completion of that project is decades away. New infrastructure, including a gas pipeline, will be needed to make this accessible.
- Shell proposed to finance a \$150-200 million for a LNG terminal at Aqaba a few years ago, but nothing was done. Now there is renewed interest in such a project.
- Since 2009 there have been seven MOUs with different international firms for oil shale – Shell, Estonia, China, UK, etc.
- There is a “paralysis” of government decision-making that is a major barrier for large resource development projects. Some years ago, the GOJ let issued long-term contracts for phosphate production on government lands. Prices were set to attract buyers in the international market. Now world market prices are high and the contract prices seem low, leading to accusations of a “sell out” by Government. This makes the government (e.g., the Natural Resources Authority) agonize over how to proceed with new mega-projects.
- For the Fujeij Wind Project 40MW Phase I plus 40 MW phase II, four bids have been under review since July 2011, waiting for response from MEMR. A US TDA-funded feasibility study is under way for the Shams Ma’an 100 MW Solar PV plant proposed by Kawar Energy.
- There is also interest in investment to upgrade the power grid to improve efficiency and to explore greater regional interconnectivity and potential for imported electricity.

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Foreign Commercial Service, U.S. Embassy, Tuesday, 21 February 2012

Meeting with: *Sanford Owens, Commercial Counselor*
Fareedon Hartoqa, Commercial Specialist

- There have been four fossil-fueled IPPs power plant solicitations in past years. Two are completed AES Amman East is IPP 1, KEPCO, the Korean Electric Power Company, constructed IPP 2. All plants must be triple-fuel: natural gas, diesel, and heavy fuel oil. KEPCO has recently won IPP 3 for 600 MW in two units - a 350 MW and 250 MW.
- There are 64 expressions of interest under review at MEMR for RE projects. MEMR has limited staff and the expertise to evaluate them, so it is unclear when the next steps will be taken.
- PETRA Solar, a US company, is planning a project to install PV on rooftops of 10,000 homes.

- AES has proposed to build 40 MW of solar power generation in Azraq in 2 increments of 20 MW. This proposal has not received a response from MEMR.
- The WB has funded three studies as part of its Jordan renewable energy project: one on feed-in tariffs, one on by-laws to the RE/EE fund, and one on grid issues.
- A “commercial agreement” has been signed by MEMR with Estonia for oil shale development. The proposal had to address exploration, production and electricity generation. An EIA had to be completed. No more information is available.
- By 2013, Jordan should have plenty of water because of the \$1+ billion project to pump from the Disi Aquifer water on the Jordan/Saudi border through a pipeline north to Amman and beyond. At a rate of 100 million cubic meters per year, the projected lifetime of is at least 50 years. Independent studies have shown that there is a high level of Radon in the water. The Ministry of Water has denied this. 50 years does not really solve Jordan’s water shortage problem.
- The Commercial Service believes that energy efficiency is Jordan’s biggest opportunity in the near term to solve its energy problem, and that EE projects need to be implemented.



National Electric Power Company, Wednesday, 22 February 2012

Meeting with: *Ghaleb Maabreh, Managing Director*

- NEPCO has no generating capacity. It purchases electricity from privatized generation companies and IPPs and sells to distribution companies and directly to a few large consumers such as cement companies.
- NEPCO generally dispatches the lowest cost power first, but there are security issues involved in the decision.
- ERC reviews (regulates) bulk supply agreements. They have the expertise to audit NEPCOs transactions using international standards.
- NEPCO is not allowed to make a profit by law. Sometimes a “profit” occurs because of changing fuel prices, as it did in 2009.
- NEPCO stated that their technical transmission losses are 2% to 3%.
- The WB Clean Technology Fund, with AFD is planning to provide about \$180 million to NEPCO to enhance the grid in the “green corridor” to allow transfer of renewable power from the southern regions of the country to Amman and the north.
- NEPCO does not have control over options for diversifying energy sources for Jordan, but Mr. Maabreh identified the following as priorities in his personal view:
 - Construct an LNG fuel terminal at Aqaba - a “floating terminal” at Aqaba – the port is currently very crowded and ships may wait days to unload;
 - Build an oil pipeline -- oil is currently transported by truck from Aqaba;
 - Expand storage capacity for fuels;
 - Expand electrical interconnection with Egypt, Saudi Arabia and possibly others;
 - Expand the Risha natural gas field with gas pipeline to load centers;

- Oil pipeline(s) from the Persian Gulf;
- Would like a “grid” of pipelines to Jordan’s power plants – natural gas, oil, and diesel.
- USAID support:
 - Could be useful to support oil shale development (the Estonia effort is expensive) and;
 - An energy efficiency program is urgently needed – training, equipment, soft loans to help consumers, etc.
- The process of appointing members to NEPCO’s Board of Directors could be improved. He would like to see a two-year term with one additional year option and some “non-governmental” members.

