



Fig. 6 - Root cause analysis for wind power

4.5.2 Identification of measures

Among the generic measures proposed in Table 12, price reforms would produce much substantial motivation to industrial end-users and household consumers to invest and to ensure the system operated as efficiently as possible. Significant measures for the deployment of wind technology include:

Removal of subsidies on fuel: The current electricity tariff needs to be revised to reflect the actual cost of electricity production and distribution and to subsequently encourage the use of renewable energy technologies. Until the tariff is adjusted, it is very hard to see private investments in RE. The projects already taking place stem from the desire to overcome electricity rationing and are not based on economic merit. The main objectives of tariff restructuring are to minimize the financial burden on EDL through the removal of subsidies and to ensure an adequate impact of future policies for promoting alternative and cleaner energy technologies that are currently at a cost disadvantage. Gradual tariff adjustment by GoL is expected to reach around 50% increase by 2015. This will also allow private power producers to sell at higher profit-making tariff. Moreover, tariff restructuring will lead to more rational use of electricity in the long-run leading to substantial reduction in GHG emissions

Provision of financial incentives: Financial incentives need to be set by the banking sector to encourage investments in the renewable technologies market in the country.

Feed-in tariffs: When the average tariff of the utility is corrected and set at the yardstick tariff to achieve a break even for the utility, then several RE technologies will become economically viable especially if feed-in tariff with incentives is further adopted for RE suppliers.

Institutional reforms: The environment needed to accelerate the penetration of any Renewable Energy into the market has not been installed yet. The Law 462 which was recently amended to facilitate the introduction of RE has not been approved by the Cabinet of Ministers and so it may be long before it is ratified by the Parliament. Several amendments to the law 462 are being currently discussed to allow for future plan expansions, and for the penetration of renewable energy technologies. The amended law is expected to make provisions for the feed- in tariff for co-generation, and should call for the introduction of a

transition period during which the corporatization of EDL will take place.

Technological development: Small wind power- related industries should be established and supported to manufacture spare parts and components for wind power in order to compete with imported spare parts leading to substantial reduction in the operation and maintenance costs. This can be achieved by exchange of experience and capacity building with neighboring countries and other industrialize countries with relevant experience in the field. Facilities such as permitting privileges and easy credit access should be put in place in close collaboration with the Ministry of Industry to encourage the establishment of such industries.

4.5.3 Action Plan for the deployment of Wind Power

Target for Wind Technology Transfer and Diffusion

The policy paper has set a target of up to 100MW wind power production to be financed by the private sector by 2015. The capital cost is estimated around USD 1,950/kW, whereas the additional cost due to its implementation as a mitigation technology is around USD 950/kW. The consultation meetings with stakeholders revealed a significant interest in wind power in the private sector.

The main identified measures as obtained from the stocktaking process are presented in Table 14.

Table 14 - Technology Action Plan for Wind Power

Measures	Priority	Objective	Responsible parties	Beneficiaries	Time scale	Monitoring and Evaluation indicators	Estimated cost (USD)	Potential Donors
Gradual increase in tariff through fuel subsidies removal until it reaches 50% in 2015	1	- To avoid distorting effects of energy pricing system. - To remove financial burden from EDL. - To enhance the marketability of wind power.	The Department of Investment at MoEW	- EDL through improved financial balance. - private producers	0-3 years	- MoEW decisions and governmental decrees. - Periodical EDL reports. - Windmill generators operating in the country.	2,000,000 for preparation of economical study to determine the appropriate tariff.	World Bank, UNDR, USTDA, EU
Low interest offers by the banking sector	2	To encourage investments in wind power	Banking sector.	Private power producers	0-5 years	Reports by stakeholders that cover financial Information, comparison of actual financial outputs with forecasts, and project financial statements.	0	NEEREA, Commercial banks, New Market Mechanisms Arab funds
Tax exemptions/reduction on imported technologies	2		GoL				0 Assuming that the amount of the tax reduced is added to the tax of fuel based technologies.	
Feed-in-Tariff	1	- To facilitate power purchase from private producers. - To attract the private sector.	GoL MoEW	- EDL - Private power producers	1-3 years	- New tariff structure. - Number of windmill projects by private sector.	15,000 for economic feasibility of the energy purchase prices.	NEEREA, EU
General Measures								
Specific Measures								

