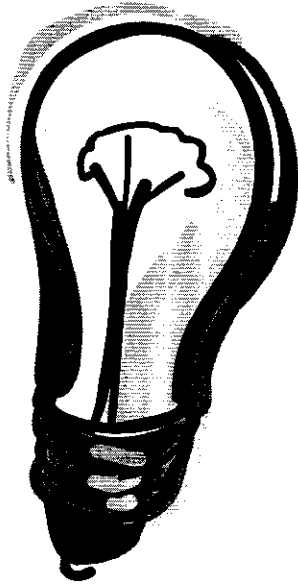


Renewable Energy within the prospects of Sustainable Development

BY

Chafic ABISAID



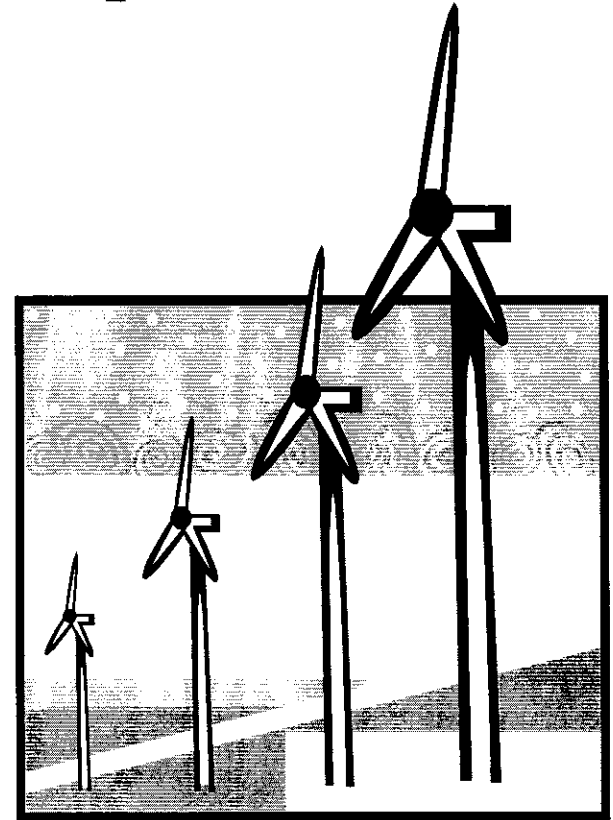
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مركز مشاريع ودراسات القطاع العام

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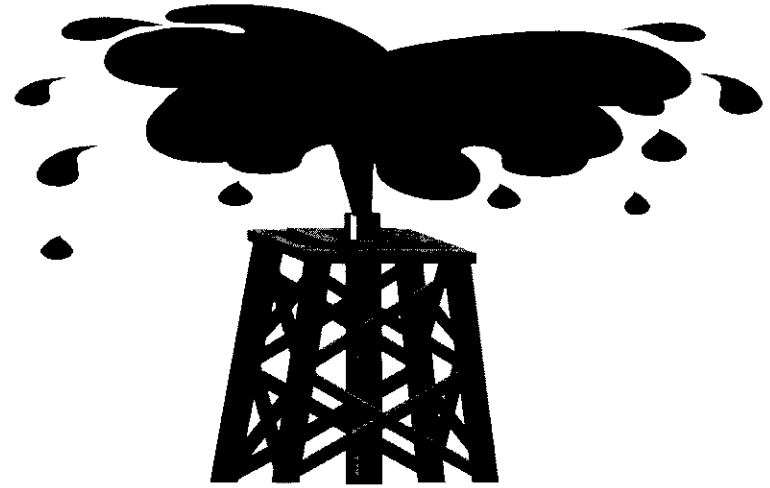
Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
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POW/02/3



Preface:

- ** Different Energy Resources
- ** Role of Energy in the world
- ** Present Status of World Energy
- ** Expected Energy shares
- ** Future Expected Energy Growth
- ** Advantages & Disadvantages of conventional Energy
- ** Prerequisites to use Energy as a tool for Sustainable Development
- ** Renewable Energy as a tool for Sustainable Development
- ** Current Status & Future Development of Renewable Energy in the World
- ** Status of Renewable Energy in the Arab World
- ** Status of Renewable Energy in the Lebanon
- ** Setting the right Framework for Renewable Energy in the Lebanon
- ** *Our future revolves around getting it right.*



