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"Climate Change Indicators Impacts on Environment, Sustainable Tourism, Water, And Renewable Energy" In Arab Countries

State and Perspectives of the Renewable Energy Sources in Lebanon

Said Chehab
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The Energy Context in Lebanon

- 97 % of the Primary Energy imported
- High Energy Demand Growth ,mainly Electricity
- Increasing Energy Bills
- Concern about Energy Supply & particularly about Electricity Supply
- RE sources are existing(Hydro, Solar, Wind, Biomass) but not yet significantly developed
- Increase of Environmental Concern: Primary Energy is mainly very pollutant oil derivatives : Acid Rains,Co2 emissions,...

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L'ENERGIE AU LIBAN 2007

APPROVISIONNEMENT TOTAL EN ENERGIE PRIMAIRE ATEP (KTEP) - 2007

	KTEP	%
1- PRODUCTION		
1-1 HYDROENERGIE	57	1.5
1-2 ENERGIE TRADITIONNELLE	120	2.9
2- IMPORTATIONS	KTEP	%
2-1 ESSENCE		
2-2 FIOUL OIL	1029	25.2
2-3 GAZ DE RAFFINERIE	138	3.4
2-4 ELECTRICITE	86	2.1
2-5 CHARBON	132	3.2
2-6 A/ P JP	43	1
TOTAL 2	3923	95.8
3- EXPORTATION		
4- VARIATION DE STOCK		
5- TOTAL	4096	100

In 2007

96 % of the primary energy was imported (Petroleum products, No N.G.)

4% was locally produced (Hydro, Solar thermal, Woods)

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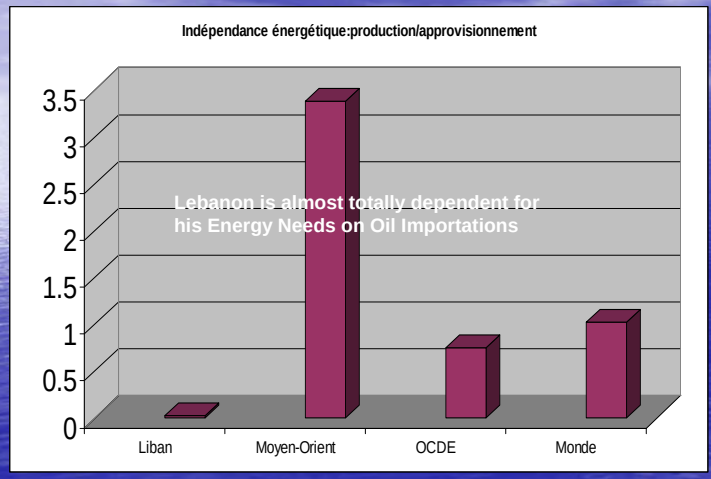

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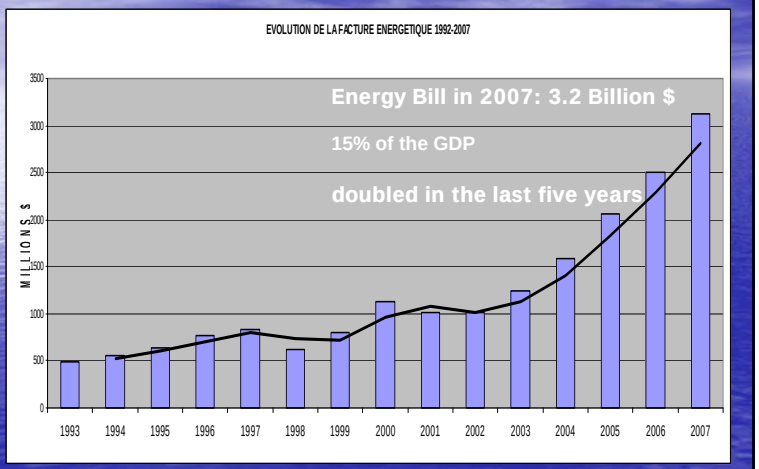

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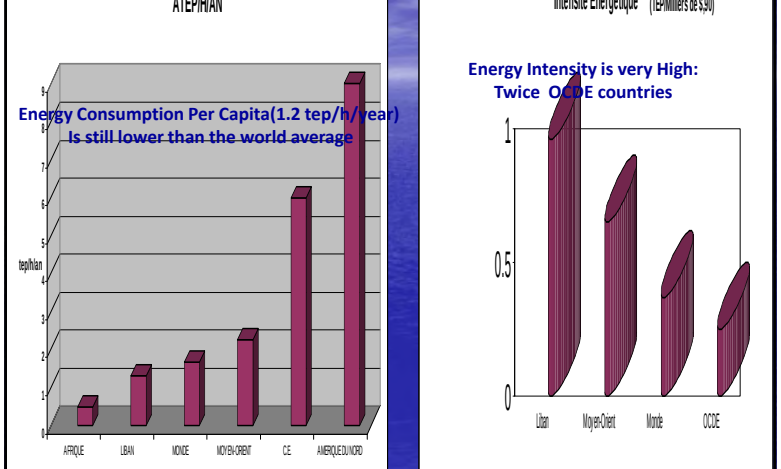

