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RENEWABLE ENERGY PROSPECTS IN JORDAN

October 2014

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Context

Jordan has very limited domestic fossil fuel sources and has traditionally imported nearly all of its energy and fuel requirements. The country imports 96% of its oil and gas, which accounts for nearly a fifth of GDP. Over 80% of energy was imported via the Arab Gas Pipeline (AGP) which transports natural gas from Egypt to Jordan, leaving the economy severely vulnerable to external shocks. Indeed, these imports were disrupted and later completely halted due to regional turbulence and repeated acts of sabotage, forcing the government to convert most of the power plants to highly expensive imported diesel heavy fuel and diesel oil. This has led to accumulated losses of about US $ 5 billion during the past three years.

In addition, the demand for electricity has increased significantly due to population growth, the influx of refugees as well as increased per capita consumption and is expected to double by 2020 and triple by 2030.

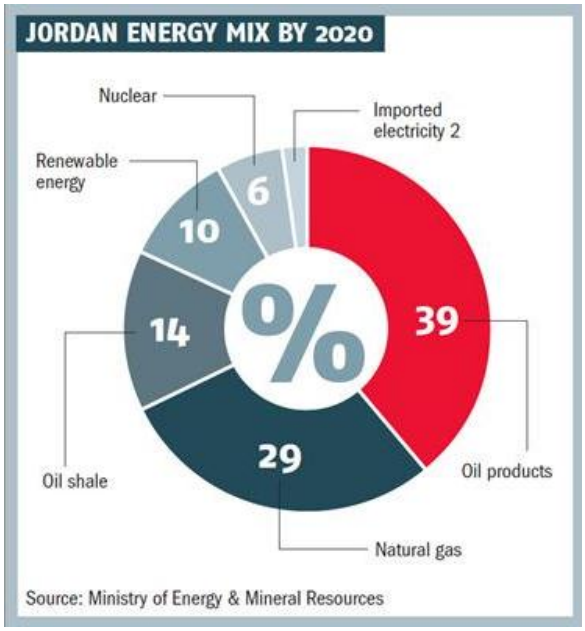
The harshest reality facing the Jordanian economy today is that energy remains, and will continue to be, the biggest challenge facing sustainable economic growth and development. Its dependence on fuel imports has forced the government to reconsider the country's energy consumption policies and address the issue of reliance on international energy markets for direct imports.

The National Energy Strategy 2007-2020

In recognition of these problems, successive Jordanian governments started exploring alternative sources of energy. Guided by the National Energy Strategy which was established in 2007, a new energy mix is on the horizon for 2020: 29% of Jordan's energy needs are to be met by natural gas, 14% from oil shale, 10% or 1,800 MWs from renewable energy sources and 6% from nuclear energy.

In the meantime, the government has launched a gradual removal of subsidies for gasoline, diesel, fuel oil and kerosene. This was driven in part by a strategy to liberalize Jordan's energy markets as well the need to alleviate the financial burden to its economy caused by rising oil prices.

This energy strategy seeks to increase dependence on local energy sources, from the current 4% to 25% by 2015, and up to 39% by 2020. Placing more emphasis on the utilization of renewable energies will attempt to remove reliance on the traditional energy sources, especially oil which is imported from neighboring countries. This will also be paralleled with the reduction of energy produced from oil from 58% currently to 40% in 2020. 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 Renewable Energy and Energy Efficiency Law (REEL)

With the push for nuclear power losing steam, and oil shale continuing to be riddled with uncertainties, the attention has shifted to renewable energy and energy efficiency which have dominated local headlines recently. Unlike many other countries in the region, Jordan has 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 Law sets out a number of measures for the use of renewable energy in Jordan 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.

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.

The legislation will be instrumental in supporting Jordan's drive to increase the share of renewable energy sources in the Kingdom's energy mix from approximately 2% actually to 7% by 2015 and 10% by 2020.

Away from the legislative front, a number of new agreements have been signed over the past couple of years; the most important being the pact signed in 2013 between the government of Jordan and "Masdar", Abu Dhabi's renewable energy company. The framework agreement details a collaborative plan for Masdar to strategically engage in Jordan's transition from hydrocarbon reliance to a more diversified and secure energy mix. The new accord has two main components: facilitating competitive tenders for renewable energy projects for Masdar in Jordan; and creating a public-private partnership between the two parties, allowing the Kingdom to consult directly with Masdar on the viability of domestic projects and leverage its expertise in the delivery of those projects.