Different Energy Resources

- 1- Fossil fuel resources, mainly Oil & Natural Gas (in our regions) , Mineral Coal.
- 2- Hydraulic resources(Large power schemes).
- 3- Nuclear resources.
- 4- Traditional resources (Wood, charcoal, agricultural & animal waste,...).
- 5- Renewable energy resources, specifically Solar(thermal & electrical), Wind, Biomass & to a lesser extent Geothermal, Marine & small Hydropower schemes.

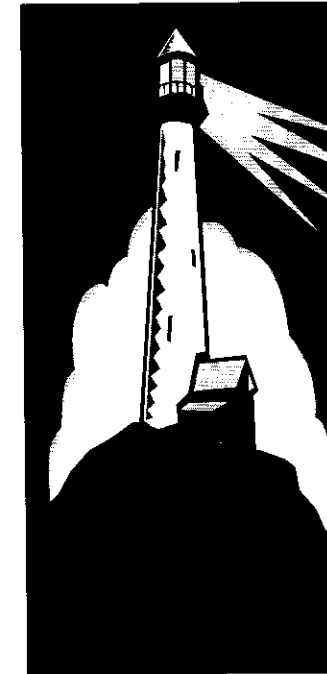
Role of Energy in the World

- “Energy is central to achieving the interrelated economic, social and environmental aims of individual and universal sustainable human development” (1).
- “Sustainable Development: requires that “ Energy is produced and used in ways that support present & future human development in all its social, economic & environmental dimensions “ (1).
- Energy consumption world wide, in particular in OECD countries, is directly related to economic growth.
- 2000-2010: **OECD** economic growth 3-3.1 %Yr. Energy cons.growth 2 % Yr. Developing. Countries econ. Growth 2-2.5 %Yr. Energy cons.growth 5 %Yr. {Arab countries 2 % (1998-1985) VS 4.9 % (1998-1990). Lebanon average energy cons. Growth 1998-1985: 6.3 %}.
- Affordable energy supplies are not accessible by 2 billion people (1/3 of world population. 65-70 million Arabs & < 1/3 of population in Morocco, Yemen Sudan, Somalia, Mauritania are supplied with electricity).
- End-use forms of Energy: Thermal- Mechanical – Chemical-Electrical.
- If the global growth rate of about 2 % a year of primary energy use continues, it will mean doubling of energy consumption by 2035 relative to 1998 & a 4 tripling by 2055.

Present Status of World Energy

1- World Primary Energy Consumption - 1998

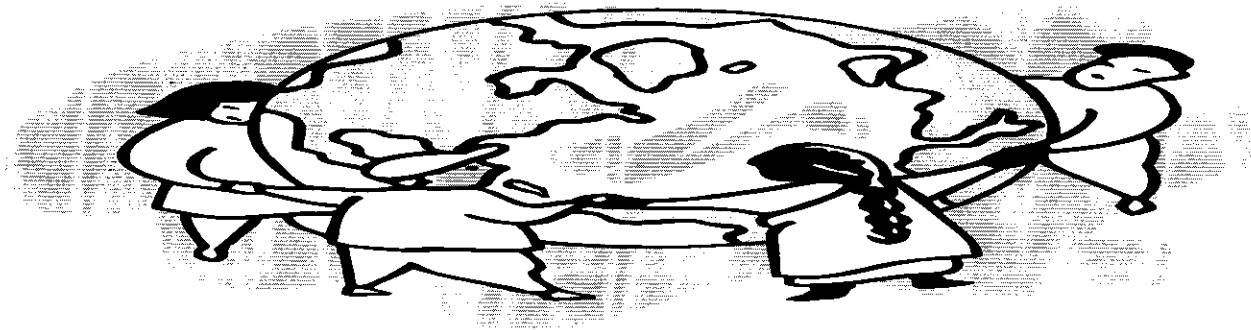
<u>Source</u>	<u>Billion T.O.E.</u>	<u>Percentage of total</u>
<u>Fossil fuels</u>	<u>7.63</u>	<u>79.6</u>
Oil	3.39	35.3
Nat. Gas	2.02	21.1
Coal	2.22	23.1
<u>Renewables</u>	<u>1.33</u>	<u>13.9</u>
Hydro	0.21	2.2
Trad. Biomass	0.91	9.5
New Renewables	0.21	2.2
<u>Nuclear</u>	<u>0.62</u>	<u>6.5</u>
<u>Total</u>	<u>9.58</u>	<u>100.0</u>