National Energy Research Center (NERC), Wednesday, 22 February 2012

Meeting with: *Former Acting Director, now consultant to NERC, Walid Shahin*
Eng. Muhieddin Tawalbeh

(NERC is now reorganized to be the Energy Research Program under the National Center for Research and Development)

Established in 1998, by the Higher Council for Science and Technology, NERC was Jordan’s autonomous “center of energy excellence” until recently. The organization suffers from a lack of strategic planning due to constant and frequent changes in government decision-makers, and their recent “absorption” into the National Center for Research and Development. (There is still some uncertainty as to how all the recent changes will settle – some believe that the autonomous NERC arrangement will be restored.) NERC has a large pool of qualified “human capital” – however, it is bimodal - - very experienced (and older) upper technical management and very inexperienced (and younger) technical staff. They lack a strong “middle management” staff. Mr. Walid Shahin provided the following information and comments:

- Jordan is “going backwards” in energy research capability. In the 1980s, Jordan was the leader; other countries came to Jordan for advice and knowledge. Now the other countries in the region are the leaders;
- Jordan has been trying to establish an EE law since 2001. Things seem to be moving now but still need to see results. Better cooperation is needed between ministries e.g., Ministry of Finance and MEMR, and MEMR has difficulty making major decisions due to constant change of Ministers (hence direction), and the fear of public criticism of perceived corruption;
- NERC needs training on proposal evaluation and additional staff to build a strong center;
- USAID supported the creation of EDAMA, an association of private companies and other stakeholders, with several committees and levels of activity. As would be expected from private companies, a lot of activity revolves around marketing their own products;

- USAID supported creation of a Jordanian chapter of the US Association of Energy Engineers (AEE). U.S. AEE held workshops and “train-the-trainer” courses to “certify” energy auditors. The training was good, but it is not clear how well the program is working. The Jordan Energy Chapter does training now, but there are questions about long term sustainability;
- A lot of energy work in Jordan is “done in pockets”. Communication is needed to form linkages. Perhaps a dedicated office in NERC (or elsewhere) for coordination of EE and RE activities is something that USAID could encourage and support;
- The Ministry of Planning is concerned with funding and not real energy sector “issues”. They do not have the capacity to provide real coordination among foreign donors as to what must be done and where funding can be best applied;
- A “brain drain” is a “huge problem” in Jordan. Well-trained personnel leave quickly to EU countries;
- Jordan needs to find its “niche” in the “production chain” of RE/EE products;
- An aerial photo of Amman would show solar water heaters on 30% of the buildings, but only about half of those work. Cheap Chinese imports and poor local manufacturing quality caused this.



Royal Scientific Society, Wednesday, 22 February 2012

Meeting with: *Rafat Ahmed, Executive Director of Testing*

The Royal Scientific Society (RSS) is a non-profit NGO that is the premiere laboratory testing organization in Jordan, and in many technical areas, for the Middle East. It does most high level testing in Jordan and a lot of regional testing funded by specific countries. RSS conducts laboratory tests to American or EU standards. It works with the Ministry of Planning and International Cooperation to secure foreign funding. The staff consists of 650 technical experts in more than 30 separate testing laboratories. They have been supported by USAID in the past to develop capacity for water efficiency testing. RSS has submitted proposals to UNDP for a washing machine testing laboratory, and to USAID for testing of air conditioners, refrigerators, freezers and lighting. The RSS receives no core support from the government; all of its funding comes from sale of its services and grants from foreign donors.



Founder and Former President of the National Committee for Women, Wednesday, 22 February 2012

Meeting with: *Dr. Hiam Kalimat Tuguz, Consultant for Sustainable Development/Good Urban Governance*

- Jordanian women have witnessed advancement in education and health, but

- significant inequalities remain, especially in economic activities and political life.
- Gender indicators related to social and cultural norms should be considered for gender analysis.
- Women are underrepresented in politics. Elections are affected by culture; “women do not vote for women”; women are not trusted for decision-making. Due to low participation of women, a quota system was introduced for municipal council seats. Currently, 25% of the total municipal council seats in Jordan are represented by women. There have been initiatives to train women to run for election.
- A high level of education for females does not translate into employment. Jobs are limited for women, and are mostly in the public sector. Women usually work in education, health and low-level government positions. Women are socially banned for working in construction, mining or tourism. It is common that young females quit jobs for marriage or maternity.
- Private sector preference is to hire men because they have no restriction for mobility and can work extra hours. Female engineers usually perform work in offices.
- In small and medium private sector companies, women are highly discriminated. In many cases, women sign contracts for full salary but they are actually paid half. Also, overtime is not paid for women but it is for men.
- Childcare is lacking at the enterprises or close by workplaces.
- Enforcement of labor laws is needed for women’s rights: childcare, maternity leave, and health care benefits.
- Transportation is a big problem for women. The public transportation service does not reach all places.
- The recent increase in electricity tariffs has had a great impact on the households’ economy.
- Communities are open to the use of solar water heaters and to learn about energy conservation.

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Green Building Council, Thursday, 23 February 2012

Meeting with: *Mohammad Asfour, Chair*

The Jordan Green Building Council was established in 2009. It is completely independent from GOJ funding as it relies on membership dues, service contracts, and training fees. The budget varies but averages about \$300,000 annually. Membership includes 60 corporate members, 73 individual members, 123 associate members, and 99 students. The fees are from \$140 to \$1,400 depending on number of employees in a company and other criteria. The GBC lobbies for an independent organization to run the JREEF and to have the fund committee approve a Director for the fund. MEMR wanted to appoint a Director from its current staff. MEMR finally agreed to include 3 committee members from the private sector. GBC background includes:

- Conducts LEED workshops to train and qualify regional experts.
- There are 130,000 architects and engineers in Jordan – a large number relative to the total population.
- Building codes are not standardized in Jordan. The country uses models from U.S., EU, UK, etc. as appropriate. The National Building Council in the Ministry of Public Works and Housing is responsible for updating the code. Codes are not up to date in some areas and even more problematic, they are very poorly and unevenly enforced, as in many other countries. Work in this area is supported by the USAID PAP.
- USAID should support “services” that have a measureable outcome. They should not just support a “conference”; they should provide funds for selected people to attend. And have some metric for determining the impact of their attendance.
- USAID might support a way to periodically bring “stakeholders” together to enhance coordination and communication. Mr. Asfour said that we must be careful in doing this as “foreign aid” is often perceived as “foreign intervention” into Jordanian affairs.
- USAID should take a broad view and encourage “dialogue” among stakeholders and not just support “individual organizations”.

