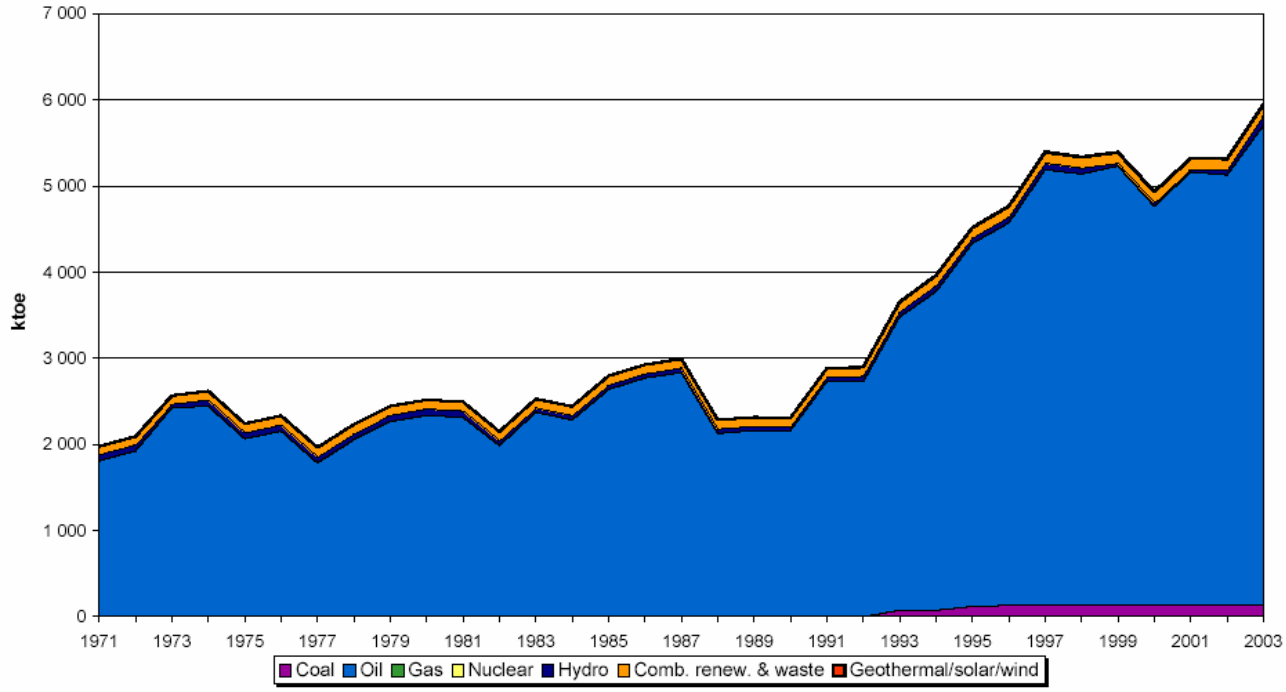
State of the Energy in Lebanon

Total Primary Energy Supply

TEPS[1] in 2003 amounts to almost 6 million TOE (tonnes of oil equivalent), including stock changes (600 ktoe).

Lebanon has no known fossil fuel resources. All energy needs are met with imports of petroleum products, which represented over 5 million TOE in 2003. The power sector accounts for about the 50% of fuel imports.