Present Status of World Energy

2- OIL & Natural Gas Reserves(1999-2000)

Region	Oil (2000) Billion T.O.E.	Nat. Gas(1999) Billion m3
-----	-----	-----
Total Arab countries	646.46	33706
Total Opec countries	636.80	32337
Total World	1034.35	150356
-----	-----	-----
Arab countries/ World %	62.50	22.42



Future Expected Energy Growth

2000-2020:

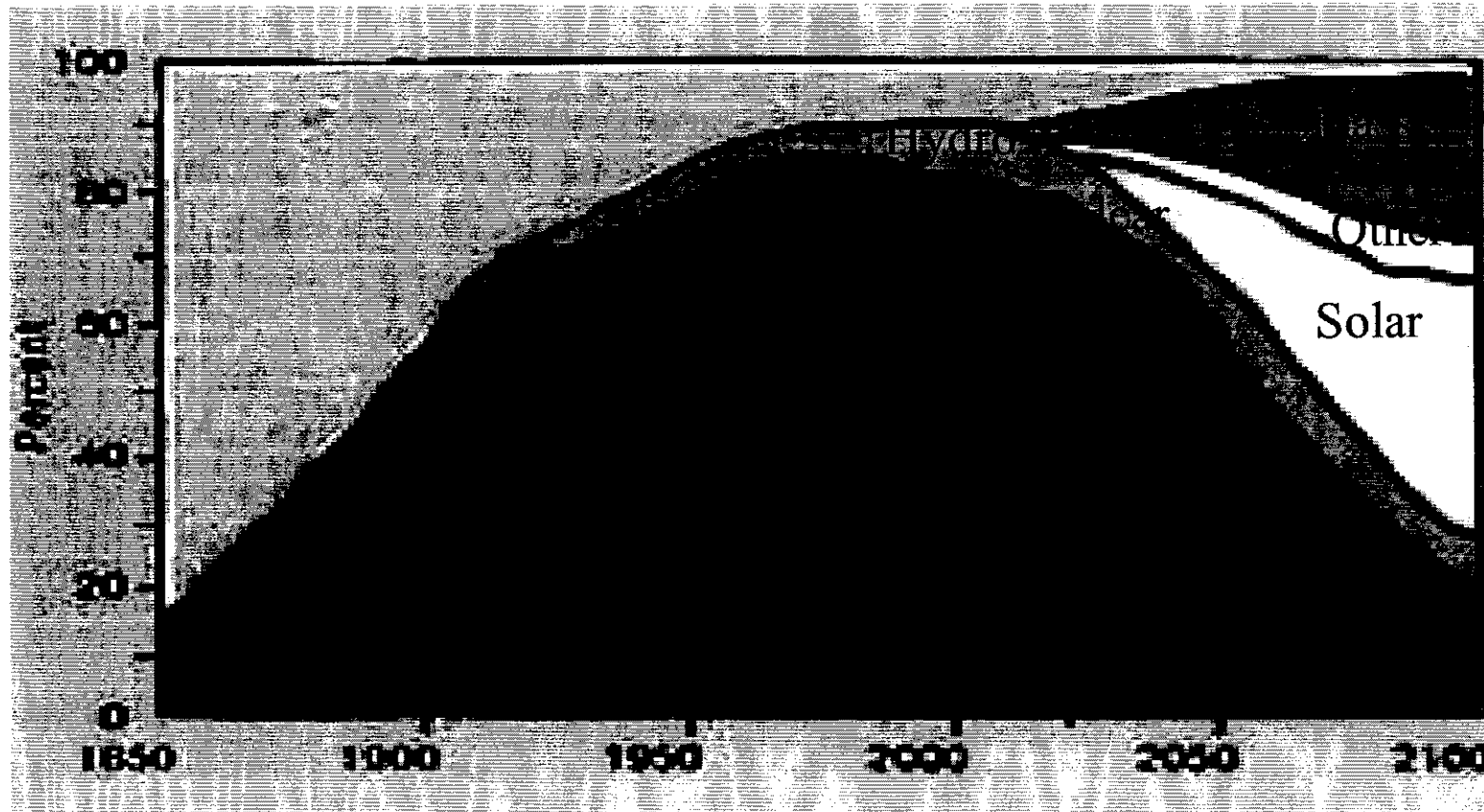
P e r c e n t / y e a r(1)

