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It has been said that energy is the pillar of the nation. Accordingly, all decisions concerning the development and management of this sector should be founded upon comprehensive, in-depth studies that take into consideration all facets of life in the country.

The consequences are many in that the investment or income motive are no longer the best or the only criteria for evaluating alternatives. Energy policy in Lebanon, as in most countries, has had the limited objective of securing the requirements of the different sectors of the national economy at suitable prices. This policy, which is still in force, is based on the premise that energy is cheap and available. With the twenty-fold increase in the price of oil that has taken place in the past eight years or so, however, that premise has become untenable. Consequently, the countries of the world have set about searching for an alternative to this source, which has become a burden on their economies, absorbing the major part of their financial reserves and encumbering them with enormous debts. The utilization of types of new energy that have the widest application and the limitation of the wasteful uses of oil have, accordingly, became urgent imperatives.

The energy policy of Lebanon should be established on these bases. The official body responsible for drawing up energy policy in the context of the reconstruction and development of Lebanon is, in fact, the Council for Reconstruction and Development, of which a few words may be in order at this point. The Council was established by legislative decree in the early part of 1977 and was entrusted with a number of responsibilities in the field of planning. Among these was the formulation of a general development plan, follow-up plans and reconstruction and development programmes; the proposal of economic, financial and social policies in keeping with the general development plan; the formulation of general guideline proposals for city planning and proposal of draft reconstruction and development legislation. The Council's mandate also includes consultation and orientation functions in the field of economy and finance and executive functions in the preparation

and commissioning of reconstruction and development project studies and in the implementation of the projects of the general plan, the follow-up plans and established programmes.

The production, import and distribution of energy, however, are the responsibility of a multiplicity of institutions. Those include the General Directorate of Petroleum of the Ministry of Industry and Petroleum, which imports oil, refines it and delivers it to transport and marketing firms of the private sector for distribution to the consumer; the Lebanese Electric Power Authority, which supplies electric power generated at its thermal and hydraulic plants to most parts of the country; a number of privately-owned electric power companies and autonomous agencies which generate electricity under the supervision of the Ministry of Hydraulic Resources and Electricity.

The facts and figures of the energy situation in Lebanon give rise to a number of conclusions that must be considered in planning for the future of the energy sector. These include the following:

1. As in the other countries of the world, Lebanon's energy sector is destined to grow substantially in the coming decades.
2. Lebanon has no petroleum or nuclear energy resources, its development, therefore, is dependent upon its sources of supply.
3. The multiplicity of organizations involved in the energy sector fragments the decision-making process, obstructs the establishment of long-term energy policies and prevents the taking of rapid decisions for rationalizing the utilization of energy.

There is no call for government policy to effect any changes in conclusions 1 and 2 above (with the exception of decisions whose effect is to arrest economic growth). All efforts should be concentrated on making the economic growth of the country more effective, more balanced and less wasteful. Measures should also be taken to co-ordinate the different facets of energy policy under the responsibility of the many authorities and

organizations mentioned above. This could be done through the creation of a Supreme Energy Council or an Energy Commission composed of representatives of the different organisms involved in energy matters. Such an authority would have the following responsibilities:

1. Monitoring energy requirements and consumption in all economic sectors; collection of statistics on energy consumption, the most efficient use thereof and projected growth.

2. Up-dating studies on different energy sources for more effective technical and economic applications.

3. Monitoring fluctuations in world energy prices, studying energy policies and technological developments abroad.

4. Preparing campaigns urging the public to avoid wasting expensive energy resources, researching more efficient ways of using energy and supplying the different economic sectors with the necessary information for rationalizing energy use.

Thus it would appear that the conservation of energy has become a matter of vital importance. The government has two alternatives before it: Either limit consumption by improving productivity or reduce economic growth. The second alternative is out of the question in a developing country like Lebanon. Accordingly, the government could adopt measures similar to those taken by most countries of the world since 1973. These would involve tax exemptions, loans, grants; highly efficient heating and lighting systems; encouraging the use of public transport; subsidizing scientific research on energy and launching consumer orientation and information campaigns.