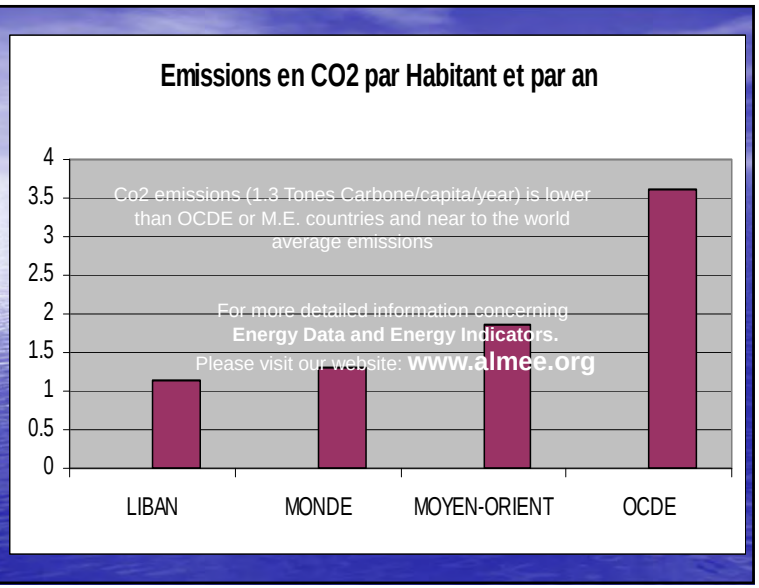

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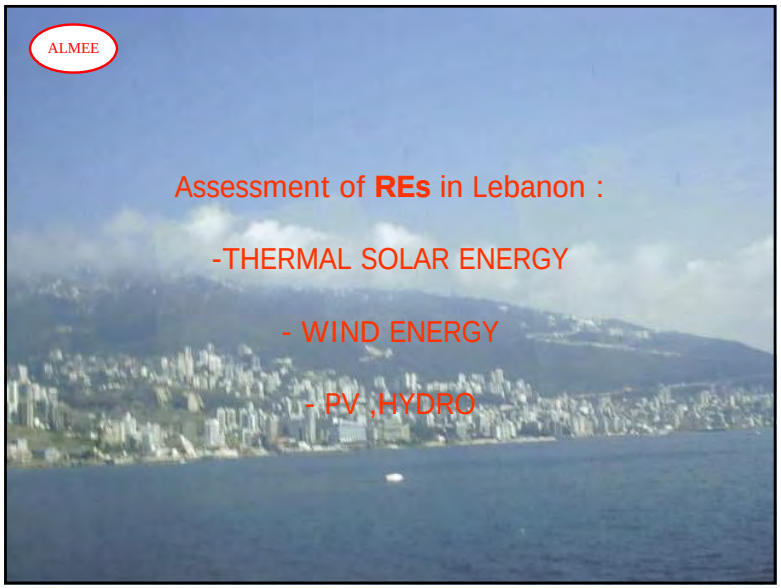

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ASSESMENT OF THE THERMAL SOLAR MARKET IN LEBANON:

Market Booming

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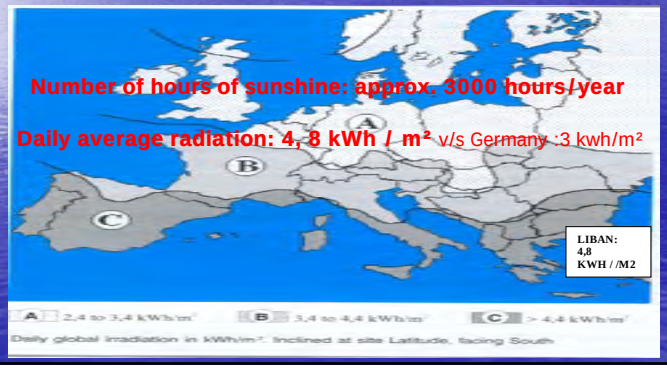
As it is the case in all Mediterranean Southern countries,
the climatic conditions are extremely favorable to the use of the solar energy
for all thermal applications and particularly the production of Domestic Hot Water.