Renewable Energy Prospects

The plan calls for up to 1,200 MW of wind, 600 MW of solar and 50 MW of waste-to-energy to be brought online by 2020. All renewable energy projects are to be linked to the grid by 2018. A large number of local and international companies have shown interest in establishing wind and solar plants in Jordan. According to industry sources, over 60 expressions of interest were submitted within the past couple of years to the Ministry of Energy. Out of these, around half passed the qualification criteria which requires the company to be financially sound and to include references of past experiences such as previous completed projects and financial track records. Memorandums of Understanding (MOUs), valid for a period of 12 to 24 months, were in fact signed with 30 prequalified domestic and foreign companies in May 2012. They will cover up to 1GW of solar and wind projects scheduled to be developed over the next five years. As the majority of Jordanian companies fail to meet this particular requirement, many have opted to partner up with foreign companies.

Amman had set a 3 phases to increase the locally produced renewable energy input. A first call for expressions of interest was launched in 2011. Submitting proposals for PV projects was scheduled for April 2013, for wind, early 2014 and for CPS mid-2014.

In the first round, 12 agreements were signed. These projects will generate 470 gigawatt hours per day and will cost US $560 million. They are expected to be completed and connected to the grid in 2015.

A second call for expressions of interest phase was launched in the summer of 2013 and bids were submitted in November 2013. This phase involved only wind and solar projects with a priority given to projects that will be realized in the North and east of the country. Among the bidders, 23 companies were prequalified and 24 were accepted under certain conditions. The Ministry of Energy and Mineral Resources

(MEMR) has recently decided to extend the deadline for EOI submissions for this stage to October 31st, 2014 instead of September 30th, 2014. The Ministry will then make a final selection of four companies among the 23 pre-qualified for projects of 50 MW each.

The third phase, which applied to wind projects and solar projects of 100 MW each and which was launched in February 2014, has recently been cancelled for the time being.

In the request for expressions of interest (EOIs), the Jordanian government has set out general guidelines or instructions to investors:

- Priority will be given to photovoltaic projects from 5 to 10 MWs and solar thermal projects from 25 to 50 MWs "in order to meet the interest of a large number of investors and to comply with the commercial applications of such projects and the similar experience required by the Law";

- Larger projects will be considered but they "will need to demonstrate their clear superiority in terms of technical and financial aspects in order to be accepted" in addition to compliance with the Law;

- Projects which generate energy for domestic consumption will be awarded priority over export projects. Projects based on exports will be considered on a case-by-case basis and priority would be given to export projects based on regional / international initiatives;

- Project developers that are successful in passing the EOI stage will receive a Memorandum of Understanding (MOU) from the government. This will enable the project developer to proceed with measurement campaigns, feasibility studies and other preparatory and due diligence work such as negotiating access to land and financing for the proposed project. Upon completion of the MOU process, the applicant will be required to submit a full and committed direct proposal to the Ministry of Energy.

Several financing programs have also been launched to support renewables and energy efficiency including:

- The allocation of approximately $300 million from the Gulf Cooperation Council soft loan package to Jordan for supporting renewable energy projects;

- Launch of a public-sector energy efficiency fund together with German finance institution KfW to the tune of 30 million Euro to support efficiency measures on 700 public buildings;

- Mobilization of the European Bank for Reconstruction and Development (EBRD) in Jordan with a partial focus on supporting renewables;

- The launch of micro-loans through the Development and Employment Funds for small scale systems;

- The placement of emphasis on renewables for projects supported by the Governorate Development Fund;

- The creation of the Renewable Energy and Efficiency Fund and its seeding with some $7 million in grant funding.

Renewable energy sources

Solar energy

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.

At present, 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. They contribute up to 1% of the total energy consumption at present. In May 2012, a 280 kilo watt solar electricity system was inaugurated to be used at El Hassan Science City.

As per the Energy Master Plan, 30% of all households are expected to be equipped with solar water heating system by the year 2020. The government is hoping to construct the first Concentrated Solar Power (CSP) demonstration project in the short to medium term and is considering Aqaba and the south-eastern region for this purpose. It is also planning to have a solar desalination plant. According to the national strategy, the planned installed capacity will amount to 300 MW – 600 MW (CSP, PV and hybrid power plants) by 2020.

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.

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.

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.

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.

Major renewable energy projects

Solar projects

- A $150 million solar-fuelled **power plant** is planned in **Al Qweira** in the south of Jordan. It will have a total capacity of 65 MW. The Ministry is currently in the process of assessing financial and technical offers submitted by several international companies and the winning bidder is expected to be announced soon. The plant, to be financed by the Abu Dhabi Fund, should be connected to the grid by the end of 2015 and will be built on the basis of engineering, procurement and construction.