Scientific research on new and renewable sources of energy has become the responsibility of the National Council for Scientific Research. This Council was created by virtue of the law of 14 September 1962, which entrusted it with the centralization of science policy in Lebanon. The law attached the Council to the Office of the President of the Council of Ministers and gave it administrative and financial autonomy.

The terms of reference of this Council are both advisory and executive.

1. Advisory responsibilities:

(a) Designing the outlines of a national science policy aimed at the development of scientific research and the optimum utilization of the resources of the country for the public interest.

(b) Formulating work programmes, beginning with a Five-year Plan embodying that policy. The Plan should take into account the economic and social objectives proposed by the different ministries and approved by the Council of Ministers.

(c) Advising the Government, when requested, on all matters pertaining to the country's science policy. The Council's terms of reference include the health sciences and the natural sciences, both theoretical and applied.

(d) Formulating, on its own initiative, proposals and recommendations to the Government concerning the adoption, promotion and transfer of science and technology in the country.

(e) Undertaking essential studies and research projects, compiling information on private and public laboratories and research bodies in the country and on research in progress therein.

(f) Receiving information from the different ministries concerning work in progress related to science policy. (The ministries are obliged to supply the Council with the information it requests concerning such activities.)

2. Executive responsibilities:

(a) Stimulating and encouraging research in the basic theoretical and applied sciences.

(b) Co-ordinating, orienting and organizing scientific research in the framework of determinate programmes of action.

In pursuit of these objectives, the Council, more specifically, untertakes the following:

(a) It grants scholarships for doctoral studies and the pursuit of higher specialization.

(b) It assists researchers of recognized ability.

(c) It assists laboratores and research bodies.

(d) It commissions scientific research of recognized priority for the development of the country's resources.

(e) It helps Lebanese scientists and research workers to travel abroad on scholarly missions.

(f) It secures the publication of scientific works in Lebanon.

(g) It holds conferences and scientific seminars in Lebanon.

(h) It mobilizes all resources to facilitate, disseminate and apply the findings of scientific research accomplished in Lebanon.

The Lebanese war has had a great impact on the work of the Council. It came just as the take-off stage provided for the Council in the Six-year Plan was being implemented. Nevertheless, there is great confidence that the Council will be able to achieve the targets specified for it in that Plan.

New Sources of Energy:

So far scientists have failed to find any indication of the presence of fossil fuels in commercial quantities. Meanwhile, the energy requirements of Lebanon have been on a constant increase. Electricity consumption has been doubling every seven years and this rate of increase is likely to persist for a long time to come. Lebanon has exhausted most of its hydroelectric power potential. Present production accounts for around 30 per cent (840 million kWh) of total power generated in the country (2960 million kWh) and this proportion

is steadily declining. Lebanon will have to depend upon other sources for the generation of electricity, such as thermal power fueled by petroleum products which are not available in the country and whose prices are constantly increasing. It is for this reason that the Council decided to encourage research on alternative and renewable sources, such as solar and wind energy.

1. Solar energy

It is widely recognized that Lebanon enjoys an ideal climate for the harnessing of solar energy. The country receives between 2800-3000 hours of annual insolation. As this form of energy is available directly only during the daylight hours of sunny days, however, its utilization during the other hours of the day and days of the year calls for enormously expensive storage and insulation facilities. At an efficiency rate of 50 per cent of the conversion of solar energy into usable power would give the equivalent of 150 kg of oil or a million kilo calories per square meter of collector surface. In order to meet the present requirements for heating in Lebanon through solar energy, about 4 million square meters of collector surface would have to be installed at a cost of about four billion Lebanese pounds. At an annual interest rate of 10 per cent and an annual depreciation of 7 per cent over a 15 year period, the annual capital cost would be 13 per cent or a total of LL520 million. The cost per square meter of collector surface would then be LL130, the equivalent of LL870 per ton of oil.

The conclusion, however, should not be taken as final. Studies in applied economics conducted recently in Europe and the United States on the basis of 1980 oil prices have indicated that total dependence on solar energy for domestic heating is not economically feasible, at least at the present time. These findings determined that it would be economically optimal, however, to depend upon solar energy for 40-80 per cent of total domestic heating and hotwater requirements.