ENSOLEILLEMENT GLOBAL JOURNALIER
ORIENTATION SUD, INCLINAISON: LATITUDE DU LIEU
LIBAN : 33 degre NORD



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Solar Thermal Applications in Lebanon

- **Low temperature Applications : T<60°C:**
  mainly for sanitary water heating (Domestic Hot Water), swimming pools heating in hotels and leisure resorts as well as for floor heating (few applications) & in some industrial processes where heat at low temperatures is needed .
- Medium temperature Applications: 60<T<250
  (Air Conditioning, Sea Water desalinization : N.E.
- High temperature Applications :250<T
  (CSP) for Electricity Production : N.E.

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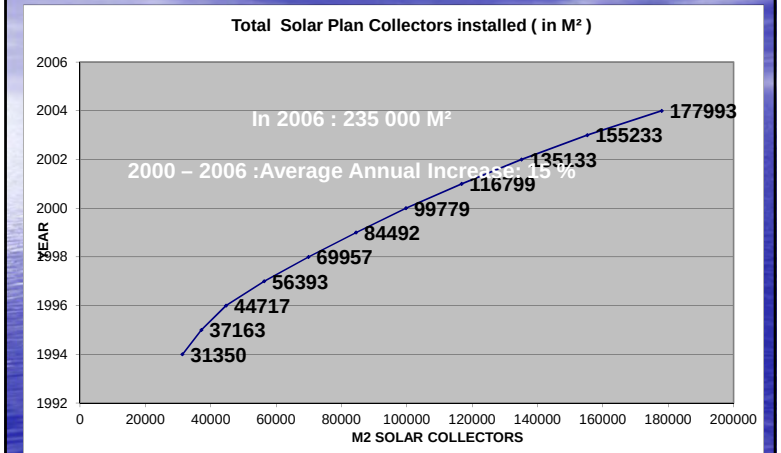
Low temperature level T<60°C



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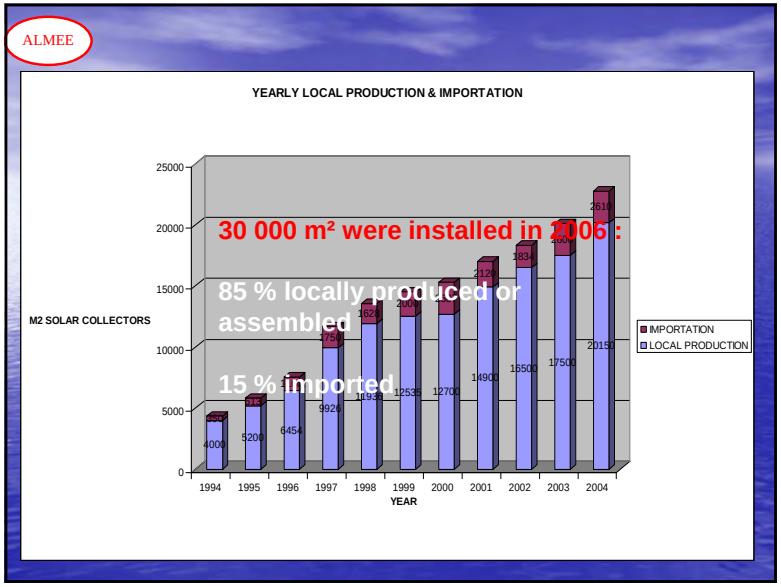

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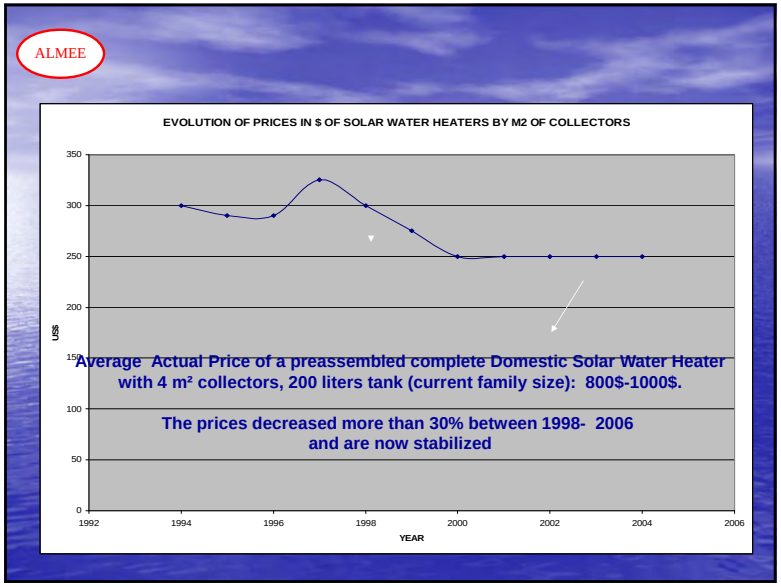