Arab Arab OECD Developing World
Countries Mashrek Countries

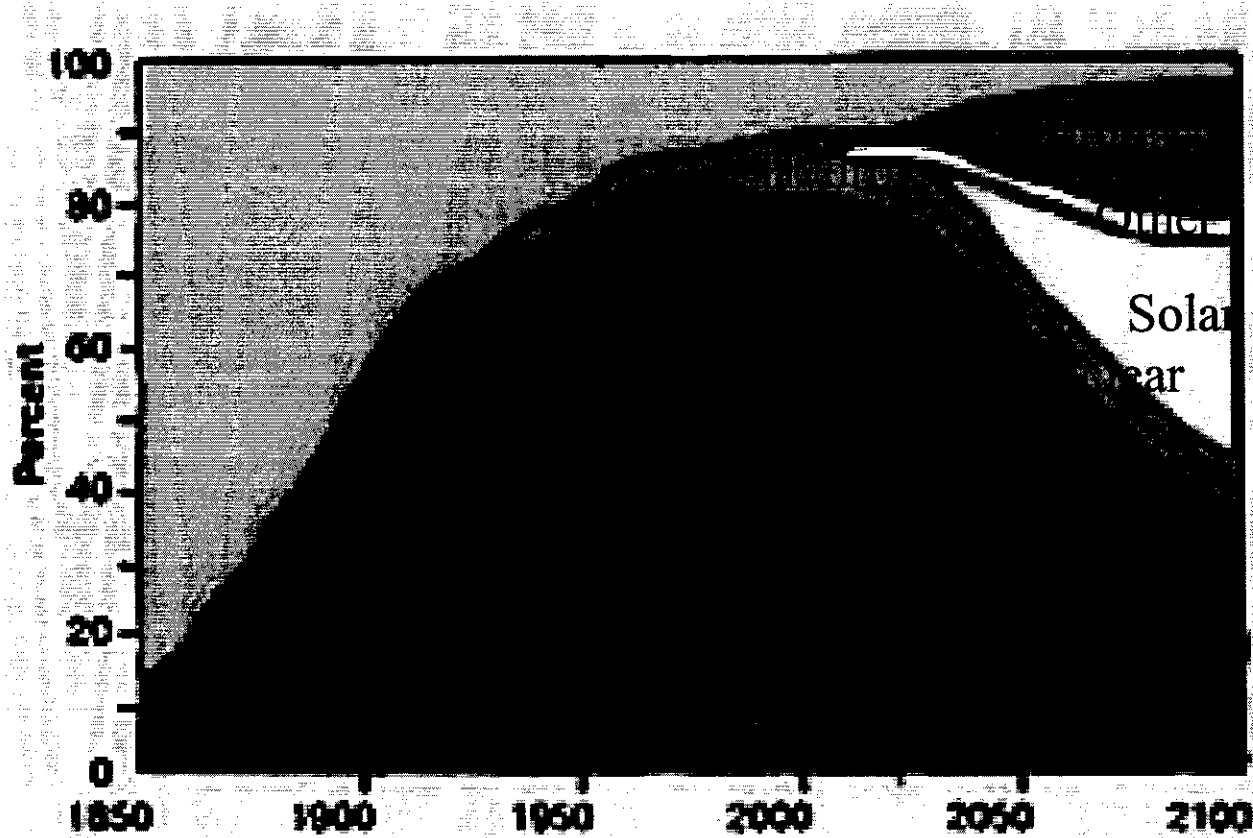
Conventional Energy_	5	5	1	4	2
Electricity	6	5	1	4	2.5
Nuclear	0	0	0	2	1
Hydropower	0	0.1	0	1	0.2
Renewable Energy	0.2	0.2	1	0.2	0.4

(1)Estimated figures.