4.6 Analysis of Technology: Photovoltaic cells

The manufacturing of photovoltaic (PV) cells has grown and advanced considerably in recent years on global scale, up to a total capacity of 40 GW at the end of 2010, distributed in more than 100 countries (REN21, 2011). This growth has been accompanied by a significant drop in the material and electronic system cost. In Lebanon, The UNDP-CEDRO project has managed to complete the installation of 126 kW for schools, municipalities and community centers. Such a progress may trigger additional penetration of PV into the Lebanese market if supported by other initiatives. The Lebanese territory is rich in solar radiation, and therefore with proper policies and incentives, paralleled with global drop in manufacturing cost could witness widespread outside major cities. Like wind power, PV cells are expected to replace or supplement the operation of diesel private generators mainly in the residential sector.

4.6.1 Identification of barriers for PV cells

The policy paper for the electricity sector did not include energy production from PV technology but it committed to start a pre-feasibility study on PV farms. The reason could be due to the high capital cost, low efficiency of PV systems and the false belief that PV cannot make a contribution if widely implemented in decentralized mode along with the new concept of net-metering in Lebanon. With most of the country connected to the national grid, PV is not economical compared to the grid produced electric energy at the present low tariff. However, the PV produced energy is competitive when compared to private generation that uses diesel oil.

Some of the generic barriers identified in Table 12 are more significant with regards to the deployment and diffusion of the PV technology, namely:

High capital cost: The initial capital cost of PV cells and supplementary technologies is substantially higher than conventional energy sources, resulting in cost-driven decisions and policies that may discriminate against PV cells as an economically feasible mitigation strategy. Moreover, large subsidies for fossil fuels do significantly lower final fuel-driven energy prices, putting renewable energy, mainly PV cells, at a competitive disadvantage if it does not enjoy equally large subsidies. In addition to the subsidies barrier, renewable energy investments from the private sector generally may face high taxes and import duties on the components. Although

capital cost has been declining over the past years, the current price is still the highest of all alternative technologies, estimated at USD 4 Million/MW.

Inadequate tariff structure: The current tariff structure of electricity is very low and does not represent even the actual cost of energy production. Until the tariff is adjusted, it is very hard to see private investments in RE. The projects already taking place stem from the desire to overcome electricity rationing and are not based on economic merit. Even with tariff adjustment, there is an urgent need to introduce feed-in tariff to encourage investments in the field of RE.

Inadequate net metering system: The already introduced net-metering scheme has to be updated so as to allow for income making from the sale of RE to the grid. As it stands now, the users can benefit from bill reduction when injecting energy into the grid. However, if energy sale exceeds the energy purchased from the grid, the customer cannot cash the balance. Until there is a reliable electricity supply, net metering will continue to suffer from the inability to inject continuously into the grid (when rotating outages are in place) and hence to utilize the energy produced, storage batteries are necessary. Such storage increases considerable the cost of RE systems.

Restrictions on siting and construction: PV installations may face building restrictions based upon height, space availability on building facades, or safety, particularly in multi-store buildings in urban areas.

Absence of transmission access: Transmission access is necessary for private PV power producers because some sites of potential PV plants may be located in remote or semi-urbanized regions and to allow direct third-party sales between the renewable energy producer and a final consumer.

Low awareness: Most decision makers are not aware of the social, economical and environmental benefits of that renewable technologies and do not consider them as high priorities in the development plans. In addition, although many citizens and institutions support the development of RE but many of them do so without being backed by the minimum level of awareness and education about the characteristics of those products

Root cause analysis results are shown in the below figure.