Evolution of Total Primary Energy Supply in Lebanon

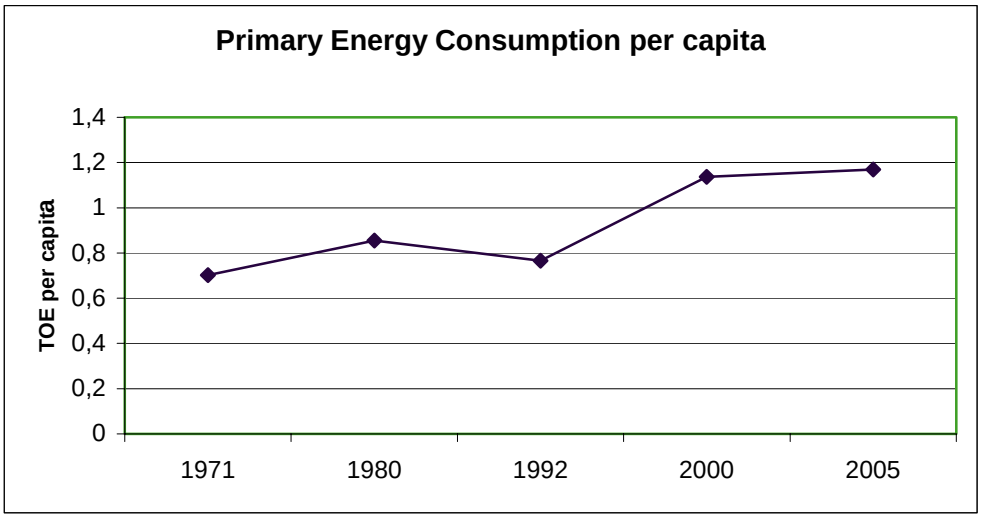


The only indigenous energy sources are hydro (117 ktoe in 2003) and CRW[2] (125 ktoe in 2003). A very small amount of primary energy (9 ktoe) comes from Solar Thermal.

Since 1991 till today TEPS increased with a very high rate together with per capita consumption.

1 Total Primary Energy Supply: Indigenous production + imports - exports - international marine bunkers ± stock changes

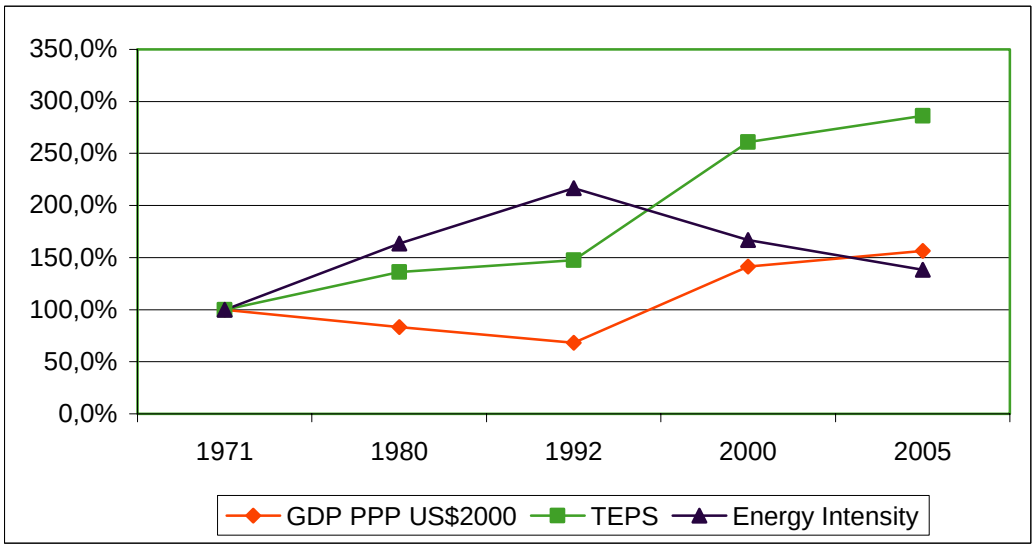
[2] Combustible Renewables & Wastes - solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste



Source OME

Lebanon is an energy intensive country, more than other neighbouring Southern Mediterranean countries, with an energy intensity measured at *225 ktoe/1000 $US 2000 (PPP)*. The per capita primary energy supply is 1,16 toe/capita (2005, source OME).

TPES, Energy Intensity and GDP in Lebanon (1971 = 100)

