

4.4.2 Identification of measures

Among the generic measures proposed in Table 12, financial reforms are the most significant to overcome the barriers linked to the deployment of the CCGT technology. Pricing reform would produce much substantial motivation for the private sector and industrial end-users and household consumers to invest and to ensure the system operated as efficiently as possible. The sector must be rigid and financially viable to attract investors since private investment would not be attracted to a utility that has a yearly deficit of more than 1.5 billion USD.

Removal of Subsidies on Fuel: The current subsidized tariff system does not motivate private sector to participate in the sector. Tariff restructuring or removing the subsidies strategy will include the amendments of the national energy pricing system through a number of measures which reduces the economic burden of the power sector and allows eventual private power producers to sell their electricity at higher tariff. EDL must calculate the revenue requirement tariff to break even and thus calculate the yardstick tariff. Consequently, a modern tariff structure is to be proposed and implemented, preferably including the following criteria:

- Categorize customers based on voltage level and the type of consumer (residential, commercial, etc.)
- Introduce the time of use of energy
- Add Fuel Cost Adjustment formula (FCA)

It is worth noting that the tariff structure also heavily depends on the metering and billing philosophy.

According to a new structure, independent power producers will submit a tender through and international bidding round (transparent) where the winner will be the one with the lowest life time cycle cost – levelized cost (including or excluding fuel, this depends on the type of the contract).

Provision of financial incentives: Financial incentives should be provided to encourage investments in the infrastructure needed for the import, storage, and distribution of natural gas in the country. These projects are characterized by high capital cost and therefore both economic and fiscal incentives are required to support the deployment of CCGT.

Incentives or financial risk reduction may come in

several forms that would encourage the private sector to bid in Lebanon. Risks that need to be carefully considered and mitigated to attract the private sector:

1. The political risk: will increase price by increasing the rate of return to recap the investment as soon as possible.
2. The credit risk: The dire financial situation of the power sector makes it non-creditworthy for potential investors and lenders.
3. Fuel supply: Fuel procurement is currently undertaken by EDL and paid for by the Government to a large extent, it is the reason of 90% value of the subsidy. In this context, a private investor in new generation capacity may prefer to have an Energy Conversion Agreements (ECAs) instead of a PPA. The substantive difference between these is that a PPA has a fuel component while an ECA does not. Under an ECA, the investor is responsible for converting provided fuel into electricity and any potential fuel interruption is outside of the responsibility of the investor. It is important to note however that it is not necessary to have a fuel component (as in a PPA) to hold investors responsible for the plant heat rate (i.e., the efficiency of fuel usage). In international experience, PPAs are much more common than ECAs, but ECA are used where fuel supply is under a monopoly and/or the risk of fuel supply is considered to be better managed by the public entities. In any event, all power plants that are constructed in Lebanon should be dual-fired otherwise the non-availability of gas would threaten the sustainability even of an ECA.
4. The regulatory risk: it is important that the Government finalize the arrangements and establishes the planned Energy Regulatory Authority as soon as possible. The existence of a regulatory agency would also help strengthen the transparency and accountability of power sector regulation and provide sector leadership in events of changes in government and in Energy Ministers in particular.
5. Foreign-exchange risk: The mismatch therefore between the revenue currency and the currency of financing of sector investment by the private sector in a context of weak macroeconomic prospects as perceived by lenders is a major issue for raising private financing for the power sector.

Institutional reforms: This includes amending Law 462, and setting the platform for fruitful collaboration amongst the governmental entities. Electricity Law 462 calls for the unbundling of Lebanon's power sector and the creation of a regulatory authority. Several amendments to the law 462 are being currently discussed to allow for future plan expansions, make provisions for the feed-in tariff for co-generation, and call for the introduction of a transition period during which the corporatization of EDL will take place. It shall also call for the gradual introduction of the private sector into EDL through service providers law and new independent power producer (IPP) to build and operate new CCGT units.

Awareness initiatives: International organizations such as UNDP, have already implemented projects with a main objective of conducting awareness campaigns and capacity building activities. The private sector should be targeted to promote the benefits and profits that could be obtained from the participation in establishing and operating new CCGT power plants. The private sector could also participate in the infrastructure for the import and storage of natural gas.

Technological development: In order to engender substantial reduction in the operation and maintenance costs of the CCGT technology and hence encourage its market development, small industries should be supported to manufacture spare parts and components for the CCGT. Some demonstration projects have already been initiated and supported in order to shape domestic technology expertise, link suppliers to the industry, and to create examples of best practice.

