

Renewable Energy in Lebanon in 2015





Introduction

Despite all the efforts that have been made in Lebanon, only 2% of its primary energy comes from renewable, which is far from being significant. During the 50s, hydro energy had experienced a big growth with the construction of dams and hydro power plants and reached an interesting figure of 274 MW which covered up to 50% of the demand. Actually, an estimated 200 MW (including micro power plants) could be added to the previous figure, but up until this moment, no effort has been made in this direction.

As for solar energy, a yearly solar irradiation average of 1900 kWh/m² shows an interesting potential. But despite the healthy growth in the individual solar water heating systems market, other types of solar systems are experiencing a tough startup although some projects have been successfully achieved. This situation is due to many reasons, but in our opinion, the main one is the absence of a clear strategy for the energy sector in Lebanon.

A basic wind atlas has been made in the framework of the “CEDRO” project which was funded by the Spanish government through the UNDP. This atlas showed the presence of windy sites in Akkar-North Lebanon, Marjeyoun Valley-South Lebanon, and the west parts of Mount Lebanon. The estimated Wind energy potential is some few Gigawatts. This inaccurate figure is due mainly to the inaccuracy of the wind atlas. There have also been some attempts to promote this energy sector, but the constraints were too hard to surpass, especially on the institutional and legislative level. For this reason, no projects have yet been realized.

Geothermal energy can be of interest especially in heat pump use, but the lack of data and support programs are preventing the development of this application. As for other forms of geothermal energy that concern heating or electricity production, we lack national data necessary for practical achievements.

Biomass can, in turn, be of interest, especially in the area of anaerobic digestion where the estimated potential in Lebanon is around 100 MW.

As for marine energy, potential remains very low in Lebanon in the absence of waves and swamps on the Mediterranean coast.

Therefore, according to the above, the two sources of renewable energy that may be further developed in Lebanon over the medium and long term are solar and wind power.

Solar Thermal Energy

Individual Solar water heaters are experiencing a boom in Lebanon. This may be due, in small part, to a spread effect and encouragement and also because they are quite affordable. But the main reason for this boom is a reaction to a near critical situation. Indeed, the most commonly used systems to produce hot water are electric water heaters, but electricity shortage in households makes it hard to reach the necessary target for hot water, making solar water heaters most reasonable solution. That is why we are witnessing in recent years a sizeable increase in the number of solar water heaters installed that exceeds 15% annually. Unfortunately, individual systems are the main systems on the market. We know that in Lebanon the population lives mostly in urban areas, and collective housing represents more than 70% of all Lebanese homes. We are even starting to see collective housing propagating to rural areas. Moreover, in the absence of any technical inspection, certification, or a guarantee of outcome, the quality of solar water heater (CES) is not always guaranteed. But if the thermal performance is not very critical in the case of individual water heaters, it is a major requirement on the collective systems because the constraints are more important. It is to be noted that in Lebanon, a solar water heater can save up to 75% of electricity compared to an electric water heater, and that the demand on sanitary warm water is enormous ($> 110,000 \text{ m}^3/\text{d}$)¹.

Therefore, in order to promote the SWHs, it is essential to focus on the very high potential of the collective solar systems. That's why we must adopt a plan that includes actions to lift all barriers that prevents the adoption of the collective SWHs on the national level. These barriers are of different natures:

- Certification and regulation: to ensure satisfactory operation it must require minimum thermal performance for the entire installation from the collector to the hot water tap.
- Technical skills: to all players since the designer via the manufacturer, the sponsor, the installer and maintenance service, one must ensure permanent training on the entire chain to ensure the achievement of a good product and its proper installation at the customer.
- Promotion Programs: fully inform the public of the importance of CES, financial aid mechanisms and other types of benefits.
- Financial support mechanisms or other national or local aid: optimizing existing mechanisms to encourage adoption of CES.

¹ See Solar Thermal Market Study www.almeelebanon.com

If it is difficult to install collective CES in existing buildings due to lack of space or practical possibilities of transportation and distribution of hot water, it is easier to properly design the CES in new buildings; an operation quite feasible in collaboration with stakeholders and can be a requirement to obtain the building permit.



The Solar Concentrator: Recent studies have shown significant potential for power generation using solar concentrators in some regions such as eastern Bekaa. Unfortunately no installations have been performed to date for lack of investors in this field because of the lack of clear mechanism that would regulate the production of this type of installation.