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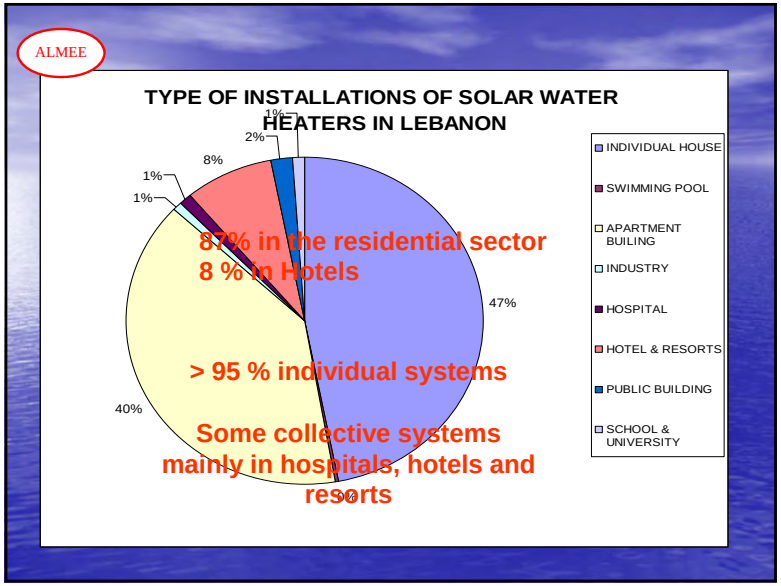

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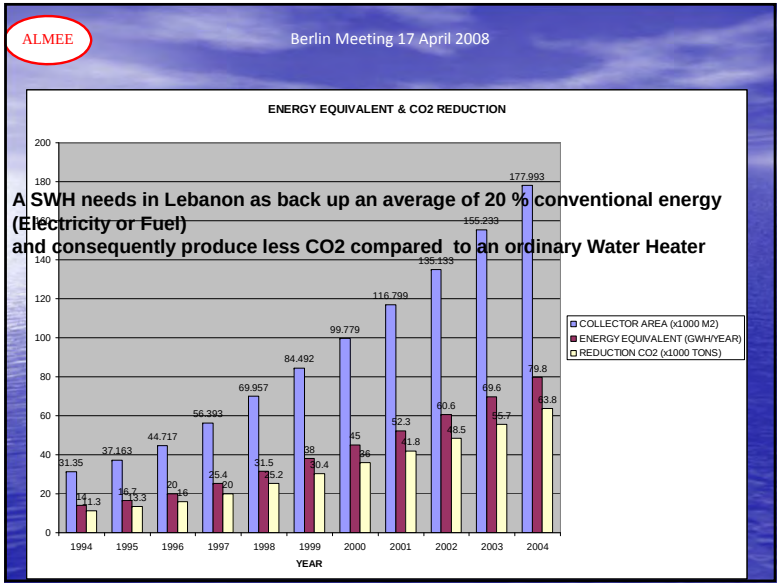
Berlin Meeting 17 April 2008



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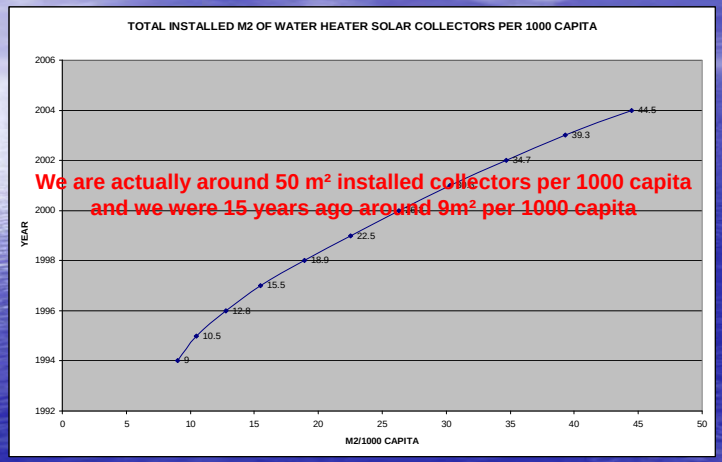