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Ministry of Planning and International Cooperation (MOPIC), Thursday, 23 February 2012

Meeting with: *Nasser Al-Zou’bi, Head of American Relations Division, International Cooperation Department,*
Ziad Obedat, Director, Programs and Projects Department

- Jordan has an Energy Security Committee that is chaired by the PM. It includes all governmental stakeholders – MEMR, Finance, MOPIC, Water, Environment, etc. They have met 3 to 5 times recently trying to reach a “quick solution” to Jordan’s energy crisis.
 - MOPIC expressed basically the same priorities for the Jordan energy sector as NEPCO – RE and EE, LPG terminal, pipelines, expand the Risha gas field, etc.
 - MOPIC received draft EE by-laws from MEMR and is currently reviewing.
 - The new JREEEF is expected to promote wind power and concentrated solar power as well as capacity building and technical support.
 - US TDA has supported feasibility studies for two solar projects in the Ma’an development zone – Kawar Energy Shams Ma’an project and Millennium Energy Industries CSP pilot plant.
 - The National Resource Authority that is dealing with Jordan’s oil shale efforts could use some TA support.
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American Chamber of Commerce (AmCham), Thursday, 23 February 2012

Meeting with: *Jack Rabah, Business Development Manager*
Mehran Meserlian, Vice President, CDM Smith
Stephen Blair, Principal Water Resources Engineer, CDM Smith
Samer Hanania, Deputy General Manager, Hanania – Ideal Solar Energy Company
Mohammad Meftaur Rahman, Chief Executive Officer, AES Jordan PSC

Samer Hanania stated that the new RE/EE law requires solar water heaters for all new apartments larger than 150 square meters. He said that he has been working for over 30 years to get the GOJ to help low income families purchase solar water heaters. In the 1980s, Jordan was installing about 1,000 SWHs/month. In the 1990s this virtually stopped. In 2003, with the rise in diesel prices, SWH became “fashionable” again. NGOs and rising prices are the reason for increased interests in SWH not the GOJ.

Mr. Rahman, CEO of AES Jordan, stated that he has met with 6 different MEMR Ministers in the last 5 -6 years. Each new Minister has to come “up to speed” on what is going on in power generation in Jordan. AES has submitted IPP proposals for grid-interconnected PV systems but has not received a decision from MEMR. They have proposed to build 40 MW of grid connected solar, in two 20 MW increments, in the Azraq district. Mr. Rahman stated that if MEMR was hesitant about 20 MW PV then they should implement a more feasible project in the 1-2MW PV range.

Mr. Stephen Blair, Principal Water Resources Engineer for CDM Smith, stated that the company has done a lot of work with USAID and that he thought that USAID should help Jordan develop an updated national strategy for energy development.

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Fiscal Reform II Project and with Secretary General of Ministry of Finance (MOF), Sunday 26 February 2012

Meeting with: *Dr. Khalid Hmoud, Economist. Policy Analysis, and MOF Operations Components Lead; Mark Gallagher, PhD., Chief of Party; Dr. Omar 'Mohammad Mansour' AL Zo'bi, Secretary General, MOF*

The Fiscal Reform II project, supported by USAID:

- Project supports MOF in a range of areas including design and management of major capital projects, MOF Policy, tax administration, and development of PPPs;
- PPP law is in Parliament, USAID is considering support for establishment of a PPP unit and drafting of bylaws to implement this law when passed;
- Responsibility for a PPP unit has been discussed in various places in the government several times. Currently it is slated to be part of the Ministry of Finance;

- The PPP Unit is to be responsible for evaluation of projects, including calculation of economic returns, and their implementation;
- Line ministries effected by the projects need to be involved and financial managers need training;
- There are potential problems with the collateralization of assets to the satisfaction of bankers, and structuring of step-in rights, which should be resolved before projects can be successfully financed;
- GOJ has decided not to give any more sovereign guarantees to projects;
- Jordan has a very developed banking system. 3 banks control 70% of deposits;
- Major funds are in the pipeline from the EU and GCC for capital mega-projects – the ‘disi aquafer water pipeline project’ is underway. Three other candidates are: a proposed nuclear power plant, the Red Sea-Dead Sea pipeline and a major new railway system expansion;
- MOF needs a template for economic analysis /cost-benefit analysis to standardize and facilitate comparison across projects.

Meeting with: Secretary General Omar Al Zo'bi

The Secretary General when we met had been in office for a full weekend, after his predecessor had been given new responsibilities on the evening of Feb. 24. Being a personal friend and confidant of the current Minister of Finance, we assume that he was speaking with authority.

- The first point is that energy has provided myriad difficulties to the Jordanian economy.
- The current energy situation leads to inflation, balance of payments problems, budget overruns and shortage of foreign reserves.
- MOF wants to address these problems, but the “fiscal space is not available.”
- Consumers are impacted, but must wait to see what will happen.
- The solution is partnership with the private sector. The cabinet has approved the PPP Law and the PPP unit must be established. This will be the main driver of economic growth for Jordan in the future.
- MOF plans to remove subsidies and recycle some of the added revenues to the neediest. The cabinet is debating raising electricity tariffs again for all consumers using more than 400 kWh/mo.
- There is a proposal to remove subsidies from gasoline on 1 April and begin gradual removal of diesel subsidies.
- In the RE and EE Law, the provisions for the fund have been changed by the Parliament to place it within MEMR and not as an autonomous body. We should cover concerns about this in our report. What can be done to build in safeguards within the Ministry?