Expected Primary Energy Shares, 1850-1990 & Scenario 1 to 2100



Expected Primary Energy Shares, 1850-1990 & Scenario 2 to 2100



Advantages & disadvantages of Conventional Energy

Advantages of fossil fuels:

- Abundance of world reserves (oil & gas: 50-100 yrs., coal much more).
- Advanced technical know-how.
- Relative affordable prices in OECD countries..

Disadvantages of fossil fuels:

- Long term depletion of world reserves
- Environmentally unfriendly (emission of SO_x, NO_x, CO₂, CO, particulates,...) leading to environmental degradation.
- Environmentally best fossil fuel perspective: Natural Gas (no Sox, 26 % CO₂ less than the fuel-oil and 49 % less than coal, also less NO_x).
- Most countries lack fossil fuel reserves. In Arab countries 10/ 21 countries import their fossil fuels).
- 2 Billion people in the developing countries (1/3 of world population are deprived of modern energy).

Nuclear Energy:

- High installed price.
- Nuclear fuel availability & processing.
- Operational risks & hazards.
- Danger of Technology dissemination.
- Residue discharge storage.

Conventional Biomass:

- 20th Century: fossil fuel consumption : 20-fold; conventional biomass: 3 times.
- Desertification & deforestation.

Prerequisites to use of Energy as a tool for Sustainable Development

- ▶ More efficient use of energy.
- ▶ Increased reliance on renewable energy sources.
- ▶ Accelerated development and deployment of new energy technologies.



Renewable Energy (RE) as a tool for sustainable Development

- RE resources, specifically Solar, wind and Biomass are available in varying degree in most countries.
- No physical limitations on total RE resources, provided economic, technical financial and environmental policies are solved in a timely manner.
- RE have the potential to supply with almost zero emissions. GHG abatement.
- New RE satisfy basic human needs in rural areas, where no electric grid exists:
 - Processed solid fuels (biomass & coal).
 - Photovoltaic as an electric sources.
 - Solar hot water heating for both rural and city dwellings.
- RE reduces consumption of fossil fuels and generates economic benefits.
- Promotes social and economic development.

Current Status & Future Development of Renewable Energy in the World

- **1998: New RE sources contributed 2 % of total world consumption:
 - 1.5 % in the form of modern biomass (bio-gas, bio-ethanol, ETBE, vegetable oil, .
 - 0.5 % Geothermal, wind, solar, marine & small hydro.
- ** Traditional biomass: 12 % in rural areas of developing countries.
- ** Solar & wind are intermittent sources. Nevertheless, can reliably provide 10-30 % of total electricity supply , if operated in conjunction with hydropower or fuel-based power generation (1).
- ** Solar photovoltaics and grid connected wind installed capacities are growing at a rate of 30 % a year.
- ** "Slide 14" details current status & future costs of RE technologies.
- ** "Slide 15" Expected RE contribution in World Energy consumption in the 21st century.
- ** Rapid expansion of RE based energy systems will require actions to stimulate the market in this direction: R & D to improve technologies and reduce costs,
- ** Government incentives, public awareness, removal of subsidy of conventional energy.

