Renewable Energy Hybrid System for OGERO Telecom Station in Lebanon

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1. Abstract

This report will present a hybrid wind-solar renewable energy pilot project, installed in June 2008 for OGERO TELECOM, to replace a 25KVA diesel generator.

2. Project Description:

"Future Power" the Committed Company:

Future Power is an experts company at designing, procuring, and installing renewable energy systems.
Future Power has been providing clean, reliable, renewable energy to major companies and government facilities. They were the first to deploy a fully hybrid system for Ogero Telecom in Lebanon; as they focus on hybrid systems.

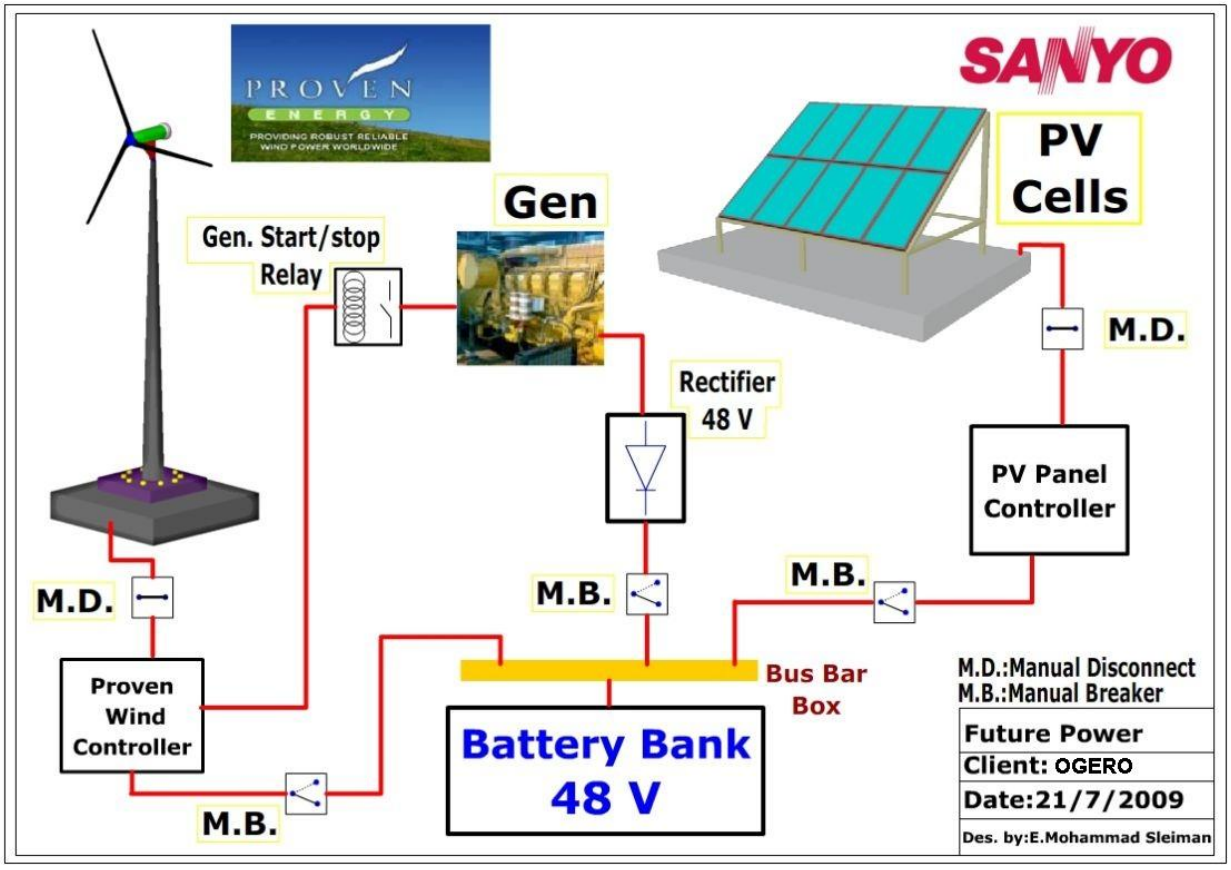
Future Power specializes in residential and industrial systems of 50 watts to 45 kilowatts output, including:

1. Renewable Energy Systems Design and Installation (solar and wind)
2. Large-Scale Uninterruptible Back-up Power
3. High-Efficiency Appliances
4. Power Quality Enhancement
5. Whole Systems Integration

They were the first to deploy a fully hybrid system for Ogero Telecom in Lebanon, in Ain Hazir between Zahle and Tarshish; in one of its stations in Mount Lebanon.

The Pilot Project:

A 6kW Wind Turbine and 10x205W PV Solar panels, replacing a 25KVA diesel generator that kept running all years round is the project's core.



