THE ENERGY SECTOR IN JORDAN

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Introduction

Energy remains Jordan’s top challenge. The Kingdom has almost no indigenous energy resources. It imports some 96% of the energy it consumes. This almost complete reliance on foreign oil imports consumes a significant amount of the country’s GDP (about 18% annually). Moreover, multiple attacks on the Arab Gas Pipeline from 2011 to 2014, which supplied 88% of the country’s electricity generation needs, forced the country’s power plants onto diesel and heavy fuel oil, costing the treasury millions and pushing the national energy bill to record highs. All these factors have left Jordan struggling to meet its energy requirements.

Population increases, industrial development and a growing economy have also led to a rise in annual demand for power of around 5.5%-6.5%. Consequently, the government has recognized that its reliance on energy imports, especially gas and heavy fuel, is a major challenge and has thus made the sector on the top of its priorities. Jordan has indeed undeniably acknowledged that making affordable energy solutions available is crucial to support industries, trade and investment, and attain sustainable growth.

In response, the government unveiled in 2007 an Energy Master Plan (2007-2020) for the development of the energy sector, requiring an investment of $18 billion. This strategy focuses on maximizing the use of domestic resources from the current 4% to 40% by 2020, particularly oil shale; encouraging energy conservation and awareness; generating electricity from nuclear energy; and promoting the development of renewable energy projects.

Jordan is looking at medium and long-term initiatives across a wide range of energy sectors to diversify its energy sources. These include importing LNG, exploring for oil and gas, implementing an energy efficiency program, importing electricity from neighboring countries and diversifying the types of fuel it uses for power generation.

This drive to bolster local energy production is now gaining pace, as Jordan moves to forge new public and private partnerships for a number of wide-ranging projects that will help it diversify its power mix and help create a sustainable energy future.
Boosting and diversifying supplies

In order to stabilize supply streams, Jordan has also moved to secure replacements for Egyptian gas supplies which were disrupted due to the repeated sabotage of the Arab Gas Pipeline.

In June 2015, Jordan completed the $65 million project to construct the Aqaba New Liquefied Natural Gas (LNG) Terminal, situated at the port of Aqaba on Jordan’s Red Sea coast. The government had tasked Aqaba Development Corporation (ADC) to develop and diversify the country’s energy intake capabilities to ensure a consistent supply of energy fuels such as LNG, LPG and oil.

The Aqaba Special Economic Zone Authority has recently announced that the Kingdom will receive the first shipment of the liquefied natural gas (LNG) via this new specialized terminal. The development of this facility is part of a JD1 billion ($1.4 billion) port development master plan for the years 2005-2030, which is now at its “peak period”.

Several supply agreements are being considered:
● Local authorities are looking to reach an agreement to import around 150m standard cu feet per day (scfd) of gas from Cyprus. The gas is expected to be delivered in LNG form via the Aqaba terminal.

● The government is in talks with British Gas Group to import gas from Gaza offshore waters, where the UK firm has a production concession called Marine Field. Jordan seeks to import 130 to 150 million cubic feet of natural gas per day from the company.

● Jordan reached an agreement with Israel that will allow it to begin importing $500 million of gas for its potash and bromine plants on the Dead Sea from the Tamar field over a 15-year period starting 2016. Jordan had also entered into discussions with Israel on the subject of importing around $15 billion of gas from the neighboring Leviathan field. However purchasing gas from Israel has proved to be politically controversial for the Kingdom, with the majority of MPs voting against this proposal.

● Royal Dutch Shell is expected to start supplying this year LNG to the Aqaba terminal under a five-year agreement with the National Electric Power Company.

● The National Electric Power Company (NEPCO) has recently floated a tender which is seeking offers to buy 59.13 trillion British thermal units of LNG over a period of four years starting in January 2016.

In the medium term, Jordan is looking to lock in supplies from recent gas discoveries in the nearby Eastern Mediterranean.

Oil shale

Jordan possesses one of the largest oil shale reserves in the world with total deposits estimated at 70 billion tons. These deposits underlie more than 60% of Jordanian territory. They include a high quality marinite oil shale of Late Cretaceous to early Tertiary age. The most important and investigated deposits are located in west-central Jordan, where they occur at the surface and close to developed infrastructure.

A series of multibillion projects to generate oil from oil shale and build oil shale-fuelled electricity plants may start operation in the next few years. Jordan has signed several agreements and memoranda of understanding with key international companies with experience in oil shale in order to utilize its reserve of oil shale. According to the government, between 2 and 6 million barrels of oil are expected to be produced from oil shale per day by 2035. Production is expected to start in 2018, initially in small quantities, rising gradually every year to reach significant quantities by early 2020.