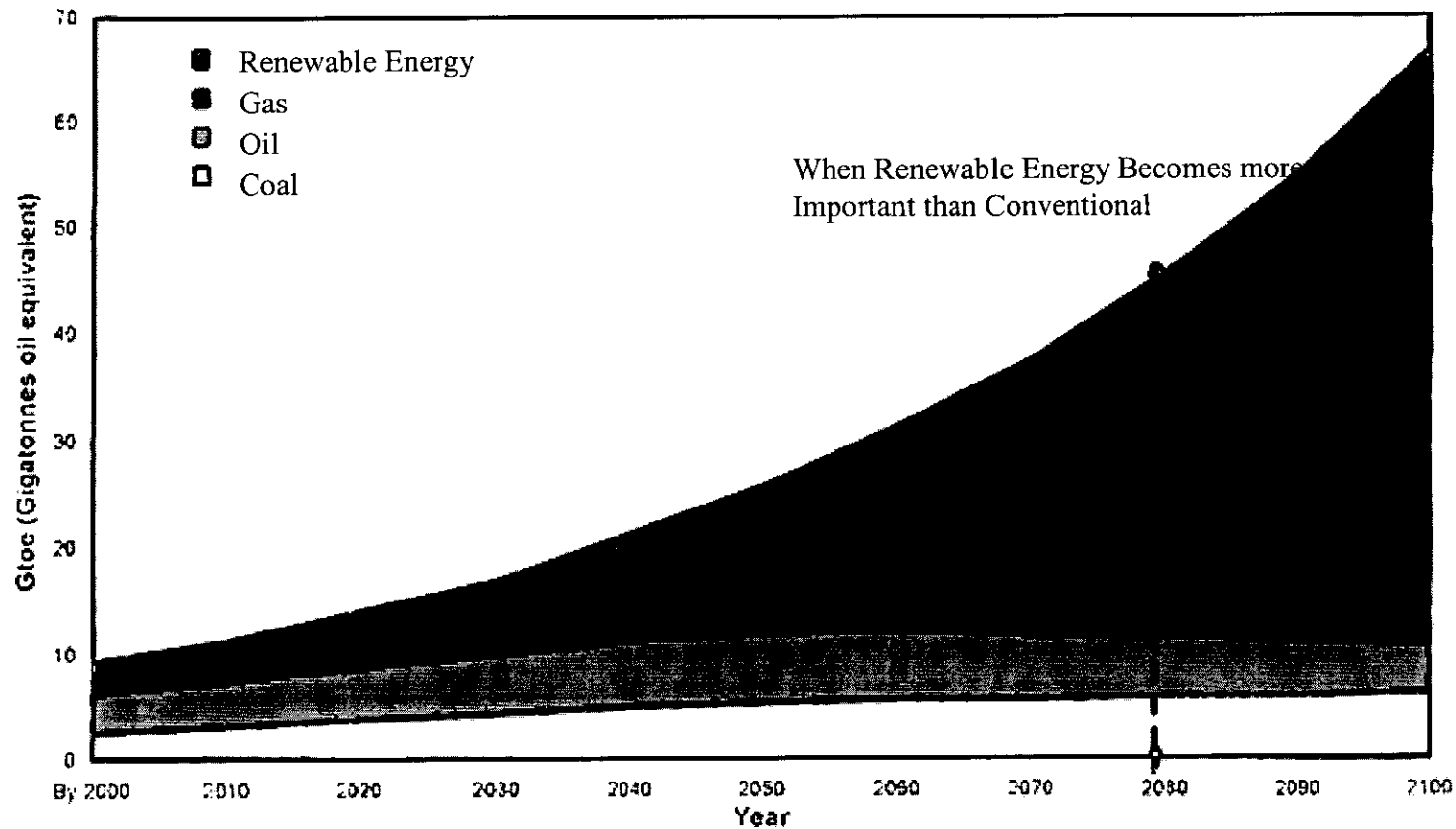
Current Status & Future Development of Renewable Energy in the World