We are actually around 50 m² installed collectors per 1000 capita and we were 15 years ago around 9m² per 1000 capita

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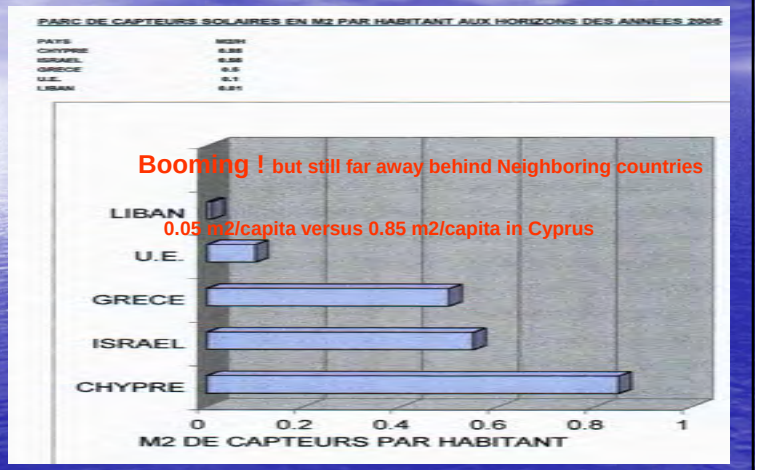

Booming ! but still far away behind Neighboring countries

0.05 m2/capita versus 0.85 m2/capita in Cyprus

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Berlin Meeting 17 April 200

Even more, actually HSBC is offering, with each housing loan, a Solar Domestic Hot Water for free

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Main Barriers to be removed

- **1. The structure of the electricity prices** that do not reflect the real cost.
- 2. The absence of a political will and **specific policies** in favor of the solar energy that can focus on the national and macro-economic interests toward those of the consumer and the end user.
- 3. An insufficient taking into account of the **environmental impact** and of the public health due the atmospheric pollution.
- 4. The **relatively high price** of the DSWH (about 1 000 $ for a complete DSWH of 4 m² - 200 liters versus 700 $ in Cyprus and 400 $ in Palestine).
- 5. Lack in **testing,** certification , labeling and guaranty of result.
- 6. The **quality of water** is generally hard and calcareous which leads to a fast deterioration of the DSWH (water tank collectors, heat exchangers particularly for the open circuit one,) dragging an appreciable reduction of the output and the life of the DSWH system.
- 7.The **individual DSWH** isn't adapted to urban zones.

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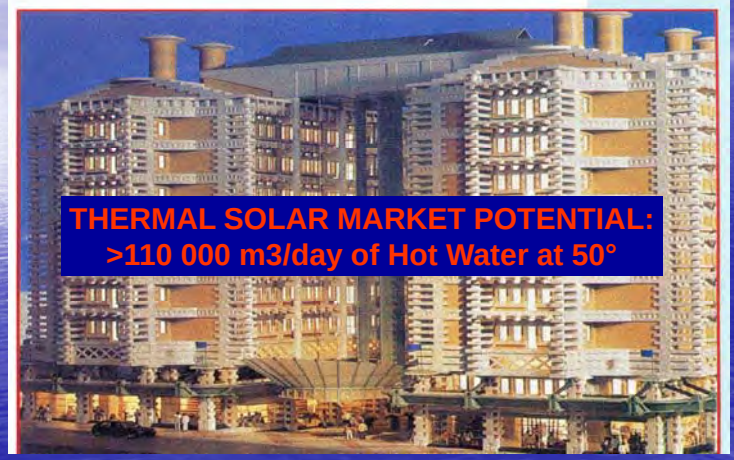
Berlin Meeting 17 April 2008



THERMAL SOLAR MARKET POTENTIAL:
>110 000 m3/day of Hot Water at 50°

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The main consuming sectors of domestic hot water are in the urban area

Sector	*Nature*	*Number*	*Total Consumption in m3/day*
Residential	Apartments and individual houses	900 000	**108 000**
Health	Hospitals	145	**475**
	Clinics	55	**3**
Hotel	Hotels	218	**773**
	Furnished apt.	94	**367**
Education	Schools	1200	**140**
	Universities	100	**80**

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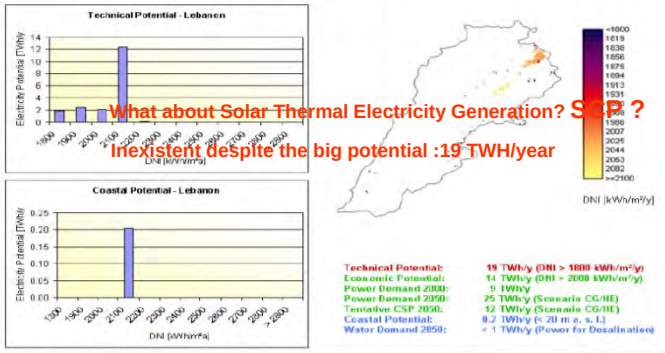
MED-CSP

DLR

Solar Thermal Electricity Generating Potentials in Lebanon



What about Solar Thermal Electricity Generation? SCP ?

