

EGYPT: BUILDING THE FOUNDATION FOR RENEWABLE ENERGY INVESTMENT



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With a population of over 78 million (99% of which has access to electricity), Egypt is the 16th most populous country in the world. It has depleting oil reserves,ⁱ more plentiful natural gas resources,ⁱⁱ and impressive wind and solar potential. Egypt is also strategically located as a transportation hub and has electricity interconnections with Jordan, Syria, Iraq, Turkey and Libya.

Electricity demand is increasing at about 7% annually and is expected to continue to grow at this rate for the foreseeable future. Egypt's peak electricity demand reached 21,330 MW for the fiscal year 2008/2009 (fiscal year June-July).ⁱⁱⁱ Under Egypt's five-year plan (2007/2008–2011/2012), Egypt intends to add 7,750 MW of power generation capacity to meet the expected average annual demand growth rate of 6.38%. For the five-year plan (2012/2013–2016/2017) an additional 11,100 MW will be needed to meet the expected average annual demand growth rate. Thus Egypt is looking to a portfolio of resources to increase supply, including rapid addition of thermal plants, most of which are combined cycle gas.^{iv} In January 2010, the Egyptian government announced that it was considering constructing five IPPs, with a total capacity of 3,500 MW. Recently built combined cycle plants include Cairo North (1,500 MW), Nubaria (1,500 MW), Talka (750 MW) and El-Kureimart (750 MW).

At the same time, Egypt has some of the highest greenhouse gas emissions in the world. The Arab Forum for Environment and Development states that rising sea waters risk shaving 6% off Egypt's gross domestic product, while UN studies indicate that possible flooding of 4,500 square kilometres of agricultural land in the Nile Delta would cost \$35 billion. To address the dual issues of demand and emissions, Egypt is taking impressive steps to develop its considerable renewable energy potential.

The regulatory system was designed in 1998, while the Egyptian Electrical Utility and Consumer Protection Regulatory Agency (EgyptEra) became operational in 2001. Movement appears ongoing towards both regulatory strengthening and price rationalization, which are needed to make Egypt's renewable resources more cost competitive and therefore attractive to private investors in the long term. In the RE field, EgyptEra has prepared itself over the last few years to ensure sound regulatory frameworks and its capacity to address an influx of new renewable energy projects.

This profile reviews how Egypt is moving towards this goal by examining (1) Egypt's resource potential; (2) the application of and adjustments made to the regulatory framework to encourage use of RE potential; (3) the incentives used as interim steps until the RE market is developed; and (4) the crucial role of the regulator in helping to bring these goals to fruition.

Existing RE generation and potential penetration in Egypt's energy mix

Egypt's wind and solar energy potential has been mapped and appears substantial. Two-thirds of the country's geographic area has a solar energy intensity of more than 6.4 kWh/m²/day. In some areas of the country, such as the Red Sea coast, the wind speed approaches at least 10 m/sec.^v The country has set a target of reaching 20% of its energy mix from renewables by 2020 (primarily hydro and wind) and 50% by 2050.

In order to understand the work of EgyptEra to ready itself for RE penetration, it is important to review the background of the Egyptian energy market and the various RE strategies and initiatives now in place. In brief, the Egyptian Electricity Holding Company (EEHC) continues to own over 90% of Egypt's generating capacity and transmission and distribution also remain a monopoly under the EEHC umbrella (which includes six generating companies, nine distribution companies and one transmission company). Generation facilities have been built using the build, own, operate and transfer (BOOT)/IPP model. Egypt has a long history of using the BOOT model; in fact, the Suez Canal was financed using this approach. Sidi Kiri, a 683 MW natural gas power station, was the country's first IPP. Using a 20-year PPA BOOT approach, the project was awarded to InterGen in 1998 and commercial operation began in 2002. Additional facilities were built at Port Said and the Gulf of Suez using similar models.^{vi} In 1996, a law was enacted allowing foreign entities to own power stations, but (flowing from nationalizing of electricity assets in 1962) most remain under the publicly-owned EEHC.