It would seem advisable, then, for the Government to encourage investment in this field and to set as its target the installation of 2 million square meters of solar collectors in 10 years with a capacity of producing temperatures below 100°Celsius.

There are two ways of converting solar energy into electric power: through photocells and solar concentrators. The high cost of these systems prevents their widespread application. The present cost of generating one kW could reach LL80,000 for photocells and LL30,000 for solar concentrators.

On the basis of a 15-year depreciation period at current interest rates, the generation of a kWh of electricity through solar concentrators would cost LL1.50 and LL500 through the photocell method. This is evidence of the economic non-feasibility of these two methods, as the generation of one kWh of electricity costs only LL0.13 through oil and LL0.09 through nuclear power.

2. Wind energy

The energy derived from the velocity of the wind can be harnessed in a number of regions in Lebanon, especially in the Bekaa Valley, where wind movements follow a regular pattern. Isolated dwellings situated in remote areas may find it beneficial to harness wind energy to a number of limited uses. This type of energy, however, is not expected to have any significant impact on the calculation of the energy balances of the country in the foreseeable future.

3. Geothermal energy

The temperature of the crust of the earth increases at the rate of the degree Celsius per depth of 33 meters. In some areas of the earth, this rate is much higher. The presence of groundwater reservoirs subjected to temperatures as high as 60°-120°Celsius at depths no greater than 1500 meters

makes it possible to harness this heat for the production of medium-range temperatures for domestic and industrial heating. Unfortunately, no preliminary exploration study of this phenomena has yet been undertaken in Lebanon. This subject deserves serious study in order to determine the feasibility of measures for developing thermal energy applications in the future, should they be found to exist in Lebanon.

4. Biocombustible

This source of energy is derived from agricultural and animal residues and urban refuse which are fermented to extract methane gas for domestic applications and alcohol for possible use as automobile fuel. This source of energy deserves serious study and consideration for use in Lebanon.

5. Scientific and Technological research and energy policy

The National Council for Scientific Research has decided to give priority in its science plan to research on the harnessing and application of new sources of energy in Lebanon.

- In the field of solar energy, the Council decided to equip a network of 12 stations in a number of districts with different atmospheric conditions for the purpose of studying solar radiation in the country. The findings will be distributed in atlas form to experts in the field who will then have a solid and accurate data base for their research and calculations.

- The Council's plan also includes the study of solar energy storage techniques and applications suitable to atmospheric conditions in Lebanon.

- The Council intends to study systematically the use of collectors and to create a laboratory unit for conducting experiments on them, testing

their performance and guiding technicians in the most favourable methods of utilizing them.

- In the field of geothermal energy, the Council intends to make deep probes under the secondary layers of the earth's crust in order to try to locate possible hydrocarbon, fuel gas and geothermal resources.

- The Council has also programmed a number of research activities into the sources of wind energy.

- The Council is presently experimenting with the formentation of organic refuse in urban and remote areas in preparation for actual implementation of biomass energy projects.

- The Council is also supporting theoretical and applied research on photocell conversion and biological photosynthesis in order to provide the Government with the information and the facts necessary for the implementation of the above mentioned energy policy.

- Urgent decisions are required concerning the application of nuclear energy, the mobilization of the country's available solar, wind, geothermal and biomass energy resources and the prevention of wasteful practices. It is also imperative that the country benefit from the plans and experiences of the more advanced nations in providing for future energy needs.

6. Spring seminar on solar energy

The Council and the French Embassy in Beirut are organizing a seminar on solar energy to be held in Beirut between 7-21 May 1981. The purpose of the seminar is to give an overview of the present state of research on solar energy in general and on the conversion of solar radiation into electric power on thermal energy in particular. The seminar is for the benefit of

scientists and engineers already engaged in solar energy studies and applications and ones desiring to enter the field.

The lecturers will include three French and two Lebanese specialists in the field and all experts engaged in solar energy activities in Lebanon and neighbouring Arab countries will be invited to participate.

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