- The current Minister of Finance has no problem with increasing the national debt ceiling or providing guarantees for PPP.
- The current problems are due to the Arab Spring that in turn has disrupted energy supply – a short-term disruption. Things are moving in the right direction now and will return to normal over time.

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Jordan Forum of Business and Professional Women (JFBPW), Sunday 26 February 2012

Meeting with Rabha Al Safadi, Secretary of the Jordan

- The Forum provides legal counseling for business and professional women regarding work and business regulations and laws registration, export, import, general trade and services.
- Laws are equal for men and women starting new business, but women do not feel confident in such initiatives. JFBPW provides training to constantly encourage women to start new businesses.
- JFBPW activities not only focus on JFBPW members but also in women in general. The Forum starts with the selection process, then provides training, and finally introduces services to the members in the fields of information, projects implementation, legal guidance and advocating for more encouraging laws and regulations.
- JFBPW supports young women entrepreneurs. The Forum identifies young entrepreneurs in training workshops provided to Universities.
- The Forum serves as an incubator for new business women doing advertising, food processing, plumbing, domestic harvesting, and dead-sea products among many others. The business incubator is part of the long-term strategic plan of the Forum.
- Microfinance is available by law for women entrepreneurs.
- The Forum is not receiving as much support from the MOPIC as are other NGOs.
- The Forum has implemented RE projects across Jordan such as solar water heaters and greenhouses. Other energy related projects have been collecting rainwater for domestic agriculture, and food preservation for export.

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Jordanian Women’s Union, Sunday 26 February 2012

Meeting with: Mukaram Odeh, Executive Manager

- Violence against women is an issue of concern in Jordan for both Christian and Islamic women.
- JWU does not have national statistics about violence against women, only provides shelter and prepares them to advance in their lives and to get out of that

environment. JWU provides training in different areas for them to have better job opportunities according to their capacities and special conditions.

- To guarantee economic independence for abused women, JWU started a department of income-generating projects. Such projects include a beauty salon, a computer center, an internet cafe, a kitchen, and a Manual Handicrafts Project.
- JWU runs campaigns for reforms in family law and laws on trafficking in women. For instance after a campaign the marriage age for women increased from 14 to 18 years old.
- JWU also runs campaigns to protect foreign domestic workers who are employed in Jordan, and generally not protected by Jordanian law. Domestic workers usually come from Egypt, Sri Lanka and Philippines.

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Gender Specialist Consultants, Monday 27 February 2012

Meeting with: Dr. Menan S. Hattab and Salma Nims

- Awareness campaigns are needed to address new ideas such as energy efficiency and energy conservation; they should send messages to communities carefully respecting men and women's areas. Media engagement is necessary.
- A special approach for awareness on energy conservation must be designed for domestic workers. More than seven thousand foreigners from Egypt, Sri Lanka and Philippines are working as housekeepers.
- Gender mainstreaming at ministry level. Dr. Hattab provided training to ministries gender focal points the help them to understand gender concepts, mainstreaming and integration. Ministries have created gender units/divisions/departments to support gender mainstreaming and implementation in their institutions across their departments, to improve service and policy implementation.
- Top management positions for women in ministries are needed for addressing real women's concerns in rural areas.
- Dr. Nims joined the meeting at 10:30
- There is a need to conduct assessments to learn what has been done geographically regarding the nexus of energy and gender.
- Create proper communication strategies to help minimize resistance. Strategies must be specially designed for three audiences: policy makers, implementers and community.
- To change behavior of an energy user, strategies must follow a demand side approach. For that, user's information is required to design appropriate action plans. Data should be disaggregated by sex, age, geographic region, income, and number of family members.
- Many development projects have been implemented but there is no way to measure properly their social and economic impacts. Disaggregated data required for monitoring and evaluation does not exist.
- Gender sensitive capacity building for policy makers is needed to increase social

- impacts and to push gender agenda.
- Gender mainstreaming is very weak in the public sector. Need to conduct assessment on organizational culture in ministries for effective gender mainstreaming.

Gender Unit Ministry of Planning and International Cooperation (MOPIC), 27 February 2012

Meeting with: Ms. Majd Hammad

- The gender unit’s purpose is to foster the gender agenda in the MOPIC, enabling policies and gender mainstreaming and integration.
- The gender unit is part of the network coordinated by JNCW.
- Gender mainstreaming is not effective in MOPIC because gender focal points (GFP) are usually appointed without any selection criteria, and they have not allocated time for this task because it is not part of their job description; as well as, salary is not well remunerated.
- People attending trainings specially designed for GFP, are not committed to the gender concepts. Training is not as effective as it should be. “Some trainings are some kind of entertainment since they have been conducted in Dead Sea, Aqaba and other cities.”
- The gender unit identifies indicators to women’s empowerment to be used in the design, monitoring and evaluation of policies, programs and projects.