Photovoltaic Systems

The great potential of solar energy and the current poor state of the electricity sector in Lebanon, to which are added other factors such as the high cost of energy or the good level of per capita average income represent all elements favorable to the development of photovoltaic in Lebanon. Unfortunately, and despite some isolated projects, this is not enough to promote this form of clean and abundant energy, despite a growing and unmet need of electricity. Several reasons are the cause and it is more than necessary to work on a national action plan that is concrete and feasible but especially in consultation with all stakeholders in the energy sector. This plan must promote the use of PV in particular, and renewable energy in general. It shall define the actions needed to remove all obstacles to the development of photovoltaic.



Among these actions we note:

- An evaluation of the electrical energy produced by a series of essential measures:
 - Phase out subsidies by the change of the current electricity pricing system, which dates from 1994 and has no reason to continue because conditions have greatly changed since that time. It is necessary that the new pricing should be more in line with the actual current cost of energy. This measure is quite possible since the income per capita has increased.
 - Limit losses: first nontechnical that easily reach 25% of the electricity generated and then the technical losses which account for about 15%, and this by a renovation of the entire network (transmission and distribution).
 - Enable programs and promotion campaigns of energy efficiency to limit demand of electricity.
- Encourage the consumer, but also give him the possibility of adopting photovoltaic through some essential measures:
 - Provide technical and practical ability to connect to the network and to have a proper management of its production and consumption (currently difficult to achieve with shortages of 16 h/d for some areas).
 - Encourage an exchange or adequate tariff system that favors this form of clean energy; an action entirely possible given that the current subsidies for power sector exceed 1.8 billion euros per year.



- Set up adequate financial mechanism that recovers the cost of the installation with the energy saving money; if possible through ESCOs.
- Ensure a minimum quality of imported systems as a series of measures standardization and normalization of all components.

Wind Energy

Despite the worldwide development that wind energy has experienced in recent years and despite a cost that competes with that of kWh thermal and nuclear generation, Lebanon remained lagging behind as for many other forms of renewable energy. The Lebanese wind atlas and certain other measures campaigns studies confirmed the existence of good potential. Many investors have expressed their interest to produce wind power; they even initiated practical steps of measurement campaigns or land rentals. Unfortunately these efforts were unsuccessful due to the rigidity of production and sales sector. Indeed, only the Electricité du Liban (EDL) has the right to produce and sell to consumers. Investors faced this problem and couldn't use the network or sell the generated power to the client. The other problem is the guarantee required by an investor that he can sell and get paid by a reliable partner, and it is certainly not EDL that can play this role.

Therefore, the few facilities that exist are low power (few KW unit power). This remains within the framework of specific initiatives which have no real weight in the national production record.

An important and indispensable step must be crossed before seeing the different forms of renewable energy as a real alternative energy production in Lebanon, and it is the authorities and politicians role. We first must value the energy produced with the available means. It then takes a whole sector rehabilitation (technically but also organizationally). Place to private initiative should be left to open this very important sector to competition and to end the monopoly that was very costly to the economy and to the development of the country.



State of the Renewable Energy in Lebanon

SECTION 1: NATIONAL POLICY TARGETS BY TYPE OF RENEWABLE ENERGY TECHNOLOGY

Lebanon doesn't have a National Renewable Energy Action Plan

Existing Primary and/or Final Renewable Energy Use Targets at the National Level				
Technology	Target Value %, MW, GW etc.	Target Year	Primary or Final Energy Target?	References
Renewable Energy	12%	2020	Not clear if final or electricity only?	Statement by the Lebanese government in 2010: setting a target of 12% renewable energy by 2020. No strategies for implementation or monitoring. Currently renewables account for 2% of primary energy and it is especially Hydropower

Sector target for Total Final Consumption of Renewable Energy			
End-use sector	Target Value %, MW, GW etc.	Target Year	References
Residential and Commercial	50-100 MW	2015	NEEAP (2011) To date only 10 MW were performed
Industrial	5-10 MW	2020	CEDRO ² Project

² www.cedro-undp.org

Existing Renewable Electricity Targets at the National Level				
Technology	Target Value %, MW, etc.	Target Year	Capacity or Generation Target?	References
<i>Renewable Energy</i>	<i>12%</i>	<i>2020</i>	<i>Only electricity</i>	<i>Policy Paper for Electricity sector (2010) To date nothing has been done</i>
<i>Wind</i>	<i>60-100 MW</i>	<i>2015</i>	<i>Electricity</i>	<i>Policy Paper for Electricity Sector (2010) To date nothing has been done</i>
<i>Solid waste to energy</i>	<i>15 -25 MW</i>	<i>2015</i>	<i>Electricity</i>	<i>Policy Paper for Electricity Sector (2010) To date nothing has been done</i>
<i>Hydro-power</i>	<i>40 MW</i>	<i>2015</i>	<i>Electricity</i>	<i>Policy Paper for Electricity Sector (2010) To date nothing has been done</i>
<i>PV</i>	<i>10MW</i>	<i>2020</i>	<i>Electricity</i>	<i>MoEW-LCEC 1 MW was installed</i>