With respect to renewable resources, approximately 11.2% of Egypt's power comes from hydropower facilities, the first of which was built in 1960. This facility, the Aswan Dam, was constructed to control the Nile water discharge for irrigation. In 1967, the 2.1 GW High Dam hydropower plant was commissioned, followed by the commissioning of the Aswan 2 power plant in 1985, the commissioning of the Isna hydro power plant in 1993 and that of Naga-Hamadi in 2008. Power generation from gasification of sewage sludge in waste water treatment plants is already being used (for example, the El-Gabal El-Asfer 23 MW plant), with a potential generation of 1,000 MW from agricultural waste.

Less than 1% of Egypt's current energy mix comes from wind, despite an abundance of wind resources, particularly in the Suez Gulf area: Western Egypt (west bank of the Nile), Kharga region, Eastern Egypt (east bank of the Nile) and the Gulf of Aquaba area.^{vii} As of 2008/2009, Egypt's New and Renewable Energy Authority (NREA), the authority affiliated with the Ministry of Energy that manages Egypt's clean energy portfolio, has installed 425 MW of wind power, including a wind farm at Zafarana. Zafarana has been operational since 2004 and has a capacity of 360 MW, where wind averages 9 meters/second. Egypt has registered Zafarana as a CDM project. Though wind penetration is small at present, Egypt's experience with wind projects goes back 20 years, with a plant of installed capacity of 405 MW. Various studies indicate that electricity generated from wind resources represents the best opportunity for Egypt's RE to reach competitive prices with electricity generated from oil and gas. Similarly, solar penetration is negligible (though undergoing radical advances), though Egypt receives some of the highest solar radiation in the world (up to 3,000 kWh per square meters per year) and 96% of the country is desert, making it a prime location for use of this resource. More than 20 years ago, Egypt issued a ministerial decree requiring all houses in new communities to utilize solar water

heating systems. About 500,000 square meters of such units were installed, modest relative to Egypt's neighbors (for example, Jordan installed 6 million square meters and Israel installed 3 million square meters). Solar heating for hotels was required beginning in the 1980's, but implementation was retarded by the large demands of four and five star hotels, dust covering the solar panels (reducing their efficiency), and hard water causing calcification in the piping. In addition to maintenance difficulties, the high initial investment needed for these projects has proved a difficulty in bringing additional solar to market. Commercial operation of the first solar thermal power plant at Kureimat should begin soon.^{viii}

Egypt faces considerable challenges in bringing wind and solar energy to market and is tackling many of these issues through advances to its regulatory framework, which is supported by various market actors, including the regulator. These challenges include:

- At present, Egypt has some of the lowest retail prices for electricity (from fossil fuels) in the world, making the challenge to make renewable energy cost-competitive all the greater.
- One challenge with the current system lies in the fact that oil and gas are subsidized upstream, with the transmission company, which buys from generators and then redistributes power to distribution companies, buying electricity at a low rate. Given that fossil fuels, absent recognition of societal costs and externalities, remain less expensive than renewable alternatives, these oil and gas subsidies exacerbate the distortions in the market, making renewables uncompetitive.
- The Ministry of Finance also provides social subsidies, distorting market signals to end users and discouraging conservation.
- Renewable energy projects also tend to have intensive capital costs (often requiring technology and parts not produced in Egypt). Solar, which uses some of the most expensive kinds of technology, is particularly vulnerable to the price differential.
- Most renewable energy sources have low power intensity, presenting problems for the power system, which is currently structured with centralized plants, and requires the use of distributed generation.
- With regard in particular to harnessing wind resources, many high wind speed resources are concentrated in discrete and/or state-owned land areas, requiring attention to land use regulations.

The importance of Egypt's RE focused regulatory framework and its RE prepared regulator

The regulator plays an active role in realizing Egypt's RE potential and many steps have been taken in the last five years to integrate RE as a more significant part of Egypt's energy mix.