Energy Management Services (EMS), Monday, 27 February 2012

Meeting with: Naim Awadallah, Executive Consultant

- Established in 1991, EMS was the first energy service company in the Middle East. A Canadian technology transfer program provided software and a library of technical materials that were very helpful in getting up and running in a new business. Initially, marketed services to large industrial companies. Energy prices were low and sales were very difficult.
- EMS introduced energy performance contracting with payment from shared savings. This worked well with large industrial customers until it was stopped in 2009 due to the global financial crisis.
- The company raised capital and expanded by attracting new private investors, including Jordan-Dubai Energy.
- Over time, developed other services, including ‘energy value engineering for facility and building design’

- Assisted designers, builders and owners to save construction costs by correcting over sizing, etc, and operating costs through insulation, windows mechanical, electrical and plumbing systems;
- Support for LEED certification – EMS worked on the new LEED Gold certified design for the World Health Organization (WHO) building in Jabal Hussein;
- Commissioning of systems to LEED requirements in new buildings.
- LEED certification for new buildings is attractive because of
 - 1) ability to obtain higher rents,
 - 2) tax benefits during construction, and
 - 3) tenants lower operating costs and higher productivity.
- The market for efficient energy services needs to grow faster to benefit the country. Perhaps the new electricity tariffs will provide a stimulus.
- EMS typically finances projects from its own equity and debt based on its balance sheet, not project based financing. Typical small industrial or commercial projects are JD 30-100,000 and pay back in around 2 years.
- EMS has conducted audits for USAID of the MOPIC and Ministry of Environment building, for MEMR of 5 commercial buildings and 15 industrial facilities, and of 8 Hospitals for the SABEQ Project.
- USAID could provide useful support in:
 - development of an ESCO association;
 - financing for audits with implementation – refund cost of audit if measures are implemented;
 - support the GOJ and Jordan Engineering Association in enforcing laws, codes, etc.;
 - labeling and standards for equipment, products and materials;
 - assessment of SWH systems maintenance and approaches to ensure that systems are maintained.
- On gender issues, EMS has only 2 female engineers who work in the office. They believe that women will not do outdoor work, lifting, climbing roofs, etc.

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European Bank for Reconstruction and Development (EBRD), Monday, 27 February 2012

Meeting with: Miroslav Maly

- The EBRD was established in 1991 to support economic transition in Eastern Europe and the former Soviet Socialist Republics, reaching 29 countries. Its mandate was for twenty years and was expected by many to phase out after that time.
- 3 years ago, Turkey applied to join the Bank. After some internal discussion the member countries agreed to extend the life for another 15 years and to extend membership to Middle Eastern and North African countries that desired to join.
- EBRD's portfolio is 80% commercial loans with only 20% sovereign loans – mostly for infrastructure, such as energy transmission systems, water supply, generally as lender of last resort.

- EBRD develops country strategies from the bottom up that is business driven.
- Several approaches are possible for Jordan:
 - Join projects already under development by other IFIs, especially EIB, KfW, AFD, NIF. One existing project in Jordan is to upgrade the transmission grid to support large scale additions of RE with bulk transmission from south to north. Considering joining with EIB in this area on a loan to NEPCO;
 - Direct lending to medium and large industrial projects – waste to energy, cement, steel, chemical, food processing. NERC has done an extensive audit program and has identified many projects with less than 1 year paybacks. EBRD would do partial lending – maximum 60% for small projects and 30% for larger ones. Need commercial lending partners:
 - Direct lending facility – for standardized projects (e.g., industrial boilers):
 - Credit line facilities – EBRD understands that the National Energy Efficiency Action Plan (NEEAP) will propose requirements for periodic audits of large facilities with mandatory implementation of some or all of the recommended measures with penalties for non-compliance. EBRD would prefer to see positive incentives for implementation in the form of low cost loans from credit line facilities. EBRD may join with AFD to propose something in this area. Another possibility is financing of SWH through utilities with customer payback through utility bills. This would require prequalification of equipment and installers and would result in very low risk. Another possibility is for lending to ESCOs for public sector EE projects – street lighting, SWH, building EE, etc.
- Jordan is not yet signed on as a country of operation with the EBRD, but this is likely to happen soon. The Bank could be making loans within 1 year.

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Jordan National Commission for Women, Tuesday, 28 February 2012

Meeting with: Ms. Fadwa Abdulqader

- The JNCW is a semi-governmental organization that has been tasked to implement the National Strategy for Women. The National Strategy sets Jordan’s objectives for 4 years. Objectives relate to women’s involvement and status in education, health, agriculture, economics, politics, and recently in environment.
- JNCW is coordinating gender mainstreaming at ministry level. Regular coordination meetings are held by JNCW with ministries Gender Focal Points. Participant inputs are used to help elaborate, produce and analyze the National Strategy.
- JNCW showed great interest in the nexus between gender and energy but expressed the need of technical expertise for developing this part of the strategy.
- It is urgent for the MEMR to create a gender unit and coordinate with JNCW for inclusion of energy issues in the 2016 National Strategy for Women.
- JNCW has amended many laws in favor of women related to under-age marriage, divorce, quotas in elections and domestic violence.

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Women’s Unit of the Ministry of Labor (ML) 28 February 2012

Meeting with: Ms. Haya Zayadin and Asma Abu Asbeh

- MOL Women’s Unit analyzes labor laws and legislation to identify and ameliorate gender based discrimination.
- Pay equity has been identified as a priority in both the 2011-2015 National Strategy for Women and in the National Employment Strategy in Jordan. MOL works with JNCW to promote ‘equal pay for equal value’ for men and women.
- MOL recognizes that private sector firms prefer to employ men because they have no restriction on mobility and can work overtime.
- In small and medium companies, women are highly discriminated against. Women prefer to work in public sector because it responds to cultural norms. In big companies discrimination does not occur as much.
- Childcare must be provided by private sector according to the law, but the public sector is not required provide this service.
- Enforcement of labor laws is needed for women’s rights: the other MOL women’s unit priorities are childcare, maternity leave, and health care benefits.
- MOL Women’s Unit is part of the network coordinated by JNCW; “gender mainstreaming is effective at the ministry.”
- USAID supports women’s employment through MOL at factories in rural areas. USAID supports women for 6 months, 3 meals per days and accommodation.