One of the projects is by Enefit, a joint Estonian-Malaysian consortium, which plans to produce 553 megawatts of power through an oil shale-fuelled power plant. The $2 billion power plant is expected to be operational at the end of 2018. Under the development
agreement signed with the Jordanian government in 2008, Enefit was granted the sole and exclusive right to develop, design, finance, construct and operate this oil shale fired power station in Jordan.

The following preparation activities for this plant have been completed:

- Detailed geological and hydrogeological studies for understanding in detail the Attarat oil shale and groundwater resources. In total, more than 10 km of oil shale drilling and analyses have been completed and three deep hydrogeological wells drilled,
- A geotechnical program for determining the mine design parameters. A JORC compliant Mineral Resource status has been issued by SRK exploration for the Power Plant Mining Area in 2013,
- Extraction of large oil shale samples which have been used for pilot testing for oil and power projects,
- Completed weather monitoring to collect environmental baseline information over a 2 year period,
- An Environmental Impact Assessment and associated open cast mine approved in 2013,
- Engineering, procurement and construction tender completed in Dec 2013 and Guangdong Power Engineering Corporation was selected as the EPC contractor,
- Mine tender completed for the Power Plant Open Cast mine operation in 2013.

Recently, the price of electricity has been agreed upon with the Jordanian government. Construction can start after the financing contracts have been signed and the due diligence has been carried out.

Other oil shale-related projects include:

- Another major agreement to produce oil from oil shale is the one with the Jordan Oil Shale Co. (JOSCO), which is wholly owned subsidiary of Royal Dutch Shell plc. It was registered in Jordan in 2009 to explore for and evaluate the commercial potential of the deeper layers of Jordanian oil shale. In case of success, JOSCO will use its proprietary "In Situ Conversion Process" (ICP) technology to produce oil and gas. The company is supposed to continue the assessment phase for three years. After that, it will decide on whether to proceed with the development phases. JOSCO entered an initial appraisal phase in 2013. If this and the consequent pilot phase are successful, and the project is deemed viable, JOSCO should potentially start production in commercial quantities in the late 2020s.

- A group of Chinese, UAE and Jordanian companies have shown interest in building a 900-megawat oil shale-fuelled power plant, to be operational in 2017.

- The Jordanian government has signed a contract with Canada-based energy company Questerre Energy Corp to develop oil shale. The latter expressed willingness to invest around $1.4 billion in the project. As part of the deal, the company will conduct studies in
two areas in the south of Jordan to develop oil from oil shale. The firm will start conducting initial technical and geological studies to come up with a feasibility study.

- The Karak International Oil Company is planning to produce 15,000 barrels per day (bpd) of oil from oil shale in 2018 and will go up to 50,000 bpd in 2020.

- Last year, Jordan signed a $2 billion agreement with the Saudi Arabian Corporation for Oil Shale (Sacos) for the right to extract and develop oil shale resources from a 4.2-square mile area of Jordan’s Attarat Umm al-Ghudran region. By 2019, Sacos plans to start producing 3,000 barrels of oil per day from oil shale, with production rising to 30,000 barrels per day in 2025.

It seems however that some of these projects have struggled to attract financing.

**Nuclear**

In January 2007, King Abdullah II announced Jordan's intention to develop a civilian nuclear power program. The kingdom is not known to possess nuclear, chemical, or biological weapons programs, or ballistic or cruise missile systems. The country is a member in good standing of all relevant nonproliferation treaties and organizations, in addition to participating in ad hoc efforts such as the U.S.-led Proliferation Security Initiative. It enjoys a productive relationship with the International Atomic Energy Agency since 1974, the year which it signed the Treaty on the Limitation of the spread of nuclear weapons.

In the 1980s, Jordan signed a number of agreements and protocols with the IAEA covering the Agreement on the Privileges and immunity of the Agency, and the Treaty on Early Notification of a Nuclear Accident and Assistance Treaty in the event of a Nuclear Accident or Radiological Emergency, the Treaty on Nuclear Safety.

Jordan also signed the Regional Cooperation Agreement for Arab States in Asia (ARASIA), to develop research and training in nuclear science and technology, and the Additional Protocol to Safeguards Agreement in the context of treaty limiting the spread of nuclear weapons.