Project Information:

Country	Lebanon
Location/City	Ain Hazir
Address	Ain Hazir between Zahle and Tarshish
Building Type	Telecommunication Center
Start	June 2008
Duration	6 weeks
Project cost	50,000 $
Roughness of Terrain	Mountain
Height above sea level	1400 meter
Average Wind Speed 10m ref. height	5.5m/s
Latitude / Longitude	33°52'N / 35°50'E

Site overview:

This site in Tarshish was one of the first of its kind for a telecom Site with hybrid system, on such height of 1400meter over sea level, with speed up to 120km/h with high turbulence. The turbine was selected by OGERO TELECOM to reduce the annual spend on electricity as well as help promote a greener environment.

This project was the first of its kind in Lebanon and helped opening the door for further wind turbines up and down the country. Since this installation has reduced number of solar PV.

PV Solar system:

The PV panels used in these projects are from SANYO, HIT205, 10 modules are used, each can deliver 210 Wp, thus yielding a 210*10 = 2.1kWp

The total price is:

10 * 1300 = 13000$

The price of the MPPT charger was 800$.

Wind Turbine system:

The used turbine is one of the most robust and efficient turbines in the world.

The PROVEN 6 Wind turbine generator has a rated output of 6000W at 48V D.C.

The price of this turbine was 20,000$.

Technical Specification:

Rated kW output (at 12m/s): 6kWp

Cut in wind speed: 2.5m/s

Cut out wind speed: N/A

Blade Diameter: 5.5m

Rotor Thrust: 10kN

Noise @ 5m/s: 45dBA

Hub Height (center): 9m

Head Weight: 500kg

Tower Weight: 360kg

Main foundation Dimensions: 2500mm x 2500mm x 1000mm.

Battery storage system:

Type: Gel

QTY: 12 Batteries

Capacity: 200Amps

Price: 10000$.

Expected life span: 10 years

3. Economic Feasibility Study

Load-Supply Description:

Load

Equipment detail sample loads	Operating (Hours/day)	Estimated Load (KW)
Radio (Telecommunication) Equipment	24	1.5
Room Lights	8	0.08
External Lights	8	0.12
Tower light	12	0.4
Fire Fighting System	24	0.024
Total Load peak		**2.13**

RE Supply

The PV and Wind Turbine system can deliver a maximum of 2.1 + 6 = 8.1 kW.

However, due to low wind speed, the system can deliver approximately 3~4 kW as average.

Thus the excess of energy goes to charge the batteries, that can supply load during night and low wind speed conditions, and to dump loads if necessary.

Compound annual growth rate:

Compounded Annual Growth rate (CAGR) is a business and investing specific term for the smoothed annualized gain of an investment over a given time period. CAGR is not an accounting term, but remains widely used, particularly in growth industries or to compare the growth rates of two investments because CAGR dampens the effect of volatility of periodic returns that can render arithmetic means irrelevant. CAGR is often used to describe the growth over a period of time of some element of the business, for example revenue, units delivered, registered users, etc.

Since in our case we don't have revenues, thus we can't find the CAGR.

Net Present Value (NPV):

In finance the **net present value** (**NPV**) of a time series of cash flows, both incoming and outgoing, is defined as the sum of the present values of the individual cash flows of the same entity.

Time value of money:

The time value of money is the value of money figuring in a given amount of interest earned over a given amount of time. The time value of money is the central concept in finance theory.

For example, $100 of today's money invested for one year and earning 5% interest will be worth $105 after one year. Therefore, $100 paid now or $105 paid exactly one year from now both have the same value to the recipient who assumes 5% interest; using time value of money terminology, $100 invested for one year at 5% interest has a future value of $105.

Return on Investment (ROI)

The internal rate of return on an investment or project is the "annualized effective compounded return rate" or "rate of return" that makes the net present value of all cash flows (both positive and negative) from a particular investment equal to zero.

The system can deliver about 5+1(half a day) kW, thus giving about 6*24=144kWh/day.

The average generator kWh price (depends on fuel prices) is 450L.L/kWh.

Thus the system saves about 144*450=64800L.L/day = 43.2$/day.

Thus ROI= (13800+20000+6000+10000)/43.2 = 1153 days = 3.16 years =3 years and 2 months.

Thus the system a=can payback its price only after ~ 3 years, which is a short time.

CO_2 Saved:

If we consider that generating 1kWh of power needs an equivalent of 0.3 kg of CO_2, thus we can calculate CO_2 saved, which can be calculated by:

CO_2 saved = 144*365*0.3= 15.7 ton of CO_2 are saved each year.

4. Summary and Recommendations

As can be concluded, renewable energy resources are effective, environment friendly and reliable.
Thus they can be adopted with no constrains, even though their initial cost are high but at the long term they are becoming an effect solution.

Recommendations are to apply the same project at varies telecommunication centers.

5. References:

http://www.fp-lebanon.com/default.html

http://en.wikipedia.org/wiki/Internal_rate_of_return

http://en.wikipedia.org/wiki/Net_present_value

http://www.skyscrapercity.com/archive/index.php/t-724292.html