Wind energy in Lebanon, a personal experience

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Wind energy in Egypt has started in the mid 1990s with the Zaafarana wind farms generating a capacity of 225 MW, and operated by the Ministry of Electricity and energy NEW and the Renewable Energy Authority (NREA). More recently, Egypt has been requesting tenders for the implementation of a 200 MW Wind Farm at the gulf of El-Zayt. In Jordan, the Central Electric Power Generation Company operates 2 pilot wind farms: A 320 KW farm in Ibrahimia, established in 1988, and a 1.2 MW plant in Hofa. Jordan has accepted bids for a 40 MW wind farm in Al-Kamshah, near Jerash, and is conducting a feasibility study for the establishment of a 200 MW wind farm in Al Harir and a 150 MW in Al Maan. In Syria, wind speed studies have been conducted, but until now there are no large wind farms. In Lebanon, there are many small wind size projects operating, but no wind farms. In this paper, we will review our experience in small wind size projects implemented by our team of ***Altaka-Albadila*** *during the past 18 months.*

The first project executed by our team was in Dibbiyi, above Saadiyat. It consisted of a hybrid wind/solar system for residential applications (see Photo 1). Two wind turbines were installed, each of 2 KW output, each turbine is equipped with 3 blades, made of fiberglass, and with a diameter of 3.2 meters. The height of each supporting pole is 9 meters. We did not conduct wind studies, but we consulted with the meteorological center at Beirut's airport, and according to Dr. *Khodari* the wind speed was on average about 3 meters per second. This uncertainty led us to propose a hybrid wind/solar system, as to cover both possibilities: In case there in no wind, power generation would come from the solar panels, and vice versa. Therefore, we installed in addition to the 2 wind turbines, 10 solar panels, each of 160 Wp, monosilicon. The controller and inverters were hybrid as well and electricity was stored in a bank of batteries: 20 batteries 150Ah/12 V each, sealed, maintenance free. The system is working fine, except for one episode of malfunction of one wind turbine generator, due to an eroding of the electric wire inside the generator, which was easily repaired. It should be noted that the wind turbines are spinning around 60% of the time.

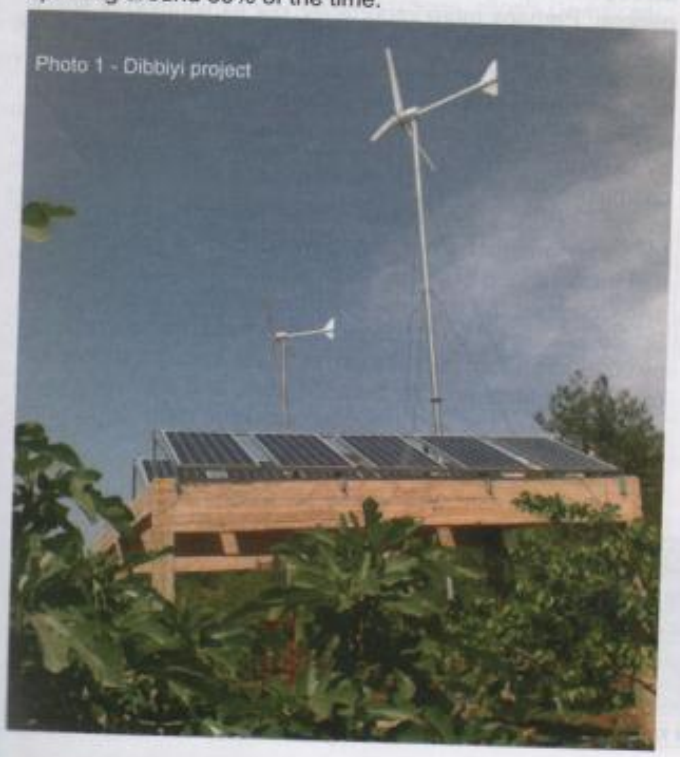

Photo 1 - Dibbiyi project

The second project was implemented in Ksara, near Zahle in the Bekaa Valley region. Here, the nature of the terrain did not allow us to use the tubular pole, so we had to locally manufacture a 12-meter high lattice tower for the 2 KW wind turbine (see Photo 2). We applied for legal permission from the Civic Authority and the municipality; we were told that there are no laws available in this regard. The head of the municipality encouraged us to go ahead with the project, although he could not give us a written authorization. Again, we opted for a hybrid wind/solar system. We added 5 monosilicon solar panels, 160 Wp each, and connected the DC generated power from the solar panels, and the 3 phase AC generated electricity from the wind turbine to the same hybrid controller and hybrid inverter. We used 10 deep cycle batteries: 150-Ah/12V, sealed (maintenance free) to store the electricity. We are now looking for an interactive inverter that could shut off the power from the grid when the batteries are fully charged. In this case, the customer was looking to end his subscription to the local street generator, and to become independent; the owners of the local street generators are selling the 10 Amps for US$ 100 per month to cover a power outage of 6 to 8 hours per day. The system is working fine, and it should be noted that the wind turbine did no spin most of the nights, and wind speed during the months of September and October was not enough to rotate the blades. The owner stated that during those 2 months it was spinning only 15 to 20% of the time. This proves that installing hybrid systems in low wind speed areas is required. However, during the month of August, the customer used to disconnect the power from the EDL (Electricité Du Liban) grid around 10 hours, 3 days per week, in addition to covering the frequent power outage.