4.4.3 Action Plan for the deployment of Combined-Cycle Gas Turbines

Target for Technology Transfer and Diffusion

CCGT is considered by GoL as an economically feasible option for generation expansion and GHG mitigation, especially with the high potential of extracting natural gas in marketable quantities from the Lebanese territories in the Mediterranean. The target is to operate the Zahrani and Beddawi plants using CCGT instead of the current use of Diesel by 2015.

The measures identified in this process could be distributed as shown in Table 13.

Table 13 - Technology Action Plan for CCGT

Measures	Priority	Objective	Responsible parties	Beneficiaries	Time scale	Monitoring & Evaluation indicators	Estimated cost USD	Potential Donors
General Measures	1	- To avoid distorting effects of energy pricing. - To remove financial burden from EDL. - To enhance the marketability of CCGT.	The Department of Investment at MoEW	EDL Private Power producers	0-3 years	- MoEW decisions and governmental decrees. - Periodical EDL reports.	2,000,000 for preparation of economical study to determine appropriate tariff.	World Bank, UNDP, USTDA, EU.
	2	- To encourage investments in CCGT infrastructure.	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.
	2	Tax exemptions on imported technologies	GoL				0 Assuming that the amount of the tax reduced is added to the tax of fuel based technologies.	
Specific Measures	1	- To run new and re-furbished power plants on NG. - Fuel diversification.	GoL	EDL Private power producers Industries	0-2 years	- Imports statistics. - Energy bill. - Plants running on NG.	500,000,000 cost breakdown as follows: 1. Gas Pipeline connection: 200,000,000. 2. FSRU as an LNG import terminal: 250,000,000. 3. Administrative, consultancy, supervision and logistics: 50,000,000.	International donors, Private sector.

4.5 Analysis of Technology: Wind Power

The wind farm concept is yet to be deployed in the country. According to the wind atlas for Lebanon recently published by CEDRO, the potential for wind power generation is estimated at around 6.1 GW including offshore facilities, with the northern regions of Akkar being the most appropriate in terms of wind availability.

Lebanon used to have a strong wind measurement system, but it was mostly destroyed and the records lost during the civil war. As of November 2007, there were seven complete synoptic stations for meteorological measurement, all reporting wind speeds and directions, but the equipment lack proper calibration and their locations are affected by various construction that affect the accuracy of the readings (CEDRO, 2011).

4.5.1 Identification of Barriers

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

Initial capital cost: The initial capital cost of wind power is generally higher than conventional energy sources, resulting in cost-driven decisions and policies that may renounce the technology as a mitigation strategy. A true comparison must be made on the basis of total lifecycle costs that account for initial capital costs, future fuel costs, future operation and maintenance costs, decommissioning costs, and equipment lifetime. Large subsidies for fossil fuels can significantly lower final energy prices, putting renewable energy at a competitive disadvantage if it does not enjoy equally large subsidies. The capital cost for the installation of wind turbines in Lebanon is estimated at USD 1.9 Million/MW.

Absence of feed-in tariffs: Due to the high capital cost of renewable energy technologies, the private sector is not encouraged to be involved in the deployment of such technologies. 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. PV energy is only competitive when compared to private generation that uses diesel oil. The electricity tariff is still low and is actually below the average production cost of electricity. A feed-in tariff has not yet been in place that can stimulate the market and encourage investments in RE.

Restrictions on siting and construction: Wind turbines and large scale farms may face building restrictions based upon height, aesthetics, noise, or safety, particularly in urban and semi-urbanized areas. Wind turbines have faced specific environmental concerns related to siting along migratory bird paths and coastal areas.

Absence of transmission access for independent power producers: Transmission access is necessary for private power producers because some renewable energy resources, mainly the potential sites in Akkar are somehow far from population centers.

Lack of expertise: Potential private wind power producers may be ignorant of the technology potential and benefits. They may also be faced with conflicting information and data about the wind regime in the country, leaving them with decisions not in preference to the new alternative. Consumers, managers, engineers, architects, and other stakeholders still lack information about wind despite the recently published wind atlas.

Lack of local spare parts manufacturing industries: Little incentives have been developed to promote the manufacturing of RE systems and products. The companies that provide services in RE are numerous but not all of them are experienced. Equipment suppliers currently import all kind of products without quality control and taxes on the imports of RE products and systems have not been waived yet

Fig. 6 shows results of the root cause analysis for wind power. Common causes and impacts of renewable technologies have been identified earlier.