Jordan is a signatory to the treaty limiting the spread of nuclear weapons (1974) and is committed by and calls for the need to create a zone free of nuclear weapons and other weapons of mass destruction in the Middle East.

Jordan's Committee for Nuclear Strategy, set up in 2007, set out a program for nuclear power to provide 30% of electricity by 2030, and to provide for exports. The nuclear law was modified in 2007 to establish the Jordan Atomic Energy Commission (JAEC) and the Jordan Nuclear Regulatory Commission (JNRC), including radiation protection and
environmental roles. JAEC's functions include safety and security, nuclear science and technology, and safeguards and verification.

Nuclear resources

Home to large but unexploited deposits of natural uranium ore, Jordan, which views this resource as a potentially significant source of new revenue, has announced plans to mine them. According to JAEC, discoveries made in recent years show that Jordan has a wealth of important deposits of uranium in a number of regions of the Kingdom. Three general areas of uranium mineralization have been discovered in Jordan: central Jordan, Al Hasa and south Jordan. In fact, it is estimated that there are about 65 thousand tons of uranium reserves in the center of the kingdom, in addition to other amounts being located in areas such as Wadi Al Bahia, and Wadi As-Sahab Al-Abiadh, and Ruweished. It is expected that the rate of production of uranium from the mines of the Central Jordan will be about 2000 tons annually.

The Commission is also working to explore the resources and uranium stockpiles in other parts of the Kingdom, such as Mafraq, Al-Modawarah and Ruweished and Wadi Araba in cooperation with the Chinese company Sino-Uranium and the British-Australian company, Rio Tinto.

Jordan's International agreements, Non-proliferation

Jordan has signed nuclear cooperation agreements and/or memorandums of understanding with France, Canada, the United Kingdom, the United States, Argentina, Japan, China, Russia, South Korea, Spain, Romania, the Czech Republic and Turkey.

A full nuclear cooperation agreement with USA is pending, though the USA wants Jordan to emulate the UAE and rule out uranium enrichment.

A selection of major developments in the nuclear field in Jordan:

Even as the debate over whether Jordan needs to generate nuclear power rages on, work is forging ahead on building an entirely new energy industry to run the Kingdom’s controversial nuclear program. Several agreements were signed in that regard, the most important being:

- While it is estimated that Jordan will be able to export uranium by 2020, for now, the country has set its immediate sights on building a uranium extraction plant and is studying how to recover the heavy metal as a by-product of phosphate production. The Commission signed an agreement with the French company AREVA in September 2008 to explore and extract these resources. Subsequently the Jordanian-French Uranium Mining Company was established which began work in the concession area, the center of the Kingdom (and specifically in the areas of Suwaka, and Khan Zabib). The development of detailed studies of the project and the excavation of trenches and the drilling of wells to determine whether the reserve quantities are accurate have begun.
In December 2009, the JAEC selected a consortium headed by the Korean Atomic Energy Research Institute (KAERI) with Daewoo to build a 5 MW research and training reactor (JRTR) at the Jordan University for Science & Technology in Irbid – the country's first. The $130 million reactor is a version of South Korea’s 30-megawatt Hanaro heavy water reactor with new developed features. Fueled by 19% low enriched uranium, it is slated for completion by 2015. Its fuel will be supplied by the French firm Areva. It will be financed partly by a $70 million soft loan from South Korea, with 0.2% interest rate and repayment over 30 years. The JRTR will serve as an integral part of the nuclear technology infrastructure and will become the focal point for a Nuclear Science and Technology Centre (NSTC) with a key role in educating and training future generations of nuclear engineers and scientists.

In September 2009, the Jordan Atomic Energy Commission (JAEC) awarded a $12 million contract to Belgium's Tractebel Engineering to conduct a siting study for the country's first nuclear power plant. Under that arrangement, Tractebel undertook a two-year survey to assess the proposed site some 25 kilometers south of Aqaba and about 12 kilometers to the east of Jordan's Red Sea coastline. The studies cover public health, safety, and security issues, in addition to conducting specialized surveys to assess geological stability, geophysics, soil characteristics, water proximity and cooling water requirements, risk assessment, electricity grid connectivity, environmental and health impact, and natural and human induced events. Tractebel was selected from six international companies which competed for the site study contract. The Australian consultant Worley Parsons will give advice and technical support to Tractebel. The site had earlier been identified as the preferred site for the plant by JAEC and a technical national committee.