Among the most important of these are the Renewable Energy Strategy, the draft Electricity law, the Renewable Energy Fund and efforts to bring a feed-in tariff into force for smaller RE projects. In all these efforts, the regulator has contributed its expertise and sector know-how to drive forward reform and prepare itself for RE integration.

The Renewable Energy Strategy of 2008 marked a vital step in this effort, setting a target of reaching 20% of total electrical energy mix from RE including hydropower by 2020. Taking into account current hydropower capacity (and projections for that hydropower), it is expected that 12% of contribution from renewable energy sources other than hydropower will need to be added by 2020 (i.e., equivalent to installed capacity of 7,200 MW). The Strategy identifies concrete steps, including large pilot implementation of solar projects and electrification of rural areas, development of mini and micro hydropower plants with capacity of less than 100 MW, assessing potential for geothermal, and developing 1,000 MW of biomass from agricultural and municipal waste. The Strategy also promotes the local manufacturing of RE equipment, including incentives for activities supporting localization of RE technologies. As part of its efforts to implement the Strategy, EgyptEra coordinates with Egypt's Industrial Modernization Center (IMC), which is responsible for direct contact with manufacturers.

Initially under review in 2007, a proposed new Electricity Law is now “under ratification” and includes important market reforms, such as the establishment of an independent operator, shifting from the single buyer to a bilateral market, third party access, and priority dispatch for power generation from renewable energy sources. The proposed Law, while not final, is expected to pass largely in its current form. Considerable work has already been done by the regulator and others to ensure the draft Law's framework is supported upon adoption. In sum, there are four avenues by which RE is now incentivized in Egypt; these are reviewed below.

- **Plants built through competitive bidding:** Under this approach, the grid operator will issue tenders requesting power supply from RE sources, directed at large size installations (such as a 250 MW wind farm). These tenders will be designed to: control the increase in RE capacity such that it matches the capacity of the transmission system and the capacity of the market to absorb the new RE; increase local manufacturing; increase private investment; drive down cost; and provide the investors with guarantees through long term PPAs. The goal is to reach 2,500 MW in capacity through long terms PPAs, in blocks of 250 MW, targeting large international developers with strong financial status and high capacity for technology transfer. Evaluation criteria will include additional points for a high share of locally manufactured components. EgyptEra's role with respect to the competitive bidding process is to review power purchase agreements, issue licenses, help the investment review process, and auditing.
- **Feed-in tariffs for smaller RE projects:** Feed-in tariffs will be introduced for smaller capacities (less than 50 MW installations), again with a goal of reaching 2,500 MW capacity, and will work in parallel with the competitive bidding process. The tariffs are to be set for 15 years, and development of the tariff design and PPA contract is underway. As with the competitive bidding process, EgyptEra's role is to review power purchase agreements, issue licenses, help the

investment review process, and audit projects.

- **The Solar initiative.** Recognizing the natural resource potential, the Egyptian government has identified the growth of solar energy as a priority. Solar energy can benefit from the recently adopted European directive (2009/28/EC), which enables European countries to build renewable plants in a third country, providing that electricity will be physically exported to Europe. There are currently two regional solar initiatives that Egypt will be able to participate in, the Mediterranean Solar Plan and Desertec, though both are inhibited by existing transmission capacity limitations. To accelerate the establishment of solar power implementation and mitigate the lack in transmission capacity in the short and medium terms, Egypt may need to consider alternative methods. One such option would be to export the natural gas quantity equivalent to the electricity generated from RE sources, while using the actual generated electricity from RE domestically. Under the solar initiative, a registered and internationally recognized logo will be issued by the regulator which accredits solar energy consumers, offering holders better financing terms, export advantages and potential tax credits. Interested consumers will voluntarily commit themselves to consume up to 5% of their electricity from solar energy. A Solar Energy Trader, or “SET,” will be established to consolidate the committed inquiries and contract suppliers through long term PPAs to satisfy these demands. SET will be owned and operated by a financial institution(s); committed consumers can have shares in SET, while suppliers cannot. Transactions will be conducted according to a feed-in tariff which will be a pass through cost to consumers. EgyptEra is expected to play a prominent role:
 - Issuing the solar energy logo/certification
 - Developing a committed consumer register
 - Setting up mechanisms to guarantee consumer payments through electricity supply contracts and transactions between SET and distribution or transmission networks operators
 - Licensing SET and monitoring its operation to ensure transparency, free competition and nondiscrimination
 - Issuing the solar feed-in tariff, approving the PPAs and ensuring their transparency
 - Licensing the solar energy producers; issuing certificates of origin
 - Ensuring third party access and priority of dispatching
 - Ensuring exemption from transmission or distribution fees as well as energy banking as a requirement for Public Social Obligation (PSO) of network operators