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Nur Solar Systems, Tuesday, 28 February 2012

Meeting with: Waleed Darwish, Marketing Manager

- Nur Solar Systems started in 1983 installing SWH systems in the residential sector. It soon added government and commercial buildings.
- In 2009, the company started a new ESCO business under the name of Nur Energy – They do energy audits for industry, the public sector and commercial buildings. Energy prices and government regulations are starting to move the market in this area.
- NUR Energy also does some work with LEED design – subcontracting with other firms, such as EcoSol that have LEED Accredited Professionals on staff.
- In January/February 2012 the company has received more inquiries for solar systems than in the previous full year.
- For SWH there are 2 large, high quality manufacturers, and 2-3 companies that import quality equipment. Many companies import less expensive but substandard equipment. JSMO has good quality standards and MPWH has codes for installation, but none of this is enforced.

- A similar situation exists in the ESCO market. Firms use unqualified auditors and installers and import substandard equipment. Audits offer large savings at very low cost, raise unreasonable expectations. Customers sign on for installation of EE technology that subsequently does not perform. These companies often declare bankruptcy or just disappear within a few months, leaving unsatisfied customers with no recourse.
- One example was provided of a major paper and cardboard products company that hired an unknown firm to audit and then install energy saving technologies. The result was a disaster. The company continues to invest in energy saving, but now will only work with large international firms at much higher cost than necessary.
- USAID can make a major contribution by supporting capacity strengthening and implementation of enforcement of existing codes and standards. Additional support for new standards, labels and codes to address the changing marketplace will also be extremely valuable.
- The newly developed building code will require that new buildings over a certain size must have SWH systems in order to obtain connections to municipal electricity and water systems. If enforced this should be very effective.
- JSMO and MPWH have developed new standards for SWH systems, with consultation of Nur SS and others. NERC and JSMO have worked together to develop a proposed new quality mark for SWH systems. This is under review in MEMR. With enforcement this could also be of great importance and could provide a basis for JSMO and NERC to build on in other technology areas.
- There must be an objective system for the purpose of rating companies, registering complaints, certificates, etc.
- It would be useful for USAID to support capacity development and program implementation in JSMO, NERC and RSS to improve development and enforcement of equipment standards/labeling.
- There is great scope for EE and SWH improvements in the public sector. The Military in Jordan is very active in this area. USAID should consider working with the military to demonstrate the effectiveness of EE and RE strategies for public facilities.

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International Business Legal Associates, Tuesday, February 28, 2012

Meeting with: Dr. Sahlaheddin M. Bashir, Managing Partner; Jawad Zeidat, Attorney at Law

IBLA is a premiere Amman law firm with IPP experience for the AES and the Korean IPP projects, where they represent project developers. The purpose of the meeting was to learn about any deal killers that may impede IPP and PPP development.

- MEMR is holding up projects because they delay decisions.
- NEPCO takes fuel risk. Developers paid for converting fuel to electricity.

- GOJ gives tax holidays.
- Transactions have been transparent. But in the current climate, all transactions between the private sector and the government are being viewed as corrupt by the public. This is one reason for decision paralysis.
- No IPP deal has been tested in court. If they were to be, there would be major concerns including:
 - Security of cash deposits at Jordanian banks;
 - Asset securitization - particularly movable assets;
 - Subordination of loans;
 - Adverse international arbitration is enforceable only if there is a bi-lateral investment treaty with the other country (there is one with the US);
 - Foreclosure through Jordanian courts;
- One percent of project value in stamp taxes payable to GOJ makes transactions in Jordan very expensive. The AES project was closed overseas for that reason and several collateralization issues. AES taking higher risk than in other countries.
- Jordanian courts are generally considered clean, but lack technical capability. Asking them for rulings on any of the above issue would be a crap shot.

Annex E: Background Information on Power Generation Technologies

Over the next eight to ten years Jordan requires an additional 300 to 400 MW of newly constructed electrical generation capacity each year to meet forecasted demand and to meet economic growth projections. Following is a discussion of ten technologies which are available to Jordan to achieve this goal. Each includes a short description of the technology, estimates of cost, development and construction time, water consumption and environmental impact.

A mix of power generation technologies is necessary for Jordan to achieve its objectives of reliable, affordable electricity supply. A well designed electricity generating system (a power generation mix) is the sum of several options, each fulfilling its specific role to provide either base load power, intermediate generation, peaking power, and/or back-up supply.

1. Demand-side Management (DSM)

DSM brings the fastest results if either demand for power consumption cannot be met, or the intent is to either postpone larger capital investments or gain time to construct new generation facilities. The effects of DSM are also reduced air emissions and water consumption from the electricity generation process. While DSM has a cost, e.g., for the installation of new water pumping technologies, distribution or sale of energy efficient light bulbs, water heaters, and consumer education, the power demand reduction that negates the need for a new power plant is always the cheapest alternative.