Inexistent despite the big potential :19 TWH/year

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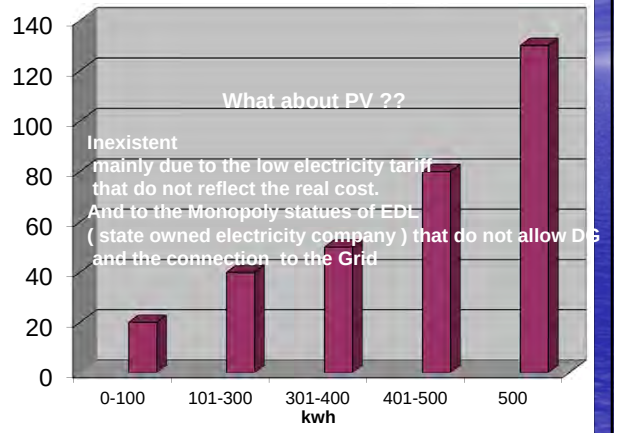
Kwh prices depending on band consumption: from **2.5 $cents (0-100kwh)** to **20 $cents (>500kwh)**

Cost of PV generation: 40/50 $cents/kwh



What about PV ??

Inexistent
mainly due to the low electricity tariff that do not reflect the real cost.
And to the Monopoly statues of EDL (state owned electricity company) that do not allow DG and the connection to the Grid

The biggest PV Plant :15 kWp in Mar Sarkis & Bakhos Monastery (Achkout Mount Lebanon)

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Wind Energy Applications in Lebanon

Assessment of the Wind Energy Market in Lebanon: Inexistent Market but Promising one

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Some Lebanese Attempts Stand Alone Small Scale

- A recent Dutch Turbine in Ammiq-Beqaa

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Power Generation Component (Mercy Corps project)

- Rated Power: **7.5 kW at 13.8 m/s**
- Cut-in Wind speed: 3.6 m/s
- Rotor diameter: 7 m
- Furling speed: 16 m/s
- Output voltage 48 VDC
- Tower: 30 m
- Storage: 53 kWh in Battery Bank

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Hybrid Wind/Solar in Dibbiyi :
Two Wind Turbine ,2KW each coupled to a 10 PV Panels: 160Wp each

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Hybrid Wind/Solar in Ksara:
One Wind Turbine ,2KW coupled to a 10 PV Panels: 160Wp each

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BARRIERS

- Absence of reliable wind data : No comprehensive wind map is available :Standard measurements for wind energy are taken at 10 m and 30 m
- No Access to the Grid
- High initial cost
- Very low electricity Tariffs (1kwh Wind=20 $cents)
- Current Payback of small turbines is too Long: 20-30 Years

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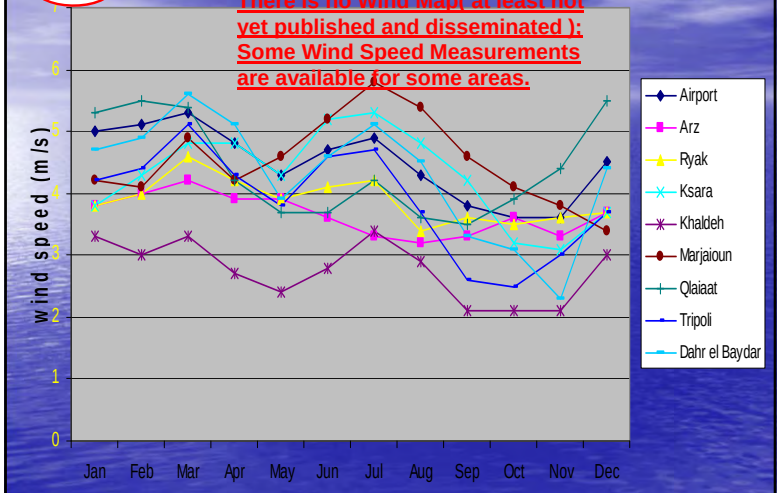
There is no Wind Map(at least not yet published and disseminated); Some Wind Speed Measurements are available for some areas.