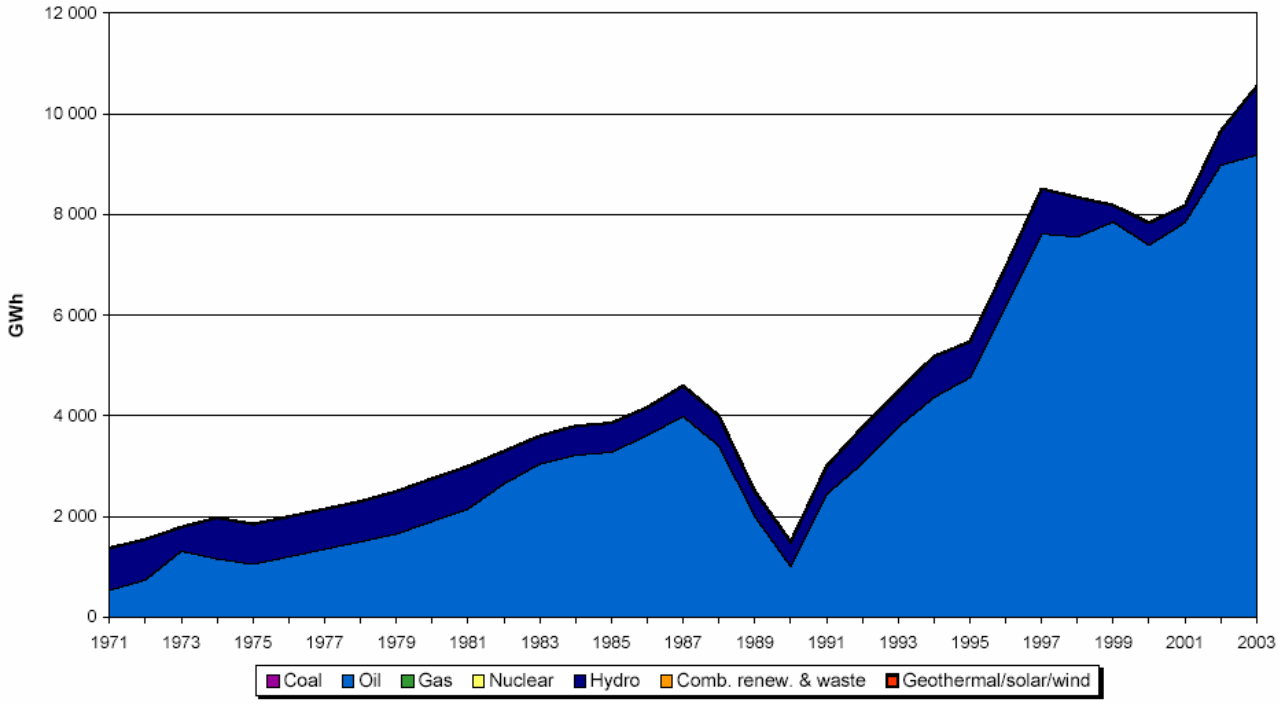


Source OME

Electricity sector

Since 1990, after the end of the Lebanese civil war, the generation of electricity started to grow with a high rate, achieving a production of 10,5 TWh. The 87% of the electricity is produced with oil products, mainly gas/diesel and residual fuel oil. The remaining 13 % is produced with hydro.

Evolution of Electricity Generation by Fuel



Considering that the distribution losses amounts to the 15%, the total electricity consumption is almost 9 TWh, with a per capita consumption of almost 2 MWh/capita.

Despite of improvements in distribution networks, power shortage is still wide spread, due to the severe physical damage to all its production transmission and distribution facilities during the conflict.

Electricity generation comes from public sector for approximately the 77%. The 15% is private generation while the rest (almost 5%) is imported from Syria.

Lebanon's electricity sector is dominated by the state-owned Electricité du Liban (EDL). It operates 7 thermal power plants with a total installed capacity of 2038 MW, and 6 hydro power plants with a capacity of almost 221 MW.

Even though the electrification level is nearly 100%, the Lebanese electric power system still suffers in peak demand periods from fairly rigorous load sheds with poor areas suffering most. The
existing infrastructure is being further expanded to face the continuous increase in demand by building a 220 kV super grid, reinforcing the distribution network, providing new generating capacity, and by implementing administrative reforms and improving technical assistance. EDL has been regaining control over its operations and steps are being taken to address billing and collection weaknesses as well as curbing non-technical losses. The EDL system is now interconnected with the Syrian system through two 220/400 kV overhead lines with an overall capacity of 400MW.