**Plans for Jordan's first nuclear power plant**

Earlier this year, Jordan signed an agreement with Russia that sets the legal basis for building the kingdom’s first nuclear power plant with a total capacity of 2,000 megawatt. The deal was signed with Russia's state-owned nuclear firm Rosatom which will own 49% of the plant at Amra in the north of the kingdom by 2022, giving the Jordanian government a slight majority. The agreement includes the water cooling studies of the plant as well as the revision of the project’s environmental impact assessment.

The power plant, worth US$10 billion, is expected to start operating by 2022, with another one planned to be operating a couple of years later. Under the deal, Jordan must buy fuel from Rosatom for the reactors for 10 years, after which it may seek other suppliers. Construction work on the plant, which includes building two reactors with a capacity of 1,000 megawatts each, is expected to start in 2017. The plant will be provided on a build-own-operate (BOO) basis.

According to the Jordan Atomic Energy Commission (JAEC), the Russian technology was chosen in a very competitive process as it suits Jordan’s needs in terms of power generation and the ability to produce electricity at very competitive prices. It also appears
that JAEC has expressed a preference for Generation III or III+ unit with an option for a second unit with a capacity ranging from 700 to 1,200 MWe per unit.

In terms of the location of the plant, multiple sites have been considered, and the proposed site has been relocated several times. The government first chose a site 25 kilometers south of the Red Sea port of Aqaba but shifted the tentative location to the Mafraka area, 40 kilometers northeast of Amman, citing the proximity to the Kibrit Al Samra power plant for using its wastewater to cool the reactor. The decision to relocate the site was taken by Tractebel, which has concluded that the seismic padding required to build on the original site near Aqaba would have led to additional costs of about 15%.

The site then changed to Qasr-Amra in Al-Azraq province, about 70km south east of Amman. In April 2014 an expert team from the International Atomic Energy Agency (IAEA) visited the region to evaluate studies on the proposed site, which is some 70 km from the cooling water source at Samra, and well away (100 km) from a fault line. This choice faces substantial resistance from local tribes and environmental activists, who are concerned about the impact of the reactors on the local Bedouin lifestyle and economic system.

Obstacles

Of course, all these projects have been met with opposition from the Parliament, various environmentalist groups as well as skeptics who claim that Jordan can push for safer alternative energy sources. They argue that there are significant obstacles such as:

● The country is earthquake prone and water poor, which poses major environmental challenges to the development of a nuclear energy program.

● Since nuclear power is highly capital intensive, requiring enormous up-front investment, Jordan may also find acquiring a nuclear power plant financially prohibitive. The proposed bilateral cooperation between Jordan and Russia is based on the Build-Own-Operate model, which aims to facilitate the acquisition of nuclear power in newcomer countries like Jordan. It is not yet clear how Jordan would finance its nuclear project.

● Well-educated and skilled workers form the base for any robust industry. For nuclear in particular, a well-trained workforce is vital. Jordan possesses few trained personnel and a limited nuclear research and education infrastructure, though the country is working to address this challenge. Several Jordanian universities, such as the Jordan University of Science and Technology, the University of Jordan and Balqa Applied University started nuclear engineering or related degree programs in support of the budding nuclear program. Furthermore, a number of Jordanian students were sent on scholarships to study and train on nuclear engineering in countries like South Korea, Russia, China, and France. More students will be dispatched in the near future.

● Despite nuclear energy being significantly cleaner than that of fossil fuels, what’s Jordan going to do with all that nuclear waste?
• According to some experts, Jordan’s economic and geopolitical profile pose added challenges that are either underestimated or completely overlooked by JEAC.

• Another challenge is the limited size of Jordan’s electricity grid. An addition of two large nuclear reactor units of about one gigawatt of power each would cover a large part of Jordan’s generation capacity, even after including the increase in electricity demand over the next decade.

• Public disapproval and emerging security threats represent serious risks that could force the Jordanian government to suspend or cancel the nuclear project. In such a scenario, the kingdom would incur substantial financial and reputational loses, while also missing out on opportunities to invest in increasingly promising renewable energy resources.

Renewables

The National Energy Strategy 2007-2020

In order to reduce dependence on fuel imports, successive Jordanian governments started exploring alternative sources of energy. Guided by the National Energy Strategy established in 2007, they decided to place more emphasis on the utilization of renewable energies and energy efficiency. The strategy includes other recommendations on energy conservation such as grant exemptions to energy-saving vehicles, exemption of solar water heaters from sales tax, implementation of building code regulations that conserve energy and the creation of national award for rationalization of energy consumption. The share of renewable energy in the total energy mix is anticipated to reach 7% by 2015 and 10% by 2020.