2. Solar Photovoltaic (PV) Generation

Solar photovoltaic (PV) power is the fastest RE power plant to install. Solar panels can be installed on roofs, or large solar arrays can be installed on land within a matter of months. Rooftop installation would require smart meters (those that can run backwards for net metering) in the case of residential or commercial building installation, and the cost of grid interconnections in case of solar farms. PV produces neither air nor water pollution. However, the cost per kilowatt of installed capacity is between \$5,000 and \$7,000 and thus is one of the more expensive power generation options.

3. Solar-Thermal Generation

There are several solar-thermal systems to provide steam to a turbine to generate electricity. The two used most are parabolic mirrors with an oil-filled pipe to transmit the thermal energy to a boiler and a concentrator method, where mirrors direct the sunlight to a focal point on a tower, where the generated heat is again used to convert water to steam to run a steam turbine to generate electricity. Both solar-thermal technologies operate without air emissions, but water is needed for the boiler and for condensing of the spent steam so it can be recycled. Some make-up water will be required just like in a conventional thermal power plant. Installation costs for solar-thermal facilities will be between \$4,000 and \$4,500 per kilowatt of installed capacity. Fuel is free. Plant sizes will most likely be below 50 to 100 megawatts. Investors will require at least one year of site specific solar data for input into the financial pro-forma. Thus, there is at least a two

to three year development, financing and construction period involved, and there may be a need for back-up power generation from a technology not affected by the occasional lack of sunshine.

4. Wind Energy

Wind farms are an attractive option where there is a sufficient wind resource. Investors will require at least one year of very site specific wind data and preferably two years. Wind farms are relatively easy to install at a cost of about \$2,000 to 2,500 per kilowatt of capacity. However, there is no water consumption and the fuel is free. Maintenance costs are higher than with PV because the wind turbine blades are subject to varying pressures at different blade angle elevations and wind speeds.

5. Geothermal Energy

Jordan has rich geothermal potential in low temperature resources spread amongst several geothermal fields, which are well suited for direct use applications. Some geothermal resources are also indicative of potential for future potential for electric power generation power production in Jordan. Some viable applications for Jordan include:

- Power generation from medium or high enthalpy resources;
- Direct heat applications in agriculture, food industry, etc. from low enthalpy resources;
- Absorption cooling driven by geothermal heat; and,
- Seawater or brackish water desalination for deserts

The current use of geothermal energy in Jordan is for spas only, however, plans exist already to use the resources for greenhouses and other agricultural applications (incl. fish farming and absorption cooling for cooled warehouses), and for water desalination. Recent interest concerns shallow geothermal technologies for heating and cooling of buildings (offices, hotels, etc.). Direct use experiences from the western US (e.g., New Mexico) with similar climatic and geological conditions prevailing as in the Greater Amman or Zarqa areas. The highest temperatures proven geochemically in Jordan are up to 115 °C at reservoir depth (not yet accessed by drilling). The best explored region is the Zarqa Ma'in - Zara thermal area at the Eastern Dead Sea escarpment.

6. Combined Cycle Natural Gas Turbines

In a combined cycle gas turbine power plant the fuel is either natural gas or light distillates (diesel) as a back-up fuel, should natural gas not be available. The gas turbine generates electricity directly and the exhaust heat from the aircraft-similar turbine is captured and funneled through a waste heat recovery boiler, where it will generate steam, which is then expanded in a steam turbine to generator electricity. While the installed capacity cost is between \$1,750 and \$2,500 per kilowatt, there is air pollution from NO_x, and CO₂. But because of the cogeneration effect, the plant's fuel to kilowatt-hour conversion ratio is between 60% and 75%, a high ratio for conventional power generation. Development, financing and construction usually take about two years - depending very much on world market demand for both gas and steam turbines. As a

rule of thumb, the thermal cycle will produce an additional 50% of the electric generating capacity of the gas turbine itself, with no additional fuel consumption.

Water will be used for boiler make-up and condensing/cooling purposes, whereby in dry desert climates cooling can be done with air coolers, reducing water consumption greatly. Dry cooling in Jordan is technically feasible but comes at a high price in capital expenditure and electricity to drive the fans. NO_x and CO₂ emissions can be controlled, but at a price. However, gas turbine technology has greatly improved to reduce at least NO₂. The advantage of combined cycle gas turbine installations is that from a cold start, it takes only three to six hours to full output power, meaning the use of the plant can be scheduled to operate only during peak hours of the day.

7. Simple Cycle Gas Turbines

Simple cycle gas turbine power plants are one of the easiest and cheapest ways to create very flexible and reliable electricity generation. They use natural gas/distillate fuel without the waste heat recovery boiler used in the combined cycle configuration. If well designed, a waste heat recovery boiler and steam turbine can be added at a later date. However, the cheap procurement cost of between \$1,000 and 1,500 per installed kilowatt comes at the cost of a lower fuel conversion ratio (35 percent to 45 percent) - meaning more fuel is required, a trade-off between capital and operating costs. The higher per kilowatt fuel consumption produces more air pollution, but water consumption is minimal. Implementation depends heavily on the lead time for turbines which in periods of high demand can be upwards of 18 months. However, installation at the site can be completed within three months after turbine delivery. Simple cycle gas turbines are normally used only during peak demand periods because of the high fuel costs. They can be brought on line within 10 to 20 minutes after notice by the dispatcher. They can be taken off-line within minutes if demand does not justify their use any more. They are often operated from remote locations like a National Dispatch Center.