Technology	Increase in installed capacity in past five years (percent a year)	Operating capacity, end 1998	Capacity Factor (Percent)	Energy Production, 1998	Turnkey investment costs (U.S. dollars per kilowatt)	Current energy cost	Potential future energy cost
Biomass energy							
Electrical	~ 3	40 Gwe	25-80	160 TWh (e)	900-3000	5-15 ¢/KWh	4-10¢/kWh
Heat	~ 3	>200GWth	25-80	>700 TWh (th)	250-750	1-5 ¢/KWh	1-5 ¢/kWh
Ethanol	~ 3	18 billion liters		420PJ		8-25 \$/GJ	6-10\$/GJ
Wind Electricity	~ 30	10 Gwe	20-30	18 TWh (e)	1100-1700	5-13 ¢/kWh	3-10¢/kWh
Solar photovoltaic electricity	~ 30	500MWe	8-20	0.5 TWh (e)	5000-10000	25-125 ¢/Kwh	5 or 6-25 ¢/kWh
Solar thermal electricity	~ 5	400 Mwe	20-35	1 TW (e)	3000-4000	12-18 ¢/KWh	4-10 ¢/KWh
Low-Temperature Solar heat	~ 8	18 GWth (30 million m2)	8-20	14 TWh (th)	500-1700	3-20 ¢/KWh	2 or 3-10 ¢/KWh
Hydroelectricity							
Large	~ 2	640 GWe	35-60	2510 TWh (e)	1000-3500	3-8 ¢/KWh	3-8 ¢/KWh
Small	~ 3	23 Gwe	20-70	90 TWh (e)	1200-3000	5-10 ¢/KWh	4-10 ¢/KWh
Geothermal energy							
Electricity	~ 4	45-90	45-90	46 TWh (e)	800-3000	2-10 ¢/KWh	1 or 2-8 ¢/KWh
Heat	~ 6	20-70	20-70	40 TWh (th)	200-2000	0.5-5 ¢/KWh	0.5-5 ¢/KWh
Marine Energy							
Tidal	0	300 MWe	20-30	0.6 TWh (e)	1700-2500	8-15 ¢/KWh	8-15 ¢/KWh
Wave	-	Exp. phase	20-35	Pm	1500-3000	8-20 ¢/KWh	Unclear
Current	-	Exp. Phase	25-35	Pm	2000-3000	8-15 ¢/KWh	5-7 ¢/KWh
OTEC	-	Exp. Phase	70-80	Pm	Unclear	Unclear	Unclear

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Expected Renewable Energy contribution in World Energy consumption in the 21st century.



المركز
للدراسات
والمشاورات
والتدريب
والإدارة
مركز
مشاورات
وخدمات
القطاع
العامة

Current Status and Development prerequisites of Renewable Energy in the Arab World

- The Arab World enjoys tremendous RE resources, particularly Solar, Wind and Biomass.
- International organizations, namely ESCWA & UNDP are very active in the region.
- Egypt & Jordan are in the forefront of Arab countries- especially in R&D, followed by Morocco (rural electrification 32 % in 1999, 65 % in 2003 – 1500 villages/yr photovoltaic, 100 000 m2/4yrs.SHWH). In 1997:Palestinian authority >70 % residential houses used SHWH. Egypt 150 000 m2, Jordan 158 000 m2, Syria 6000 m2 produced locally..Wind: Egypt 600 MW by 2005. Desalination plants: RE in conjunction with conv. Energy 27 plants (90 in the world).
- RE would play an effective role in the future energy supplies in the area provided:
 - Proper institutional framework in individual member states.
 - Activate R & D, allocate funds & promote incentives.
 - Develop local human resources.
 - Exchange of expertise between member countries.
 - Development of local manufacturers.
 - Fund RE pilot & promotional projects.
 - Cooperate fully with international organizations and donating governments.
 - Instigate & support continuous awareness campaigns.

Current Status of Renewable Energy in the Lebanon

↔ Lebanon imports > 97 % of its need in primary energy. RE represents less than 1 %.

↔ Lebanon is relatively rich in some RE:

** Biomass: Forests 8 % of Lebanese territory; forests sick. Biomass hardly a reliable source.

** Small hydro schemes: A large number of hydro schemes 5 -10 MW have undertaken preliminary studies. < 1MW need to be assessed. Feasibility studies, taking into consideration environmental costs, are needed.

** Wind: Certain Lebanese localities have been confirmed commercial wind farms. Pumping water schemes with wind turbines are attractive projects.

** Solar: 3000 hours/yr of solar rays and an average 2200 KWh/m² makes solar energy a very promising source of cheap and clean energy, solar hot water heating (SHWH) requiring little technical know how. Photovoltaic, with its prohibitive price and the total rural electrification of Lebanon, is hardly a solution in Lebanon.