Unlike many other countries in the region, Jordan implemented a legal framework to support its renewable energy targets. Indeed, the biggest boost to the renewable energy sector came with the passing, in April 2012, of the Renewable Energy Law aimed at facilitating investment in the renewable energy sector.

The Renewable Energy and Energy Efficiency Law (REEL)

Established under Law No. 13 of 2012, the Renewable Energy and Energy Efficiency Law was created to make Jordan a recognized regional leader in sustainable energy implementation and to facilitate scaling-up of renewable energy and energy efficiency to meet the energy needs of Jordan, in accordance with the National Energy Strategy and National Energy Efficiency Action Plan.

The Law sets out a number of measures for the use of renewable energy in the country including the following:
The establishment of a regime whereby private companies (local and international) can bypass a competitive bidding process and negotiate directly with the Ministry of Energy and Mineral Resources to establish new projects in the field. The Law permits an unsolicited or direct proposal submission, where investors can identify and develop renewable grid-connected electricity projects using renewable energy sources and propose these to the Ministry of Energy. This excludes sites and projects that are being developed through a public tender.

The Renewable Energy and Efficiency Law also requires the national utility company (NEPCO) to purchase electricity from renewable energy projects and for the government to cover the cost of grid connection. The law also provides tax exemptions and incentives on equipment used for renewable energy projects.

At the end of 2012, the country’s Energy Regulatory Commission introduced feed-in tariffs for renewable energy projects. This is the first feed-in tariff to be implemented in the Middle East.

The new law also provides for the establishment of “the Renewable Energy and Energy Efficiency Fund” dedicated to supporting projects and initiatives that aim to reduce energy consumption and/or utilize renewable energy sources. Funded by state and international donor agencies such as the French Development Agency and the World Bank, private investors, both domestic and international, are eligible to apply for loans and grants to finance small and medium-scale projects that rely on renewable energy or are designed to increase the country’s energy efficiency.

**Developments in renewable energy in Jordan**

Jordan sees adopting renewable energy as an urgently needed economic step, since imported energy currently represents around 96% of the total consumption in the country. Like other Arab countries lacking major energy resources, Jordan is facing negative reactions from the public concerning its fuel and electricity subsidy policies, especially if this support decreases in light of the high percentage of these expenses on limited-income household budgets. The renewable energy program is thus a perfect option for Jordan, which is still lacking in hydrocarbon resources, in addition to its water shortages.

Concerns regarding the energy crisis in the last few years have also led to the creation of several organizations promoting the renewable energy sector in Jordan, most notable of which is the Jordan Renewable Energy Society.

As a consequence of all these concerns, Jordan’s Ministry of Energy and Mineral Resources called, in May 2011, for investors to submit expressions of interest (EOIs) for installing 1,800 MWs of renewable energy plants. Out of these, 1,200 MW will come from wind energy, 600 MW from solar power and 30-50 MW from waste-to-energy facilities. These plants will be linked to the grid by 2018 and be brought online by 2020. A large number of local and international companies showed interest in this scheme and approached the government with different projects.
The government has issued so far 3 rounds of requests for proposals from renewable energy developers.

In round I, the Jordanian Government, represented by National Electric Power Company (NEPCO), signed Power Purchase Agreements (PPAs) with twelve developers under the direct proposals submission to generate 170MW of solar power energy to the grid.

Jordan then launched phase II and III under the direct proposal submission to generate an additional 650MW of solar and wind energy. This second procurement was launched in August 2013. The deadline to submit an expression of interest was May 15, 2014. This round was restricted to solar photovoltaic and wind projects. The project size for solar photovoltaic projects was 50 MW. A range of 50 to 100 MW megawatts applied for wind farms.

Jordan launched phase III in February 2014 while it continued to collect proposals from the second round and negotiate with developers whose projects were accepted in the first round. This round was restricted to solar photovoltaic projects. The project size was 100 MW.

All qualified applicants must enter into a Memorandum of Understanding with the Ministry of Energy & Mineral Resources agreeing on the electricity tariff for any project the applicant builds. The electricity tariff included in the proposal must be a fixed tariff expressed as an amount per kilowatt hour and be within an acceptable range consistent with reference price list. The Electricity Regulatory Commission issued a new reference price list in January 2014.

The launch of the second and third round prior to the completion of the first round surprised the market, but it showed the sense of urgency Jordan feels to reduce energy imports. Several renewable energy projects with a total capacity of 500 megawatts are already being implemented and will be operational in 2015. The Kingdom is thus on track to realize its strategy to increase renewables' contribution to the overall energy mix to 10%.