SECTION 2: RENEWABLE ENERGY INSTALLED CAPACITY AND PRODUCTION

- 2.1 Electricity**

RE technology	Capacity End 2013	Production End 2013	Capacity End 2014 (provisional)	Production End 2014 (provisional)	Pipeline Capacity	Average load factors at national level
	MW	MWh	MW	MWh	MW	%
Onshore wind	2 MW	4000	3 MW	6000	1 MW	negligible
Offshore wind	0		0		0	negligible
PV utility-scale	0		0		1 MW	negligible



Rooftop PV	2 MW	3200	2.5 MW	3200	1 MW	negligible
Off-grid PV	8 MW	12800	8.5 MW	13600	1 MW	0.1
Concentrated PV	0		0		0	
Solar CSP	0		0		0	
Micro hydro (up to 100 kW)	Not available		Not available		Not available	negligible
Mini hydro (up to 1 MW)	1	4000	1	2500	0	
Small hydro (up to 10 MW)	30,6	153000	30.6	76500	0	0.72
Large hydro (larger than 10 MW)	190	881000	190	550625	0	7.84
Geothermal power	0		0		0	
Bioenergy	0		0		0	
Ocean energy	0		0		0	
Other (specify)	0		0		0	

Projects in the pipeline (approved and/or under development):

Type of RE technology	Capacity (MW)	Cost	Expected date of commissioning	Name of main investors	Type of financing scheme
PV Beirut River	10MW	32 M\$US	2017	MoEW	Public
No other approved and ongoing projects					

- **2.2 Heat**

RE technology	Capacity End 2013	Production End 2013	Capacity End 2014 (provisional)	Production End 2014 (provisional)	Pipeline Capacity	Average COP (if applicable)
	MWth	MWh	MWth	MWh	MWth	
<i>Heat pumps for space heating</i>	2925	Not available	3100	Not available	351	2.6
<i>Heat pumps for space cooling</i>	3159	Not available	3350	Not available	360	2.6
<i>Geothermal heat</i>		0	0	0	0	
<i>Solar water heaters</i>	196	252450	216	278100	22	
<i>Solar space heating</i>	1.9	3085	2.1	3399	0.21	
<i>Solar thermal cooling</i>	0.5	490	0.6	540	0.1	
<i>Biomass</i>		1535000		1550000		
<i>Biogas</i>	0	0	0	0	1	
<i>Other</i>	0	0	0	0	0	

Projects in the pipeline (approved and/or under development):

Technology	Capacity (MW)	Cost*	Expected date of commissioning	Name of Investors	Type of financing scheme
Biogas	0.2	1 M€	2015	EU + Municipality of Baalbeck	Part of EU : Subsidies
Biogas	0.8	4 M€	2015	Municipality of Saida + Private sector	

*only biogas equipment

SECTION 3: DIRECT RENEWABLE ENERGY CONSUMPTION BY SECTOR AND TECHNOLOGY

RE technology	Residential	Industry	Service	Agriculture	Transport
	ktoe	ktoe	ktoe	ktoe	ktoe
<i>Wind</i>	0.52	0	0	0	0
<i>Solar PV</i>	0.25	0.45	0.4	0.34	0
<i>Solar CSP</i>	0	0	0	0	0
<i>Hydro</i>	40	30	19	0	0
<i>Solar heating and cooling</i>	0.1	0.14	0.1	0	0
Geothermal	0	0	0	0	0
<i>Biomass</i>	135	0	0	0	0
<i>Biogas</i>	0	0	0	0	0
Biofuels	0	0	0	0	0
Other (specify)	0	0	0	0	0

SECTION 4: INDUSTRY ACTORS

Type of RE technology	Nr. of factories	Type of manufacturing/ assembly process	Nr. of importers	Nr. of retailers
<i>Wind</i>	0	6	12	12
<i>Solar PV</i>	0	9	22	22
<i>Solar CSP</i>	0	0	0	0
<i>Solar heating and cooling</i>	0	5	8	8
<i>Geothermal</i>	0	6	9	9