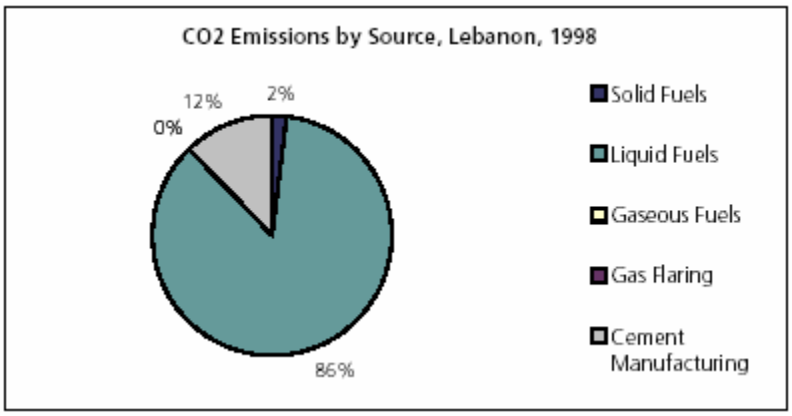
To encourage greater private sector participation in the economy, the Government with support from the World Bank initiated the Power Sector Restructuring and Transmission Expansion Project which calls for the implementation of a set of sector wide structuring and reform actions designed to introduce competition and private sector participation in utility operations and to reorganize EDL. To that end, a draft law to privatize generation and distribution but keep transmission under EDL control was prepared by the government and is currently awaiting discussion in the Lebanese Parliament.

Environmental Context

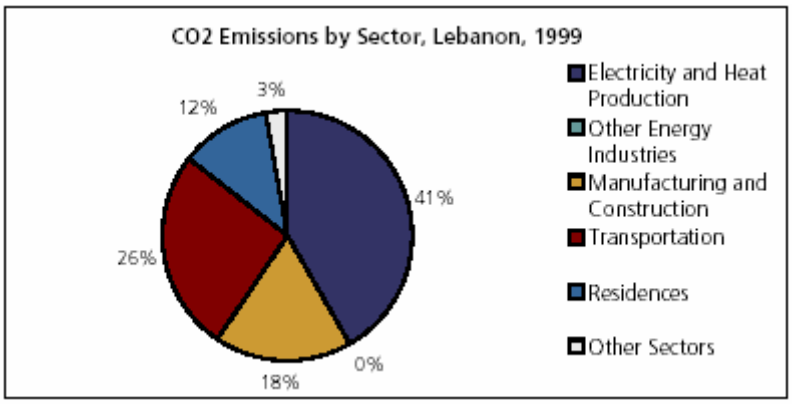
Lebanon ratified the UN Climate Change Convention in 1994 and ratified the Kyoto Protocol in May 2006. Anyway, the Designated National Authority is being established at the Ministry of the Environment.
Following, the principal indicators of CO2 emissions in 2003:

CO_2/TPES *(t CO_2/toe)*	*2.86*
CO_2/Population *(t CO_2/capita)*	*3.79*
CO_2/GDP (PPP) *(kg CO_2/thousand 2000 US$ (PPP)*	*0.79*
CO_2 Emissions[3] *(Mt of CO_2)*	*17.03*