- Jordan's first photovoltaic solar plant is being developed by the local company **Philadelphia Solar** in partnership with some of the world's leading renewable energy companies. Located in Mafraq, the US $ 23 million plant, which is expected to be operational in mid-2015, is set to generate around 10-megawatts per hour, as long as solar radiation is available. Radiation hours per year at its location are 1,700 hours, minus the nights and the cloudy days in the winter. Established five years ago to produce photovoltaic modules that generate electricity from the sun, Philadelphia is the country's first company to be given the green light to establish a power plant that operates on a commercial basis through a direct proposal.

- **Arabia One** is a 10 MW solar PV power plant located in the Ma'an Development Area ("MDA"), with an estimated project cost of US $ 30 million. All output generated by the project will connect to a newly built substation in MDA and will

be sold to Jordan's National Electric Power Company ("NEPCO") under a 20-year Power Purchase Agreement ("PPA"). The project is pending approval. The location was chosen by the government for being one of the locations that receive the highest solar radiation in the world, with levels up to 2,200 kWh per square meter.

Arabia One is co-owned by a consortium including Korean conglomerate Hanwha, Spanish renewable energy company Ennera (part of the CAF group), and Arabia Trading and Consulting (part of Arabia Group), the local partner.

- The US company First Solar and its affiliated Shams Ma'an Power Generation consortium have signed an agreement to provide engineering, procurement and construction (EPC) services for the 52.5 megawatt (MWAC) **Shams Ma'an photovoltaic (PV) power plant** in the southern governorate. The company has also finalized a long-term operations and maintenance (O&M) contract for the project. The project has already secured a 20-year power purchase agreement (PPA) with the National Electric Power Company (NEPCO), which acts as Jordan's chief power generation and distribution authority.

  The US $150 million power plant, which is expected to begin in early 2015, will be the largest PV facility in the Middle East. When it is completed, in 2016, the facility will supply an estimated 160 million kilowatt hours (kWh) of electricity per year, sufficient to power over 35,000 average homes in the country or the equivalent of 1% of Jordan's annual energy output.

  The project is part of the ambitious Ma'an Development Area (MDA) initiative, some 220km south of Amman.

  The Shams Ma'an solar PV project is a joint venture of Solar Ventures, Kawar Group and First Solar.

- **Adenium** comprises 3 x 10 MW solar PV power plants (Zahrat Al Salam, Al Ward Al Joury and Al Zanbaq) located in the Ma'an Development Area ("MDA"), with an estimated project cost of US $ 30 million for each individual project, leading to a combined project cost of US $ 90 million. All output generated by the Projects will connect to a newly built substation in MDA and will be sold to Jordan's National Electric Power Company ('NEPCO') under a 20-year Power Purchase Agreement ('PPA').

- **Falcon Ma'an** is a 21 MW solar PV power plant located in the Ma'an Development Area (MDA. All output generated by the Project will connect to a newly built substation in MDA. The total project cost is estimated at US $ 50.2 million with a proposed IFC loan of approximately US $ 17.5 million for IFC's own account and a syndication of up to US $ 20 million.

- Banks, hotels and hospitals in Jordan have submitted requests to the government for permits to build renewable energy power stations to reduce costs. The ministry is currently discussing technical and financial details with the Private Hospitals Association (PHA), the Jordan Hotel Association (JHA) and the

Association of Banks in Jordan, all of which announced plans to build such power stations as follows:

- The Jordan Hotel Association is planning to build a 30 MW renewable energy power station in the Dead Sea area to serve hotels there;
- The Association of Banks in Jordan intends to build a 40 MW renewable energy power plant;
- The Private Hospitals Association proposes to construct a 15 MW plant that utilizes renewable energy.

These stations, when operational, will cover about 80 to 100% of the needs of the hotels at the Dead Sea, banks and hospitals in the private sector.

- Jordan is in discussions with Masdar, Abu Dhabi's renewable energy company, to build a solar and wind power plant with a total capacity of 1,000 MW in the Kingdom. The two sides are expected to sign a memorandum of understanding related to the project by the end of this year. The total volume of the project is to be announced later as progress in its implementation is directly linked to securing financing to expand the capacity of the national grid to absorb new capacities from renewable energy projects.