Photo 2 - Ksara project

The third wind project we've implemented was in Rahbi, Akkar. This was the only case study where a 1-KW wind turbine was installed (see Photo 3) without any solar panels. A wind speed study covering 18 months had revealed an average daily wind speed of 6 meters per second. In Photo 3, you can see the mast with the anemometer in the background. The study of wind speed was performed by Global Wind Energy (Mr. *Cesar Nahas*). The wind turbine in this case was installed for lighting outside the Wedge Dairy factory. The blades are spinning most of the time. We encountered a serious problem during installation, as the wind generator took fire and burned, but was replaced very quickly, and the system is running in a very efficient manner for the past 3 months.

Photo 3 - Rahbi, Akkar project

If you travel all across Lebanon, you will see small wind turbines installed by various individuals, which indicates an active search for a remedy to the frequent power outage and power failures of the public grid.

What can we conclude from our limited experience in installing small wind turbines in Lebanon?

a- Site selection is important and we should rely on wind speed data. We have at present a wind atlas of Lebanon 5-10 N Syria, with a resolution of 2 km, and at 60 and 120 meters in height. This should enable us to make a better choice on site location, and should enable us to select few areas for real data measurements with masts, anemometers, and dataloggers, although this would take 12 months at least.

b- The return on investment, and the payback period is still long for small size wind turbines. ROI is faster with the installation of large size wind turbines: Starting from 4 MW.

c- We need a batteryless system, and here we need legislations for feed-in tariff. We have translated some of those legislations and submitted to the Committee for Energy a draft law project for this purpose. This feed-in tariff legislation-proposal was also handed to the minister of Energy and Electricity. However, as long as the grid is unreliable, and power outage is frequent, the feed-in tariff will not be efficient.

d- Lebanon is still behind in renewable energies when compared to his neighbors. However, several parties are interested in installing wind farms, and we sense a change in the Lebanese public opinion.

e- When we discuss with a potential customer the cost of wind turbine installation, we always mention the cost of destroying the environment, climate change, and the increase in pollution, but it falls most often on deaf ears.

f- Most Lebanese want to have a wind turbine installed on top of their roof. It is difficult for them to accept that it might induce structural damage, and that it is not recommended at all.

g- The government does not offer any incentives, on the contrary, we have to pay a 10% VAT tax on the imports of wind turbines.

h- A wind farm can and should be implemented in Rahbi, Akkar as the wind studies have been performed. The Egyptians have opted for a government operation and ownership: This would negate laws for connecting to the grid, land ownership, and purchase power agreement. It is easier to finance the project when the government is in charge, and it is much easier to get financial help, soft loans, low interest, and long grace periods. The data from the Zaafarana projects are here to prove this approach.

It is our hope that we could be involved with the installation of a wind farm in Lebanon, which is becoming an urgent matter in light of the current electricity crisis we're facing. ■

References are available upon request

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بدأ إستعمال وتطبيق تقنيات توليد الطاقة من الرياح في مصر منذ منتصف تسعينات القرن الماضي مع مزارع طاقة بواسطة الرياح في الزعفرانة ذات قدرة إنتاج تصل إلى ٢٢٥ ميغاواط تقو
بإدارتها وزارة الكهرباء والطاقة بالتعاون مع سلطة الطاقة المتجدّدة. في الأردن تقوم شركة توليد الطاقة الكهربائية المركزية بتشغيل مزرعتي طاقة بواسطة الرياح تجريبيّتين، الأولى في
الإبراهيميّة بقوة ٣٢٠ كيلوواط أنشئت في العام ١٩٨٨ والثانية في الحوفه بقوة ١,٢ ميغاواط. إستقبلت الأردن أيضاً عروضات لبناء مزرعة طاقة بواسطة الرياح بقوة ٤٠ ميغاواط بالقرب م
جرش. كما تقوم بدراسات لإنشاء مزرعتين بقوة ٢٠٠ و ١٥٠ ميغاواط. لم تُقم أية مشاريع طاقة رياح كبيرة في سوريا حتى الآن على الرغم من إجراء دراسات لسرعة الرياح في البلد. أ
في لبنان فتنتشر العديد من مشاريع الطاقة بواسطة الرياح الصغيرة مع غياب أية مزارع طاقة رياح. سيتناول هذا المقال خبرة فريق شركة «الطاقة البديلة» في مجال مشاريع الطاقة بواسط
الرياح الصغيرة الحجم التي طُبّقت وأنشئت في الأشهر الـ ١٨ الماضية.

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