[3] CO_2 Emissions from fuel combustion only

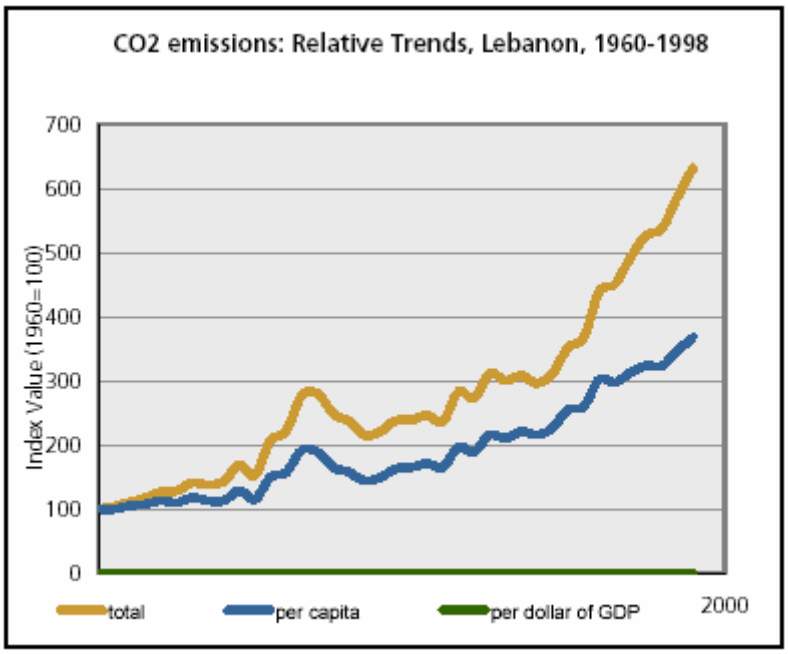


Electricity and heat production are the largest contributor of CO2 (approximately 41%), *followed by the transport (approximately 26 %), manufacturing (18%) and residential (12%) sectors.*



The Waste sector is the largest contributor of CH4 emissions (83%) while the Agricultural sector is the largest contributor of N2O emissions (96%).

CO2 emissions are increasing in the last years due to the increase in electricity generation, mainly realised with oil products.



To obtain a decreasing in CO2 emissions of the energy/power sector, Lebanon needs to improve the utilization of renewable energies further than hydro, with particular regard to solar energy, and to substitute oil fuel products with natural gas.
Considering the assessment carried out by UNDP[4], it revealed that fuel substitution by natural gas, during the period 2005-2040, can provide emissions reduction by 117 million tons of CO2 and 251 million tons of CO2 for demand growth in power sector of 4% and 6%, respectively; the improvement of supply mix through renewable solar energy can provide around 30 million tons of CO2 emissions reduction.

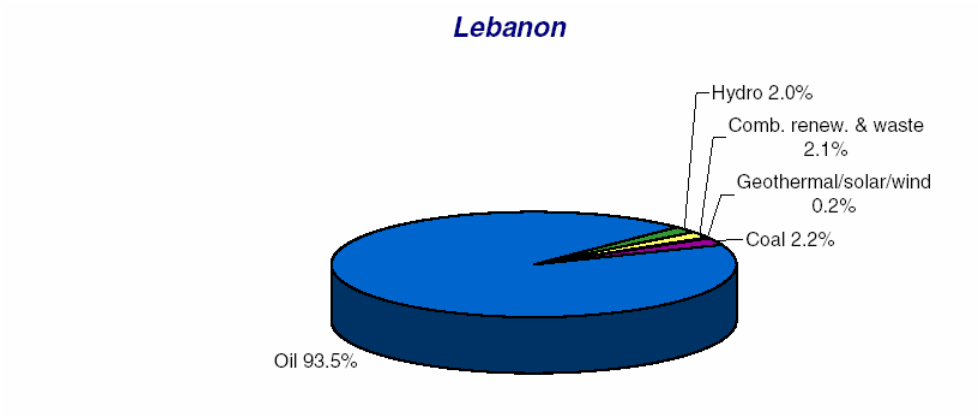
Other important measures should be taken in transportation, by introducing electric hybrid vehicles and improving mass transport systems, and industry.
A national GHG mitigation strategy has been elaborated by the team of experts of the Climate Change Project (GEF/UNDP funded project) in 1999, and introduced in the Technical Annex to Lebanon's First National Communication Report to UNFCCC, which assesses and evaluates in details feasible options for GHG emission reduction.

