PV-Diesel/Net-Metering Hybrid System

- ✓ **Eligible for the NEEREA financing mechanism**
- ✓ **Very low energy cost ($0.07/kWh VS $0.13/kWh for EDL and $0.35/kWh for Diesel Generator)**
- ✓ **Low pay back period (could reach as low as 6 years)**
- ✓ **Score booster in Green building rating systems (LEED, BREAM, HQE, ARZ…)**
- ✓ **Green marketing**
- ✓ **Ecological (Zero CO_2 and toxic gases emission)**
- ✓ **Noise free**
- ✓ **Power factor correction**
- ✓ **Very low maintenance**
- ✓ **Create shading areas (parking, reduce cooling demand…)**

Application:

- Industries (factories, refrigerated warehouses...)
- Commercial buildings (Malls, office buildings, associations…)
- Institutions (Hotels, hospitals, schools, universities, research centers…)
- Water pumps (Well, irrigation …)
- Agriculture (Farms, desalinization…)

Introduction:

The Lebanese Public Grid suffers from a chronic deficit between its production capacities (1200MW) and the Power demand (2000MW), resulting in long hours of daily blackouts. During these blackouts the consumer usually uses Diesel Generators (DG) as a costly alternative power supply source.

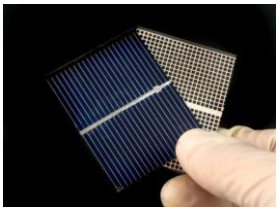
For industrial applications the average price of the kWh varies according to the blackout periods:

- 100% DG: about $0.35/ KWh
- 50% EDL, 50% DG: about $0.24/KWh
- 70% EDL, 30% DG: about $0.20/KWh
- 100% EDL about $0.13/KWh

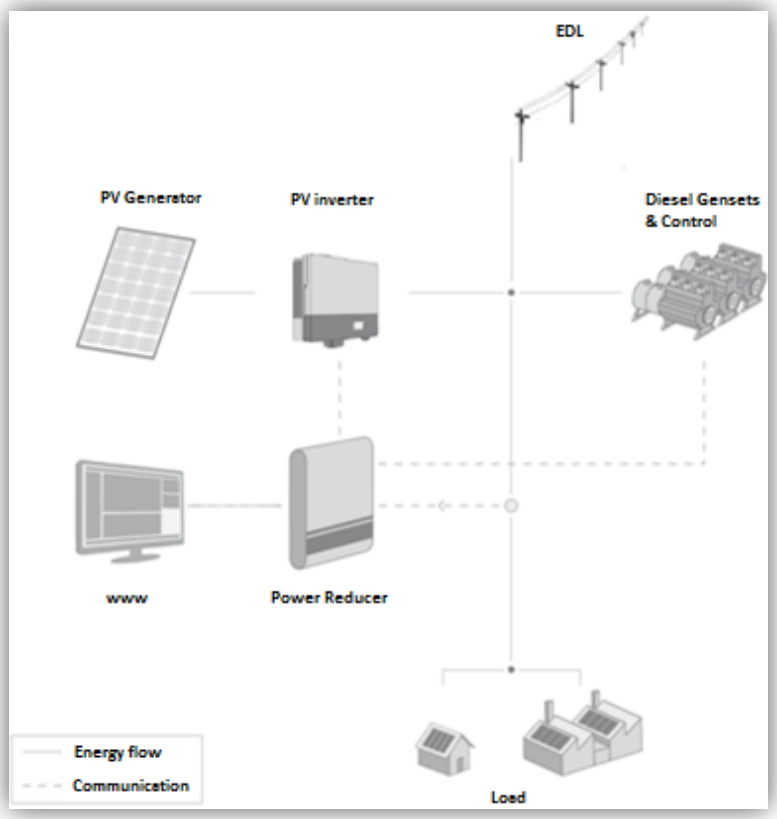
The majority of the Lebanese territory is 50% EDL Supplied with an average cost of $0.24/kWh. Moreover Oil prices are steadily increasing and the EDL kWh price is expected to increase as well, which will directly amplify the current energy bill.

Given the above mentioned diagnosis and the considerable technology development during recent years, renewable solar energies, particularly Photovoltaic (PV) Systems have become a technical and economic solution. Photovoltaic (PV) systems produce electricity as low as $**0.06-0.08**/kWh on average. No other technology has realized such cost reductions in the market as photovoltaic systems in sunny countries such as Lebanon.
In this paper we introduce an attractive solution to integrate a PV system to the existing Power feeding topology in order to lower the Energy bill by up to 50%.

What is Photovoltaic Technology?



Electricity is produced by sunlight through a process called solar Photovoltaic's (PV). Photovoltaic cells are made of semi-conducting materials.
When the sunlight strikes, it is converted into Direct Current (DC). Even if the sky is overcast, PV continues to produce electricity.
In this type of application the solar power is converted into Alternative Current (AC) and will contribute in feeding the load.



Intelligent Solution:

The solar production is synchronized with the supply source of electricity:

- When the EDL is supplying, the PV system will export its production to the grid.

Three scenarios can happen:

  - If the PV production is lower than the consumption load, only the power shortage will be taken from the EDL grid. The EDL meter will then count the reduced consumption.
  - If the PV production exceeds the consumption load, the excess of power will be sold to the EDL grid through a net metering process. This will make the EDL meter turn backwards and reduce the kWh readings.

  The EDL grid will act like an unlimited, free, 100% efficient, everlasting battery bank. This way the PV system will reduce the EDL bill up to zero through the net metering policy adopted by the EDL since December 2011.

- When the Diesel generator set is supplying electricity, the PV power will be synchronized to the Diesel Generator set's output. The PV system will contribute in supplying power to the load.
  - When the PV production is lower than the demand, the DG will only provide the power shortage. This set-up will therefore reduce the power produced by the DG which will effectively reduce its fuel consumption.
  - If at a given time the PV production capacity exceeds the consumption of the load, a special state of art protection shall be designed in order to protect the DG from backward current that can damage the generators. In this case the PV production will be reduced to ensure a minimum output power from the DG.

  This application will then reduce the fuel consumption by up to 50% which would directly affect cost of energy on the consumer.

Online Monitoring:

The PV system is web linked through a logging device. This data logging allows monitoring of the instantaneous productivity. The production will be observed through a user friendly website along with a Smartphone application.

The online monitoring will assist in evaluating the system's performance. Productivity and the net saving report messages will be sent to the consumer on a daily basis.
Warning messages will also be sent in case of dysfunction and alerts.

Prepared by:
Elements Sun & Wind
Sin el Fil, Beirut,Lebanon
GGF Center, Block A, 8th floor
Email: info@elementssw.com
Tel/fax: +961 1 492305/6/7