

**5th World Wind Energy Conference & Renewable Energy Exhibition
New Delhi, India, 6-8 November 2006
presented by WWEA and InWEA**

Paper to the conference proceedings

**Integrating Wind Power in Africa:
Case Studies of Morocco and Egypt, Africa's Wind Pioneers**

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Abstract: Unless key local stakeholders are brought together in a well-coordinated framework of action, experience has often shown that concessionary sources of financing and export credit packages have done very little in terms of local capacity building and industrial integration in the wind energy sector. When domestic employment figures become irrelevant compared to the hefty investments involved, ignoring local capacities when developing new wind power projects can often be counter-productive. Notwithstanding the financial impact of outsourced servicing on individual projects, incentives to further wind developments are generally met by grid size limitations. Displacing energy dependencies from hydrocarbons to actual wind turbine imports cannot be a long term solution. Developing a more sustainable, socially acceptable energy industry is what most developing countries currently seek when facing their rather bleak energy future. Integrating local capacities is fundamental to that objective and donor countries are welcome to contribute in making the renewable wind energy economy, initially pioneered by their own small companies, hold these promises in enabling the very same industrial and socio-economical benefits to apply in the developing world.

Morocco's Wind Energy Program

A specific earlier effort by ONE to try to jumpstart large on-grid wind power projects was the unveiling in 1997 of a plan to develop a wind farm concession scheme, similar to the one that existed in Tarifa Spain, to be located in the northern part of Morocco, across the Gibraltar straits where the wind regimes are very high (Koudia Al Baida site). Consequently, a 50 MW wind farm located at this site has been developed by a concessionaire, and ONE committed that it would: a) grant 20 years of operation to the developer; and, b) offer a long-term PPA and at the end of this period, the facilities would be transferred to ONE. This process was designed to introduce competition into project development in order to help ONE move electricity sector liberalization efforts forward. The Koudia Wind Park entered production in the year 2000 and has been supplying on average about 1.3 % of Morocco's electricity demand.

Building upon the above experience, ONE launched a series of consultations for the deployment of two large wind farms in the 150-200 MW range under concession schemes. Unfortunately, the results of the bidding process for those concessions proved to be higher

than expected (in terms of wind electricity KWh price) and since the renewable energy tariffs scheme conceded by ONE on the Koudia Al Baida wind power concession were already high, it was argued that – if allowed to proceed – the project would undermine the efforts currently led by ONE to gradually liberalize the Moroccan electricity market, starting in 2005. Since no mechanisms have been developed by ONE for recovering these losses, the company – which already lacks competitiveness on the sales price of its electricity, in part as a result of the intense financial pressure it has been enduring in order to support a very ambitious rural electrification program – finally dropped the proposed private wind park concession tendering. After several years of an enriching wind project preparation experience, the bids were officially dropped in February 2003.

An important element of ONE's strategy has been to strengthen its ownership of wind energy technology through a concrete wind project preparation/implementation cycle. A smaller 3.5 MW demo wind park called "parc éolien modèle" has been built in the same area as the larger 50 MW Koudia wind concession. This demo wind park, which is made of 7 Enercon E-40 500 kW wind turbines (financed by the German KfW¹), has been in operation since the year 2000 and has enabled ONE to get familiar with the day-to-day operations and management of wind parks.

Within the above context, the national utility company, decided to move forward and develop two major wind projects; a 140 MW farm in the northern part of the country (Tangiers), and a 60 MW farm in the Center (Essaouira). The wind farms will bring ONE's total wind electricity capacity to 253 MW. Since ONE disposes of concessional sources of financing of its own, it has decided to carry out the development of these wind parks alone, avoiding the production under concession scheme that was chosen for the initial 50 MW Koudia wind farm. While the studies are almost complete, the scheduled tendering for building the Essaouira 60MW wind park (financed by the German KfW), was issued in November 2004 with construction following thereafter, in order for the park to enter service at the beginning of 2007. Concessional financing has been obtained by ONE through a joint German KfW and a European Bank of Investment for the Tangiers 140 MW wind farm in the northern part of the country (Tangiers). The scheduled tendering for building the Tangiers 140MW wind park has been issued and the wind park should enter service as soon as bidders have been selected.