8. Cogeneration

The term "cogeneration" is defined as the simultaneous generation of two form of energy from one source of fuel. This mean in most cases that a combined cycle power plant is used for generation of electricity, and the remaining thermal energy from the waste heat recovery boiler (after the steam has been used for electricity generation) is used in some industrial process, thus increasing thermal efficiency even more. For cogeneration to work most efficiently, it should be attached to a continuous industrial process with a steady steam/thermal demand, like a chemical plant or refinery. The cost of a cogeneration unit in most cases is only slightly more than a combined cycle power plant. However, the fuel conversion to electricity ratio in an installation with a "good" thermal host match can exceed 85 percent, making the system one of the highest efficiency power generation options.

9. Power Generation from Shale Oil

Shale oil is oil trapped in rock formations which cannot be pumped. Shale can be mined like coal in either open pit mines or underground. The oil is recovered by, literally, sweating it out of the rock with thermal energy, requiring large amounts of heat and water. The same shale material can be finely ground and burned directly in a boiler for electric generation. The fluidized bed boiler is the best performing and most efficient system from the standpoint of air emissions. Unit sizes could be as large as 200 MW to 250 MW capacity at a power plant cost of \$1,200 to 1,800 per kilowatt installed. Shale mining costs would need to be added, but the fuel cost per Btu should be below natural gas, predictable and under Jordan's control, because the oil shale is indigenous. Combustion of the oil contained in the rock should be about >98%.

While fuel costs may be less significant than the cost per unit of natural gas, any kind of conventional technology larger scale generation comes at a high water cost. Water is being used for steam generation in the boiler and requires high quality make-up water and for condensing and cooling of the steam in cooling towers. Thus, utilization of this technology is very much dependent on the availability of water. While much of it can be recycled several times, cooling towers work on the principle of evaporation and that water is lost for good.

Also, air emissions are of concern. There will be NO_x, SO_x, CO₂, particulate emissions, and potentially heavy metals which may be contained in the rock and freed during the combustion process. While the fluidized bed boiler technology produces the least amount of these pollutants, and is capable of reducing SO_x by adding limestone in the boiler which will absorb most of the SO_x. NO_x and CO₂ catalysts can be added in the exhaust stream to make a solid fuel burning power plant operate nearly as clean as a natural gas-fueled power plant. However, these environmental controls come at a high price in capital and operating costs.

Ash disposal can be in the mined out-areas of the shale mine or it can be used for roadbed material, additives for cement, light-weight cinder blocks and drywall manufacturing. Thus, the ash may have economic value. Development and financing of shale mine and direct burning shale power plant would take two years, plus up to three more years for construction. Because there will be economies of scale of such an operation, interconnection issues to the grid will have to be considered (modeled) carefully.

10. Direct Burning of Oil and Natural Gas

This is the simplest and most flexible power generation technology. Simple dual fuel boilers (gas and any oil, down to unrefined crude can be used) are relatively cheap and can be scaled up from very small to about 800 MW of capacity per single unit. The fuel is burned in a boiler to raise high pressure steam and expanded in a steam turbine for electric generation. However, the energy value of the fuel to electricity conversion is relatively low: <45 percent. While only \$750 to \$1,000 per kW capacity to install, it has a high water use for boiler make-up and cooling, and NO_x, SO_x, CO₂ and some particulate emissions, plus whatever may be contained in the oil in terms of heavy metals. Technologies are available to control these emissions, but at a price. Nevertheless, it is

the cheapest conventional technology with very high fuel flexibility, reliability and ease of operation.

11. Generation of Nuclear Power

The advantage of nuclear power is that while capital cost may be high, ranging from \$3,000 to \$5,000 per kilowatt installed capacity, fuel can be cheap. Thus, on the continuum of comparison between capital cost and fuel cost, it is competitive with other technologies. There are no air emissions. The disadvantages are disposal of the radioactive spent fuel rods and “economy of scale”—unit sizes start at about 1,000 MW capacity. For a small country like Jordan, the sudden loss (outage) of a generating plant can bring down the entire system. Thus, it is not a reliable option for a small power system like Jordan's, unless the risk is spread to other countries that would be buying portions of the output under long-term off-take agreements.

However, the biggest concern for nuclear power plants in Jordan is the availability of cooling water, of which massive amounts will be required. There is a reason why the majority of nuclear power plants around the world are built either next to large rivers or near oceans or other large bodies of water.

12. The Case for a Liquid Natural Gas Terminal in Aqaba

LNG terminals consist of a tanker unloading facility, which, through the construction of a simple dock, can be moved relatively far off-shore into deep water, with pipes to carry the liquefied natural gas to a tank farm for storage. There will be a small natural gas burning boiler to re-gasify (heat to normal temperatures) the LNG to be injected into the existing natural gas pipeline system. The advantages of such a storage facility are that:

- Gas can be stored long term.
- The gas can be released into the pipeline instantly if needed in the case of an interruption of supply from upstream in the pipeline.
- Gas can be sourced from any source around the world with popular suppliers being Qatar, Algeria, and Venezuela.
- It is easily transported in specialized tanker ships.
- It can be purchased at times when natural gas prices are low, and used when they are high.
- The gas has the same qualities as pipeline natural gas. It can be used unmodified in any of the natural gas fueled power generating technologies.

LNG unloading and storage facilities vary in cost, depending on size, location and other factors. They require some, but not significant amounts of, water for make-up and cooling of the LNG reheat boiler. Because boilers are not significant in size, operate only intermittently, and natural gas is a clean burning fuel, air emissions are minimal.

Development, construction and financing are estimated to take two to three years. An LNG terminal and storage facility would be a big step towards energy security for Jordan. As an interim measure, the GOJ is considering storing LNG on a tanker, off shore, until an on-shore storage facility can be built.