↔ RE development has gained, so far, no momentum in Lebanon. The *Barriers* to surmount:

** Total disinterest of public authorities, .

** Lack of institutional reforms.

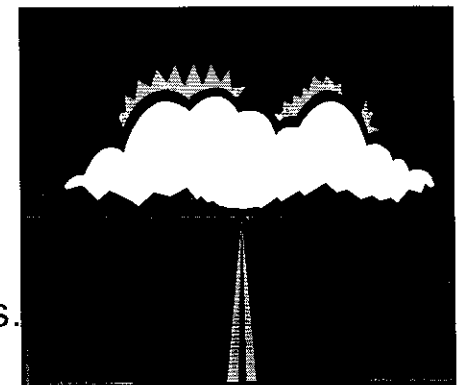
** Cheap comparative energy, unpaid/ stolen and subsidized electricity.

** Lack of awareness all round.

** Absence of promotional incentives.

** ~~Total~~ Total existence of standards and labeling of electric goods and products.

** Weak ESCOs and total public non response to them.



Setting the right Framework for Renewable Energy in the Lebanon

- 🏭 With the exception of sporadic SHW collectors in residential areas (partly imported, partly locally manufactured) and very limited research at AUB & the NCSR, Lebanon totally ignored RE.
- 🏭 With the highest rates of the polluting gas emissions from energy: in 1998: 15 Ktons of dust, 85 Ktons of SO₂, 40 Ktons of NO_x and 3500 Ktons of CO₂.
- 🏭 Urgent need to review energy policy, in particular vis à vis Renewable energies.
- 🏭 In 1995, we proposed merger of the Ministries of MHER & MOP into a Ministry of Energy ME and create a new Ministry of Water Resources. In 2000: MHER & MOP were merged into a Ministry of Energy & Water.
- 🏭 We now propose:
 - ** Establishment of a special “ Energy Council (EC)” to promote Energy Conservation and develop Renewable Energies, within the premises of the Ministry of Energy & Water.
 - ** Set the “ Legal & structural Framework” for the EC, granting it the widest *Autonomy* under the tutelage of the Energy Minister.
 - ** Secure the funds needed to keep the EC afloat, at least for the first few years.
 - ** Recruit the qualified human resources needed.
 - ** EC to establish a plan of action to surmount the barriers listed in the previous slide.
 - ** EC to work very closely with international organizations and donating foreign governments, brandishing (for maximum assistance and donation) the banner of “Environmental Protection”.

Energy: Our Future Revolves Around Getting it Right

The World Energy Assessment (WEA) concluded its conference on “Energy & the Challenge of Sustainability (September 20,2000):

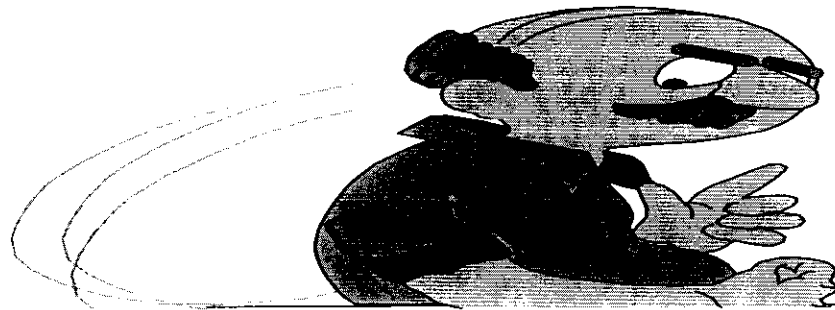
“A prosperous, equitable and environmentally sustainable world is within our reach , but only if governments adopt new policies to encourage the delivery of energy services in a cleaner and more efficient ways”.

The final report does not minimize the challenges ahead, which indeed are daunting. But it also clearly shows that we have the tools to meet them.

“We are at a cross road in term of our energy future. If we fail to take the right turns, we have no one but ourselves to blame”.

I conclude: The path is long & strenuous, but the stakes are high.

Thank you,



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10/9/2002

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