Also, small-scale installations of renewable energy systems for houses, mosques and hospitals is also on the rise, and the total capacity of such projects stands at 30 megawatts at present.

Renewable energy sources

Renewable energy in the Kingdom can be divided into the following categories:

1. Wind
2. Solar
3. Bio
4. Hydro
5. Thermal
There are several solar projects in which the government is currently involved. One example is the solar energy project for the generation of electricity through photovoltaic cells. Wind energy is also on the agenda. Bio energy, on the other hand, is one of the smallest contributors to the renewable energy sector in Jordan. To the best of our knowledge, there is only one company that is presently working on the treatment of organic waste for the production of bio energy.

► Wind

Jordan has significant wind energy resources that could be potentially exploited for power generation. The country's Wind Atlas indicates that wind speeds in Jordan are as high as 7.5 meters per second (M/S), especially in the northern and western regions and are up to 11.5 meters per second in hilly areas. There is therefore potential for several hundreds of megawatts of wind power installations around the Kingdom. Two wind pilot projects exist in the county with a capacity of 1.5 MW. They have been running since early 1990.

Several new projects are underway or planned. They include:

● The Tafila Wind Farm is a 117 MW project being developed by a consortium of Jordanian and International Companies (Jordan Wind Project Company PSC-JWPC). Located in Tafileh, 180km southwest of Amman, the farm is expected to be commercially operational in the last quarter of 2015. JWPC is a joint project between InfraMed (50%), Masdar in Abu Dhabi, UAE (31%) and EP Global Energy (19%). The $285 million project is the first private wind project to reach financial close in the Middle East and North Africa region outside of Morocco.

The Tafila wind farm was granted around $221 million worth of loans to fund this project from the International Finance Corporation (IFC) - the World Bank’s investment institution in the private sector. The European Investment Bank (EIB), the Eksport Kredit Fonden, the OPEC Fund for International Development (OFID), the Europe Arab Bank and the Capital Bank of Jordan also participated in financing the project.

● The Maan wind project: Jordan has selected the Spanish EPC group Elecnor to construct the Maan wind farm project. The $112 million initial contract includes the engineering, supply and construction of the farm which is scheduled to come on stream in 2016. The project will be financed by the Kuwaiti fund which has recently agreed to raise the generating capacity from 66 MW to 80 MW. Furthermore, seven new turbines will be added to the earlier planned 33.

● Fujeij wind project: the contract for the 90 MW project, which is being developed Korea Electric Power, dates from a 2010 tender. The project was built on a build, own and operate (BOO) basis, with the developers signing a Power Purchase Agreement (PPA) with national power utility NEPCO.

► Solar
Jordan lies in earth-sun belt area and has vast solar energy potential with average solar radiation ranging between 5 and 7 KWh/m²; one of the highest figures in the world. The country, with an estimated 330 days of sunshine per year, is also blessed with relatively moderate temperatures and low dust and humidity levels: ideal conditions for the use of solar energy.

Decentralized photovoltaic units in rural and remote villages are currently used for lighting, water pumping and other social services (1000 kW of peak capacity). In addition, about 15% of all households are equipped with solar water heating systems. As per the Energy Master Plan, 30% of all households are expected to be equipped with solar water heating system by the year 2020.

Jordan is expected to install a total of 298 MW of solar PV capacity over the next five years, and the government is planning to build a new high voltage transmission line connecting Jordan’s south with the large electricity consumption in the north. This would allow for another 300 MW of solar PV to be connected.

A large number of solar-run power generation plants are planned or under execution. The most important are:

- **Shams Ma’an Power Generation**: a 52.5-MW solar photovoltaic facility is being executed in the Ma’an Development Area. Once fully operational, the $150 million solar farm project, which is being developed by Shams Ma’an Power Generation, will have the capacity to generate 160m KWh of electricity per year, enabling it to provide power for around 35,000 homes. The initial power purchase agreement (PPA) is set to run for 20 years, after which Shams Ma’an and its US partner, First Solar, will be able to renegotiate the terms of their deal with the government and the National Electric Power Company (NEPCO). Ma’an Developing Area will host most of the solar power plants in phase I and III.

- **Solar-run power generation plant in Ma’an**: the $24 million solar-run power generation plant will have a 10-MW capacity and will also be located in the Ma’an region. The project is being implemented by a joint Jordanian-Spanish-South Korean venture, Arabia One for Clean Energy Investments.