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BARRIERS

- Monopoly of electricity by EDL
- Lack of Environmental Commitment
- Cash strapped government
- Inconsistency of regulations
- Small area

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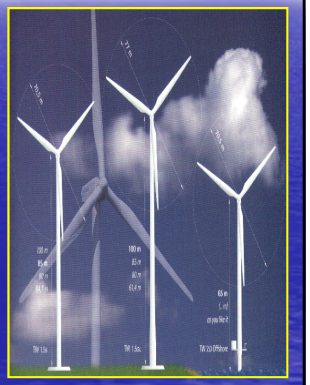
Market Incentives

- Well distributed Grid
- Dispersed resources
- Implementation of a feed-in tariff
- Allow net metering



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Market Incentives

- No significant zoning problems
- Set Reasonable Interconnection Requirements
- Strongly encouraged by international donors

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New Project ??

Project Proposal made by "Lebanon Wind Energy ,Private Sector" to EDL (actually under discussions):

60 MW Wind Energy in the Akkar, North Lebanon

Budget: 70 Millions €
Financial Scheme & Statues: BOO, Generating license
and Guaranty "*feed in*" prices for 10 years

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Assessment of the Hydro Energy in Lebanon

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CENTRALES HYDRAULIQUES EXISTANTES AU LIBAN

NOM	PROPRIETAIRE	PUISSANCE (MW)
SAFARICHMAYA	EDL (ETABLISSEMENT PUBLIC)	13
ABDEL AL	OFFICE DE LITANI (ETABLISSEMENT	34
ARKACHE	PUBLIC)	108
HELOU	"	48
NAHR IBRAHIM	PRIVE	33
BARED	PRIVE	17
ABOU ALI	KADISHA (COMPAGNIE PROPRIETE	7.4
BLAOUZA	DE L'EDL)	6.4
MAR LICHAA	"	3.1
BCHARRE	"	1.6
	TOTAL HYDRAULIQUE	273.5

Hydro: 275MW

CENTRALES THERMIQUES EXISTANTES AU LIBAN

NOM	TYPE	COMBUSTIBLE	PROPRIETAIRE	PUISSANCE (MW)
ZOUK	TURBINE A VAPEUR	FUEL OIL LOURD	EDL	145X3 175
ZOUK	TURBINE A GAZ	DIESEL OIL	EDL	18
JIEH	TURBINE A VAPEUR	FUEL OIL LOURD	EDL	62X2 69X3
HREYCHE	TURBINE A VAPEUR	FUEL OIL LOURD	KADISHA (APPARTENANT EDL)	65
BAALBECK	TURBINE A GAZ	DIESEL OIL	EDL	35X2
SOUR	TURBINE A GAZ	DIESEL OIL	EDL	35X2
ZAHRANI	C.C.	DIESEL OIL OU GAZ NATUREL	EDL	145X3
DEIR AMAR (BEDDAOUI)	C.C.	DIESEL OIL OU GAZ NATUREL	EDL	145x3
	TOTAL THERMIQUE			2034

Thermal: 2000 MW

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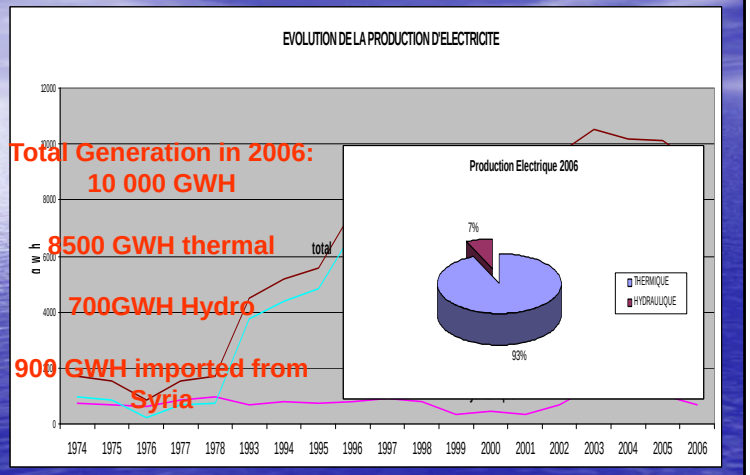