Renewable Energies

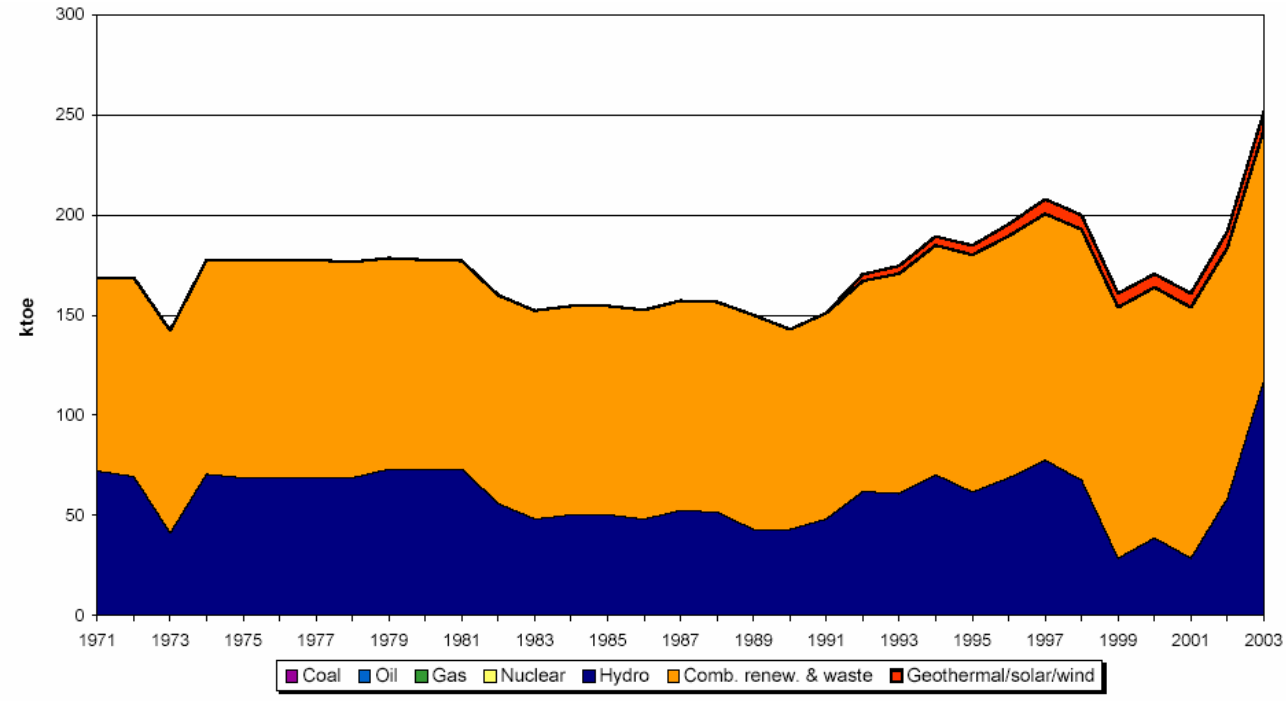
In Lebanon, renewable energy available include resources such as solar, wind, hydro, and biomass resources, but still these resources are not widely used.

Renewable energies account for almost the 4 % of the total primary energy supply in 2003 and represent the only indigenous source of energy.

[4], UNDP Project Manager - Lebanon's GHG Profile (CDM Investors Forum - Jerba 2004)



Evolution of Total Production of Energy in Lebanon



The 2.1% is represented by primary solid biomass. The rest (2%) is hydropower and solar thermal energy (0,2% equal to 9 ktoe).

As for the electricity, hydropower accounts for 1362 GWh in 2003, equal to the 13% of the total electricity supply.

Renewable Energy Data

Table 1c-Lebanon: Wind data for Lebanon

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Avg/ Year
Beirut-Airport	4.6	4.9	5.2	4.4	3.9	4.3	4.6	4.0	3.5	3.2	3.2	4.2	4.17
Cedars	2.9	3.1	3.4	3.0	3.3	2.9	2.7	2.4	2.1	2.8	2.3	2.8	2.81
Rayak	3.4	3.8	4.3	3.9	3.5	3.7	3.7	3.4	3.2	3.1	3.2	3.2	3.53
Ksara	3.2	3.8	4.2	3.9	4.5	4.8	4.2	3.4	2.6	2.4	2.9	3.68	
Khalde	3.35	2.97	3.26	2.72	2.42	2.85	3.45	2.86	2.08	2.07	2.06	3.04	2.76
Marjayoun	4.24	4.16	4.88	4.24	4.59	5.19	5.78	5.4	4.6	4.07	3.84	3.93	4.58
Qlaiat	5.33	5.51	5.41	4.19	3.74	3.75	4.16	3.57	3.47	3.89	4.41	5.56	4.42
Tripoli-Mina	4.23	4.38	5.12	4.35	3.76	4.68	4.72	3.72	2.65	2.51	3.01	3.74	3.91
Dahr-El-Baidar	4.67	4.87	5.63	5.06	3.98	4.59	5.05	4.48	3.33	3.1	2.96	4.44	4.35