- **Solar-fuelled power plant will be located in Qweira**: Jordan has prequalified 15 local and international companies to build a $150 million 65-75 megawatt solar-run power plant which will be located in Qweira in the southern Governorate of Aqaba. The project will be funded from the $5 billion Gulf Cooperation Council grant. However, the Abu Dhabi fund has very recently agreed to expand the capacity of the Qweirah solar cells from 65-75MW to 100MW. The project is currently waiting for technical and financial offers from companies competing for the scheme, assuming the tender will be floated in October 2016.

- **Falcon Maan for Solar Energy**: construction of a 21 MW solar farm in Maan in the south of the country, at a cost of $51 million.
• JOAN 1 solar project: this 100 MW solar plant is to be located in Ma’an. The project will be the world’s largest concentrated solar thermal power plant using direct solar steam generation. In 2009, California-based company Ausra was selected as the solar steam boiler supplier. Construction was due to start in 2011 and the project was expected to be operational by 2013. However, the project has been put on hold for now.


• A selection of private solar power project:

- Work under way on a 3.2 MW solar power plant in Ayla Oasis, a large touristic project in Aqaba on the Red Sea. The power generated will be used to operate the seawater pumping station that feeds a chain of lagoons at Ayla’s project in Aqaba. The developer also plans to produce more solar energy on site with a capacity of 2.6 MW to power desalination, irrigation and water circulation at an 18-hole golf course currently under construction. With this addition, the total capacity of the two phases will reach up to 5.8 MW, making it the largest private renewable energy project in the region.

- A plan to put solar panels at all 6000 mosques in the country was announced in February 2015.

- Jordan inaugurated its first solar-powered charging station for electric cars in February 2012. Located at El Hassan Science City (EHSC), the station is considered the first step towards promoting solar-powered vehicles and building more solar-charging facilities on the streets of Jordan.

►Biogas

Jordan has potential to utilize biogas from solid waste for electricity generation. A successful 1 MW pilot project using municipal solid waste (MSW) through landfill and biogas technology systems was constructed and commissioned in 2001. The project was expanded in 2008 to about 4 MW. Jordan plans to introduce about 40-50 MW waste energy power projects by 2020.

►Hydropower

Hydropower resources are very limited in Jordan. The country’s only hydropower plant is the King Talal Dam with 7 MW installed power capacity which generates 25 GWh of electricity annually. Hydropower turbines with total rated capacity of 6 MW were also installed at Aqaba Power Station using the available head of returning cooling sea water. Various studies show an additional hydro resource potential of 400-800 MW could be
exploited from the 400-meter elevation difference between Red and Dead Seas through the proposed Red-Dead Sea Canal project.

Geothermal

Studies by Jordan’s Natural Resources Authority have found medium and low geothermal waters along the Dead Sea rift valley. Small geothermal resources are also utilized in aquaculture. Recently, this resource was investigated by a consulting firm to evaluate the techno-economic potential of geothermal energy for power generation. The results of the study showed that further deep drilling (up to 3,000 meters) is required in order to judge on the techno-economic feasibility of this resource, where a Road Map showing the required actions and costs was developed for this approach.

Implication of international donors

- Jordan recently launched several EU-funded renewable energy and energy efficiency demonstration projects. The nine projects, launched as part of the Renewable Energy and Energy Efficiency Programme and worth 6 million euros in grants, represent the first EU support programme to the energy sector in Jordan. Some of the projects entail raising awareness on renewable energy at public schools and using renewable energy solutions to generate power. Other projects include renewable energy usage in hospitals and the healthcare sector. Initial implementation of the demonstration projects, which cover several development sectors, started in February 2015, with a time frame ranging from 12 to 30 months. They are implemented by a variety of partners, and cover different areas in the Kingdom, including the Jordan Valley, Wadi Araba and main cities.

- The kingdom’s renewable electricity plans received a major boost at the end of last year when the European Bank for Reconstruction and Development (EBRD) and the French Development Finance Institution, PROPARCO announced they would provide loans totaling $100m for solar energy projects.

- During a GCC summit in December 2011, Saudi Arabia, the United Arab Emirates, Kuwait and Qatar decided to extend $5 billion in financial aid to development schemes in Jordan over a five-year period, with each state contributing $1.25 billion. Part of this assistance will go to the energy sector.

- The Multilateral Investment Guarantee Agency (MIGA), the political risk insurance and credit enhancement arm of the World Bank Group, is backing the development, construction and operation of four solar power projects in Jordan, adding 50 megawatts of clean, renewable energy generation capacity to the country’s grid.