Thus, it can be argued that these recent on-grid wind electricity developments in Morocco have been a trial and error process at best. Nevertheless, the above learning-by-doing approach can be credited with having established a setting within which all local actors are now eager to explore – with targeted donor assistance – on how past experiences can be consolidated and new and innovative schemes explored with a view to really jumpstarting a commercially self-sustaining wind-electricity sector in pure private sector terms. However, unless key local stakeholders are brought together in a well-coordinated framework of action, with a measure of catalytic support, there is a strong chance that private sector led wind electricity development could actually work against the ongoing sector liberalization, rather than advancing it. Experience has often shown that government efforts at energy sector reform do not succeed without adequate donor and private sector interest and without taking into account operational challenges and realities. By removing institutional, regulatory and market barriers and developing a large-scale wind farm using an integrated and comprehensive approach such as envisioned in the large scale Sahara Wind Energy Development Project, can act as a catalyst to help align private sector activity with ongoing government reforms.

¹ http://www.one.org.ma/html/m2_01_04.htm

Egyptian Wind Energy Program

In Egypt, many years ago universities and development centers along with local industries were developing wind turbine prototypes larger than the 100 kW size range. The Red Sea coast of Egypt has one of the highest wind potentials worldwide. During the mid 80's a test centre with a 5,2 MW demonstration wind farm was built in Hurgada. Within the above context, the Egyptian authorities (a little earlier than the Moroccan utilities) decided to build several wind projects in the Zafarana region by importing Wind Turbines and have them financed through concessional sources of financing. With a total capacity of 140 MW installed at the end of 2005, these projects have been split in the Zafarana region to be financed respectively by the KfW and the Danish development agency DANIDA. During 2006 a project with 85 MW financed in cooperation with the Spanish government was commissioned. Currently there are two further projects of 120 MW each in the negotiation process, one with Japanese support and another one financed by DANIDA. Hence in terms of machines used, the program started with 105 x Nordex N 43 600 kW (55 x KfW and 50 x DANIDA), 117 x Vestas V47 660 kW (72 x KfW and 45 x DANIDA), 100 x Gamesa G 52 850 kW (Spanish financing) and 94 x Gamesa G 52 850 kW (KfW Phase IV).

Needless to say that with the growing size of the individual wind turbines whose technology is less likely transferable and the saturation of Egypt's smaller electricity grid to further wind developments, the Egyptian utility has prevented any industrial integration from taking place, displacing some of the country's energy dependency from hydrocarbons to actual wind turbine imports, while making their servicing rather costly. Further large scale extensions in Egypt should integrate these considerations as they are related to the maximization of costly energy investments and the sustainability of the wind energy sector in developing countries overall.

Conclusions

If lessons are not drawn from the aforementioned to develop a comprehensive more sustainable approach, Morocco's utility may be led to follow the very same path, while most wind turbine components can be easily integrated, as the Moroccan industry (alike the Egypt) already manufactures, assembles and exports a variety of manufactured goods such as preassembled control cables, electro-switching equipment, transformers, spares, automobiles etc...

Ideally it should be argued that in the region's current energy sector reform liberalization, new and innovative schemes ought to be explored with a view to really jumpstart a commercially self-sustaining wind-electricity sector in pure private sector terms.

Although the Saharan trade winds that extend from Morocco through Senegal represent some of the largest wind energy potentials available on earth, their erratic nature undermines any optimal utilization possibilities to the extent that only a marginal proportion of that wind energy can be fed into the region's weaker grids infrastructure. While exhaustive clean energy generation perspectives are considerably reduced, this also prevents any industrial integration and economic development from taking place locally on a significant scale. Thus, a conventional approach to wind energy developments to feed smaller local electricity markets cannot enable a viable wind energy industry to be established which could have been essential for tackling the regions economic challenges currently under pressure from Sub Saharan African migrant populations. Indeed, a large renewable energy industry accompanied by many social benefits and job creations could actually improve the region's economics

particularly as it would be based on the sustainable utilization of one of the world's largest wind energy resources.