Source: GNESD Report on "Renewable Energy Technologies Contribution and Barriers to Poverty Alleviation in Jordan, Syria and Lebanon"

Table 2c-Lebanon: Energy content in landfill gas

Year	1994	2005	2015	2040
Mass of CH_4 generation potential, Gg	43	85	123	269
Volume of CH_4 generation potential, 10^9 Nm^3	60	119	172	377
Caloric value, 10^{12} J	2153	4247	6160	13500
Oil value, 10^3 tons	50	100	143	313
Thermal value, GW-hr_{th}	600	143	1717	3763
Electric value, GW-hr_{el}	180	313	513	1130

Source: GNESD Report on "Renewable Energy Technologies Contribution and Barriers to Poverty Alleviation in Jordan, Syria and Lebanon"

Table 3c-Lebanon: Solar data for Lebanon

Month	Coastal Insolation, kWh/m^2/day	Interior Insolation, kWh/m^2/day	Coastal sunshine hours (Hrs)	Interior sunshine hours (Hrs)	Day length, (Hrs)
January	2.4	2.4	4.6	4.5	10
February	3.2	3.4	5.6	5.5	10.8
March	4.1	4.4	6.4	6.4	11.8
April	5.5	5.9	7.7	8.5	12.9
May	6.6	7.2	10.1	10.5	13.8
June	7.3	8.5	11.5	13.1	14.2
July	7.0	8.4	11.4	13.2	14
August	6.3	7.7	10.6	12.4	13.2
September	5.3	6.5	10.4	11.2	12.1
October	4	4.7	8.1	9	11
November	2.9	3.3	6.4	6.7	10.2
December	2.3	2.4	5	4.8	9.8

Source: GNESD Report on "Renewable Energy Technologies Contribution and Barriers to Poverty Alleviation in Jordan, Syria and Lebanon"

Decision-Making

The Ministry of Energy and Water is in charge of energy issues. The petroleum and gas sector is the responsibility of the Directorate of Petroleum (MoP). The Directorate of Petroleum is responsible for licensing import activities, import and refining crude oil, import of fuel oil, and setting prices for petroleum products. Electricity is supplied through the Electricit du Liban (EDL) which is an autonomous state-owned entity under the jurisdiction of the Ministry of Energy and Water. For project implementation, the Council for Development and Reconstruction is responsible for the management of foreign funds and the execution of large-scale proje cts in cooperation with the Ministry/institution in charge (Electricité du Liban, Ministry of Public Works and Transport, Ministry of Environment, etc.). Regarding the regulatory framework, the Ministry of Energy and Water drafts decrees/laws that are forwarded to concerned Ministries for review and comment, and then to the Council of Ministers for approval. Local decision-making takes place through Mohafazats (Governorates) that provide municipalities with decisions and laws to be implemented. Then local authorities have the full right to enforce the application of these laws. In addition, they have the authority to set conditions for providing licenses necessary to implement regulations pertaining to energy.

Strategic Policies Outlines for REs

The development of renewable energy resources in Lebanon can greatly contribute to the socio-economic growth of the country. First, renewable energy allows for a

diversification of energy resources. Second, the development of renewable energy technologies will assure increased accessibility of available and affordable energy services to contribute in improving the education and health care in many rural areas. Third, renewable energy technology will open many job opportunities for manufacturing, distribution, operation and maintenance, thus create income opportunities.

At present, in Lebanon only policy guidelines encouraging R&D in the renewable energy field have been recorded, which cannot constitute the necessary mechanism towards integration of RE within the overall national energy policies and plans..

More efforts should be made in developing policies and plans, taking into account its national circumstances

Data and information sources

- International Energy Agency energy statistics
- World Resources Institute EarthTrends - countries profile
- Electricitè du Liban (EDL) web site
- UNDP Project Manager "Capacity building for the adoption of Energy standards for buildings in Lebanon" - Lebanon's GHG Profile (CDM Investors Forum - Jerba 2004)
- United Nations Country Profile for Lebanon – Johannesburg 2002
- GNESD Report on "Renewable Energy Technologies Contribution and Barriers to Poverty Alleviation in Jordan, Syria and Lebanon"
- ALMEE