- Dispute resolution
- Hosting a steering committee of representatives of the stakeholders; the committee would promote the initiative among different business communities and refine the initiative as well as follow up the progress of the initiative
- **Projects led by the New and Renewable Energy Authority (NREA).** Established in 1986, NREA is both a national agency for developing and planning the technology transfer and a developer that must seek and receive a license from the regulator in order to operate its new facilities. Construction is being completed on an integrated solar combined cycle power plant with 9,150 total MW, 30 MW solar) at Kureimat, with \$327.5 million financing capacity from the World Bank using the Global Environmental facility to offset the cost differential between solar and thermal resources, and support from the Japanese Bank of International Cooperation and the National Bank of Egypt. In February 2010, NREA signed an agreement with Masdar to build a 200 MW wind farm on the east.^{ix}

The draft Electricity Law also envisions a Renewable Energy Fund, derived from the state public budget, endowments, donations, grants and investments, which will provide support to purchase electricity from plants using renewable energy. The Fund would cover: full or partial deficit between the RE cost and market prices; exchange rate risk; guarantee of transmission company payments; financial support to pilot projects; and research and development of renewable energy technologies locally. The Fund would be financed by the state budget, some amount of the subsidies that currently go to existing energy industry, donations and ultimately investment of Fund money.

These policy and regulatory advances are matched by conditions that make Egypt particularly likely to fulfill its RE objectives: a track record of bringing large investment, relatively large and stable economy for the region, transport corridor location and potential; and its place as a leader in the region, making it able to spearhead regional initiatives, such as a Mediterranean super grid that would facilitate export of RE.

ⁱ In 2007, Egypt produced 664,000 barrels of oil per day (bbl/d) continuing its fall from a high of 950,000 bbl/d in 1995. <http://www.eia.doe.gov/cabs/Egypt/pdf.pdf>

ⁱⁱ Production and consumption of natural gas production more than quadrupled over the period 1995–2007 and continues to rise with a total of 1.9 trillion cubic feet (Tcf) produced and 1.3 Tcf consumed in 2006, making Egypt a net gas exporter. Id.; http://www.iisd.org/pdf/2009/bali_2_copenhagen_egypt_wind.pdf

ⁱⁱⁱ <http://www.moee.gov.eg/english/e-fr-main.htm>. See also <http://www.eia.doe.gov/emeu/cabs/Egypt/Electricity.html>

^{iv} Energy Information Administration, <http://www.eia.doe.gov/cabs/Egypt/pdf.pdf>

^v PowerPoint presentation, Renewable Energy Strategy for 20/20 and Regulatory Framework, provided by EgyptEra, May 2010.

^{vi} See <http://www.eia.doe.gov/emeu/cabs/Egypt/Electricity.html>

^{vii} <http://www.windatlas.dk/Egypt/About.html>; http://www.iisd.org/pdf/2009/bali_2_copenhagen_egypt_wind.pdf

^{viii} <http://www.eia.doe.gov/emeu/cabs/Egypt/Electricity.html>

^{ix} Other authorities include the Hydropower Projects Authority, the Rural Electrification Authority, the Atomic Energy Authority, the Nuclear Power Plants Authority and the Nuclear Materials Authority.