Hydro	0	4	6	6
Bioenergy	0	0	0	0
Other (specify)	0	0	0	0

SECTION 5: POLICY AND REGULATION

RE technology	Feed-in tariff/premium	Electricity quota obligation	Heat obligation	Biofuels obligation	Tendering schemes	Net metering
<i>For all renewable energy technologies</i>	No	No	No	No	No	No
<i>Technology-specific (indicate which RET)</i>	No	PV	No	No	No	No

Investment support scheme (“technology push”)

RE technology	Capital subsidies	Production tax credits	Tax exemptions	Preferential loans	Public grants	Other
<i>For all renewable energy technologies</i>	No	No	No	Yes	No	No
<i>Technology-specific (indicate which RET)</i>	PV – Wind – Solar Thermal	No	No	Yes	No	No

Main public and private actors involved in R&D in Renewable Energy fields:

Names of actors:	All RE technologies
<i>Main public agencies in charge</i>	Centre National de Recherche Scientifique (CNRSL) Université Libanaise
<i>Leading Universities involved</i>	Lebanese University(UL) – Saint Joseph University (USJ)- Université Notre Dame de Louaisé (NDU)– Université Libano-Francaise (ULF)– American University of Beirut (AUB) – Lebanese American University (LAU)- Arab University – Université Saint Esprit de Kaslik (USEK)
<i>Technological centre of excellence</i>	Berytech

Annual budget for renewable energy R&D (without salaries)	Less than 3 million US\$ per year	All RE
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ADVANCED PROGRAMS AND MAJOR INTERNATIONAL CONFERENCES IN RENEWABLE ENERGY IN LEBANON

Master in Renewable Energy : Joint venture between the Faculty of Engineering of the Lebanese University and the School of Engineers of Beirut (ESIB) Saint Joseph University that contributes to educating of 25 -35 students per year and initiates RE theses works for 3-7 students per year.

International Conference: International Conference on Renewable Energies for Developing Countries, REDEC (www.redeconf.org): ALMEE in collaboration with leading universities and the Lebanese Order of Engineers and Architects of Beirut organizes every two years this international conference REDEC. The research papers presented at this conference are published in IEEEXplore (<http://ieeexplore.ieee.org>).

It also exists:

- Master at the American University of Beirut AUB (in Energy Studies), which also addresses renewable energy.
- An annual conference "Sustainability Week" organized by the Order of Engineers and Architects of Beirut.
- Beirut Energy Forum: Conference for general public on energy including renewable energy.

The main NGOs that develop renewable energy-related activities are: ALMEE, Greenline, LCEC, LGBC, and LSES.

ALMEE – Association Libanaise pour la Maîtrise de l'Énergie et pour l'Environnement
www.almeelebanon.com



The Lebanese Association for Energy Saving & for Environment

(ALMEE)

The Lebanese Association for Energy Saving and for Environment is involved in a wide range of activities related to sustainable practices and other “green” issues. Known by its French-language acronym, ALMEE (Association Libanaise pour la Maîtrise de l’Energie et pour l’Environnement), the group describes itself as “a No-political & No-profit association” committed to better handling of multiple issues and technologies associated with **Energy and Environment**, not just in Lebanon but also across the Mediterranean Basin and worldwide.

Specifically, ALMEE’s overriding goal is to develop, increase and promote scientific methods and means contributing to better management of energy and related economic policies, including the following:

- Renewable energy sources like solar, wind, biomass, hydraulic, wood, etc.;
- Technical issues designed to improve energy efficiency, such as insulation, glazing, and the latest heating and air-conditioning technologies;
- Techniques like cogeneration that lessen the waste associated with power generation and industrial processes.
- Energy Building codes, Rating System for Green Buildings, Energy Performance Label and Certificate

For more than 2 decades, ALMEE has pursued a philosophy of sustainable and harmonious development for Lebanon and the region, gaining a wealth of experience from cooperation with some of the world’s leading organizations.

In short, ALMEE has worked with local, regional and international partners – from governments and multilateral institutions of civil society and the private sector – to buttress calls for more sustainable policies and practices related to energy and environment. ALMEE’s main goal is building awareness and support for better management – and to keep the business community apprised of the tremendous growth potential exhibited by this new and exciting sector.

As the public becomes more and more concerned about environmental issues, the marketplace continues to reflect changing attitudes, opening up significant opportunities for forward-thinking companies to increase sales and revenues and be good corporate citizens at the same time. ALMEE constitutes an excellent venue to communicate these and other possibilities tied to the use of renewable energy and other means of better and more sustainable environmental practices.

ALMEE worked on developing proposed mechanisms for green house gases emissions in several projects.

www.almeelebanon.com

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