Total Generation in 2006: 10 000 GWH

8500 GWH thermal

700GWH Hydro

900 GWH imported from Syria

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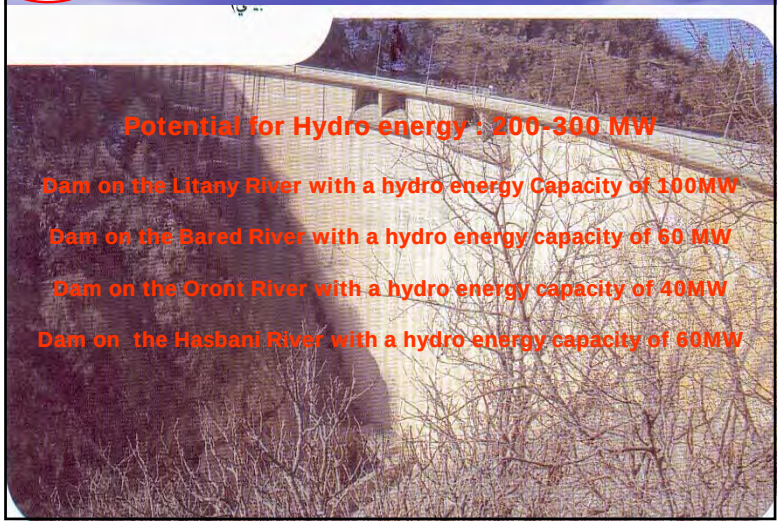

Potential for Hydro energy*: 200-300 MW

Dam on the Litany River with a hydro energy Capacity of 100MW

Dam on the Bared River with a hydro energy capacity of 60 MW

Dam on the Oront River with a hydro energy capacity of 40MW

Dam on the Hasbani River with a hydro energy capacity of 60MW

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At least five developments will affect the energy sector in Lebanon in the coming years:

- The substitution of diesel oil by Natural Gas for operating the Beddawi 450 MW Combined Cycle thermal plant. (The Regional Natural Gas Gasoline (Egypt, Jordan, Syria, Lebanon)
- The unbundling and restructuration of the power generation and distribution electricity sectors. Law No. 462
- **The development of the REs market due to the new Energy Policy *under discussion* in the Parliament**.
- The Regional Electricity Interconnections (Seven neighboring countries)
- **The development of Efficiency Energy Measures due to the new Energy Policy *under discussion* in the Parliament**.

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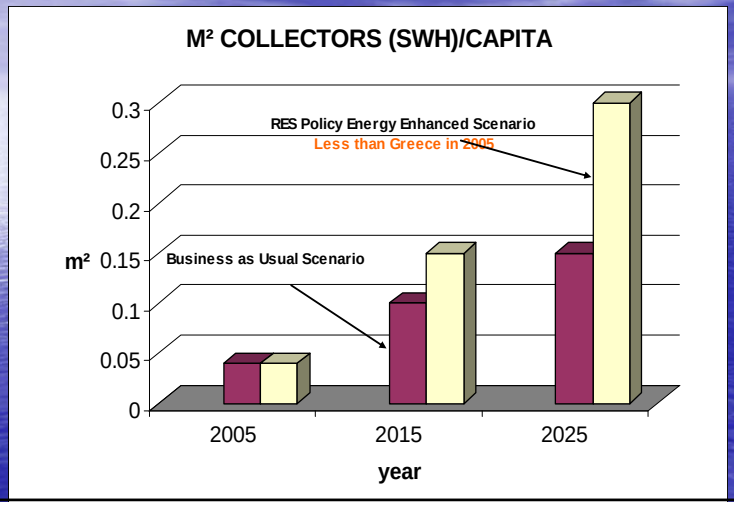

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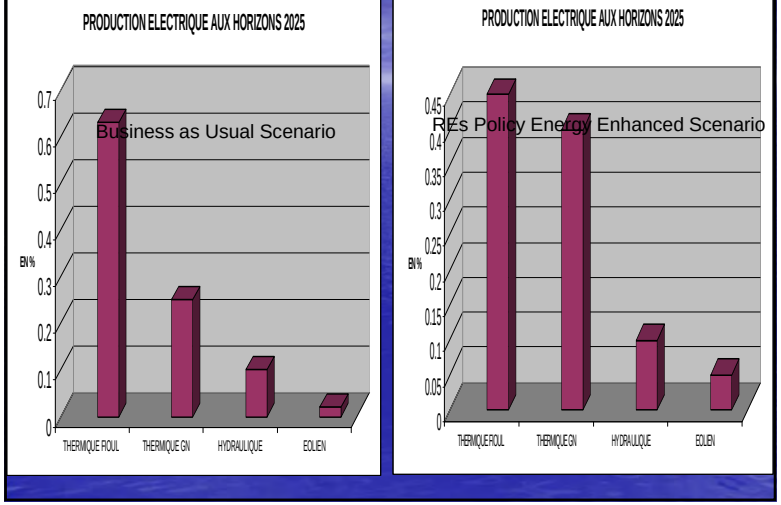


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