  Indeed, the Jordanian government has recently cancelled plans to accept proposals to build four new renewable energy power plants with a total capacity of 100 MW each. They stated that they could not secure the funds to expand the capacity of the national grid to absorb the load of these projects. They then started talks with Gulf Cooperation Council states to allocate part of the US $ 5 billion grant extended to Jordan for renewable energy projects but have not yet received their approval. The grid's capacity stands at 3,200 MW at present and can take in another 500 MW. According to the government, at this time, it can only absorb the loads of the plants which have already been signed.

  Studies were launched in 2013 in this regard. They determined that an investment of JOD 360 million or approximately US $ 504 million is needed by 2025 (short term: JOD 130 million, medium term: JOD 80 million and long term: JOD 150 million). NEPCO will also develop a "green corridor" in order to reinforce the electric grid. The project was initially planned for 2015 but it seems that it will not be operational before 2018.

Wind projects

Jordan has signed memoranda of understanding with 22 local and international companies to build wind-run power plants. The companies had until the end of May of this year to submit their technical and financial offers for building the plants. The government then planned to select six companies out of the 22. Each of the six companies will build a 50 MW wind-run power plant.

In the meantime, several other wind projects are planned or under construction such as:

- A 65-75 megawatt **wind power plant in Maan** has recently been awarded to a Spanish engineering firm. The US $ 112 million power plant is expected to be operational by the end of 2015. The project includes the installation of 33 wind turbines with a rated power of 2 MW each from the Spanish company Gamesa. It is expected to produce more than 150 megawatt hours of clean electricity per year. The scheme is financed by a grant from the Kuwait Fund for Arab Economic Development.

- Construction work on Jordan's first large-scale wind power plant, an investment worth US $ 292 million has recently started. The 117 MW **wind farm** located **in Tafileh**, 180 km southwest of Amman, is expected to be commercially operational in the last quarter of 2015. The wind power plant will then be connected directly to the National Electric Power Company grid and provide almost 400 GWh of electricity per year, enough to meet the energy needs of over 150,000 Jordanians. The scheme is being developed by Jordan Wind Project Company (JWPC), an investment by InfraMed, Masdar and EP Global Energy Ltd. JWPC awarded a contract to the company Vestas to install turbines for the project.

  Project financing was provided by a group of international financial institutions and banks including the International Finance Corporation, the European Investment Bank, Eksport Kredit Fonden, OPEC Fund for International Development, FMO, Europe Arab Bank and the Capital Bank of Jordan (ANSAmed).

- Two other wind projects: Al Khamsah (30 – 40 MW) and Fujeij (90 MW), which were tendered a while back, have failed to progress and are awaiting government approval due to inherent weaknesses in project planning. Fujeij had been awarded to Korea Electric Power Corp for US $ 187 million.

  Furthermore, the Jordanian government has recently cancelled plans to accept proposals to build five wind-run power plants with a total capacity of 400 megawatts (MW). The ministry called off the projects due to the grid's constraints and inability to absorb more loads.

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, although sluggish for the past couple of years due to regional instability, 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 in particular will need everything related to the renewable energy industry including technology, equipment and consultancy services.
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 has significant short-term energy challenges As the Kingdom has very limited fossil fuel resources, the need for energy from renewable sources is critical. By seeking to increase their share, the government hopes to decrease the country's dependence on international fuel prices, to enhance security of supply and to shift patterns of energy supply and demand into a more sustainable direction. Unlike some of its oil rich neighbors, the government has taken clear steps towards encouraging the development of renewables by implementing a regime devoted to the regulation of the renewables sector.

Despite these positive developments on the legislation level, developers still have some hills to climb and obstacles to overcome. According to energy experts, in order to realize their vision, Jordan should adopt the following strategies:

- Remove all obstacles and facilitate on-going projects,

- Provide more clarity on the tariffs for electricity produced from renewable sources and set different rates for certain regions,

- Encourage technology innovation by way of pilot projects, competition, research and development and community based projects,

- Engage rural communities,

- Commit to a phased approach based on good economics and technology innovation involving an investment program that exploits the cost and technical potential of each RE technology option,

- Engage the national and international community to build a support network of policy makers and financiers that are genuinely interested in the future of RE in Jordan.

Foremost, Jordan imperatively needs to increase the capacity of its grid in order to absorb new and planned energy projects.

Even with these obstacles, it is only fair to state that Jordan has entered a new phase of renewable energy development as there has been significant progress in the implementation of clean energy systems in Jordan, with active support from the government and increasing awareness among the local population. The kingdom has the potential to become a regional energy hub characterized by political as well as economic stability. Belgian companies active in this field should therefore take more interest in this developing market as there are many opportunities awaiting them.