The Jordanian electricity grid issue

The capacity of the Jordanian grid is presently limited. It stands at 3,200 megawatts (MW) and can only accept another 500MW. Last year, the government cancelled plans to accept proposals to build five wind-run power plants with a total capacity of 400 MW due to the grid’s inability to absorb additional loads. It also cancelled plans to accept proposals
to build four renewable energy power plants with a capacity of 100MW each over limited
grid capacity.

However, Jordan’s renewable electricity plans received a major boost when the Ministry
of Energy and Mineral Resources announced at the end of 2014 that the country will
expand the capacity of the national electricity grid by 1000 MW using part of the loans
and grants received from international donors such as the European Bank for
Reconstruction and Development (EBRD) and the French Development Finance
Institution. Furthermore, a $310 million grant was recently extended to Jordan during the
World Economic Forum by China’s Hanergy firm to expand the national grid’s capacity.
These funds will help open the door for more renewable energy projects.

Expanding the grid is a very important issue for Jordan’s plan to pave way for more
renewable energy projects and will help implement the country’s strategy.

**Market entry**

The Hashemite Kingdom of Jordan is a rapidly developing country with an untapped
potential. It is regarded as a politically safe and stable country having emerged relatively
unscathed out of the Arab Spring. However, in addition youth unemployment and a large
government budget deficit, the country has recently been burdened with having to deal
with a substantial influx of referees from Syria. Jordan remains nonetheless an attractive
home base for businesses in the Levant as well as the entire MENA region. Its economy
will continue to grow and prosper due to its progressive business environment.

Jordan has a well-educated and skilled workforce and a strong and stable banking
system. The country Jordan is best described as an open-minded society, especially
when compared to the neighboring Gulf States. The large majority of business people are
very fluent in English and business is usually family-oriented. The capital Amman is also
a hub for doing business in Iraq. A large number of Iraqi companies have their base in
Amman and it can be an ideal location to conduct business for Belgian companies unable
to travel into Iraq.

There are many opportunities for Belgian manufacturers and suppliers to export to the
Jordanian market. Ongoing and future energy projects will require everything related to
the industry, with needs ranging from technology to equipment to consultancy services.

The market is open but not limited to: wind energy equipment, solar cells and panels,
wind turbines and blades, generators, support structures, energy software management,
specialized consultancy services, etc. Demand for domestic solar power systems is also
growing rapidly as homes and small to medium sized businesses have begun taking
advantage of Jordan’s Renewable Energy Law. Indeed the implementation of this law,
which allows residential and commercial entities to generate 100% of their electricity
needs using PV systems, was a turning point for the Kingdom’s renewable energy sector.
The Jordanian market is best entered by working with a local agent, distributor or partner as they have a better understanding of its specificity and have the relevant business connections. International companies can however bid directly on projects. Although Belgian products and services are highly regarded on the market, our presence is still not significant enough. There is therefore room for the introduction of new Belgian products and services and particularly in the renewable energy field.

Conclusion

Jordan is expected to witness continued economic growth and improvement in living standards, which will drive demand on energy and electricity by 5.5-6.5% in the coming years. Even with the new LNG terminal in Aqaba and other programs to diversify Jordan’s energy sourcing, the country may still struggle to keep up with the demand for power, driven by a demographic boom and the influx of hundreds of thousands of Syrian refugees.

With the government planning to eliminate electricity subsidies by 2017, it will want to have a cost-effective source of power in place by that time to try to keep price shocks to a minimum. This will help minimize the flow of price increases to the public and lessen their impact on the economy. The country thus needs to invest in its oil shale, natural gas and renewable energy sectors to meet rising electricity demand.

The government has undeniably realized that the energy challenge is one of the main issues facing the Kingdom, and that making affordable energy solutions available is crucial to support industries, trade and investments, and realize sustainable growth. It has therefore already started focusing on the sector by generating different types of energy projects and will continue to do so during the next decade. There are no easy or cheap solutions but it seems that Jordan is on the right track.

With all of these power, energy and mining projects in the works, Jordan is certainly teeming with investment opportunities. And although challenges remain, most notably securing financing and keeping up with the pace of demand, the sector should see major growth in the next two decades.

Therefore, this is a prime opportunity for Belgian manufacturers and suppliers of energy equipment and technologies to export their products. As Jordan continues working hard toward achieving its goals, the industry’s future looks bright in the kingdom.