The Need for Alternative Sources of Energy in Sri Lanka.

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"Energy is the 'sine qua non' of a modern society's ability to do the things it wants to do. While lower energy costs allow a society more freedom of action in seeking its goals, the availability of energy is the first requirement of having any freedom of action at all."

ENERGY CONSUMPTION

The total energy consumption in Sri Lanka for the year 1977 was estimated at 10,000 GWh (electricity replacement) of which 1200 GWh was provided by hydro-electricity, 2800 GWh from oil products and 6000 GWh by traditional fuels such as firewood and agricultural residues. The natural solar energy radiation is excluded from this assessment.

ELECTRICITY

The demand for electricity which grew at about 6.5% per annum around 1970 to 1975 is now growing at about 14% per annum. Plans for installing hydropower plants were based on a 10% per annum growth rate. The per capita annual consumption of electricity which is around 110 KWh is low compared to that of our neighbouring countries like India, Thailand, Indonesia and the Philippines (between 200 and 400 KWh) and much lower than that of the developed countries like Canada and the United States of America (around 8000 KWh). Besides, only about 11% of the households and about 8% of the villages in Sri Lanka have access to electricity.

On a very broad average, in the developing countries, the demand for electricity doubles itself once in 7 years, while in the developed countries the doubling period is 10 years. There are many developing countries that have experienced sharp growth rates in electrical energy demand. In Thailand, the demand for electricity grew threefold from 1967 to 1974. In Bulgaria, the percapita annual consumption of electricity grew from 45 KWh in 1944 to 2230 KWh in 1970. In Egypt, the electricity grid grew from 348 MW in 1952 to 4100 MW in 1970.

With emphasis on rural electrification programmes and on industrial ventures, the demand for electricity in Sri Lanka is bound to rise sharply in the near future.

The Accelerated Mahaweli Development Programmes, which would be bringing into stream Bowatenna (40MW) in 1981, Canyon (30 MW) in 1982, Kotmale (134 MW) and Victoria (210 MW) in 1984, Randenigala (122 MW) in 1986 and Rantembe (49 MW) in 1987 would be meeting the growing electrical energy demands till about the year 1988. Owing to the sudden growth of electricity demand since 1977, it has also become necessary to install 60 MW of gas turbines by the end of 1980, and another 60 MW by the end of 1981. The development of these hydroplants in series would be followed by the development of Samanalawewa (possibly 240 MW and 400 GWh) around 1989 and the remaining hydropower resources which have an aggregate potential of around 750 MW and 2300 GWh/annum energy in quick succession thereafter.

THE ELECTRICAL ENERGY GAP

A gap will emerge around 1988 between the demand for electrical energy and the development of the hydro resources. This gap will widen very rapidly towards the end of the century. It will have to be filled by non-hydro sources of electrical power generation.

OIL

The petroleum requirements of the country are met mainly by the refinement of crude oil into middle distillates at the refinery at Sapugaskanda. A certain amount of kerosene and diesel are also imported from time to time to supplement the needs above what we convert from the crude oil imports. The heavy ends left over after the extraction of middle distillates from the crude oil is used for industrial heating and bunkering facilities. The introduction of secondary refining processes like the hydro cracker would convert the heavy ends also into middle distillates and save further importation of refined diesel and kerosene to meet the demand.

The bunkering facilities could be catered to by the international markets where bunker oil today

fetches depressed prices. The demand for diesel will rise with its further use in the Gas Turbines to generate electricity and for transporting and operating heavy machinery in the accelerated Mahaweli Programme, in addition to its normal increasing demand in the transport sector.

The crude oil imports over the last ten years have been around 1.5 million metric tons per annum. But the cost of these imports have risen over tenfold. It therefore becomes very clear that we will have to minimise our dependency on crude oil imports.
It will be difficult to find a substitute for petroleum in the transport sector. Ethanol is currently more expensive than petroleum. Besides, the availability of land and the more urgent need to become self sufficient in sugar will preclude the use of ethanol, in transport. We should therefore aim at replacing petroleum products in industrial heating with alternative sources of energy, conserve the use of petroleum in the transport sector, and introduce secondary refining processes in the refinery to optimise the use of crude oil imports.

FIREWOOD

Firewood constitutes 60% of our energy needs. 94% of the households in Sri Lanka use firewood for domestic cooking. Nevertheless, the efficiency of its use in domestic cooking is very low.
The need to devise and popularise an efficient domestic cooker is imperative, in order that the existing firewood resources could meet the growing domestic need. Over the past few years, we have been consuming more firewood than what the forests can naturally regenerate. This is evident by the depletion of the forest cover from 45% of our land area in 1958 to 25% today. This trend has to be arrested very quickly. The Ministry of Lands and Land Development is already taking giant strides in protecting the forest cover and embarking on a planned forest programme. The Ceylon Institute for Scientific and Industrial Research (CISIR), the Industrial Development Board (IDB) and the State Timber Corporation are engaged in making more efficient domestic stoves and in the better use of fuelwood in domestic cooking.
The use of biogas generators in re-cycling animal and agricultural wastes for the generation of methane on one hand, for its use in smallscale electricity generation or domestic cooking, and for the production of a higher value fertilizer on the other hand-which will reduce our need to import fertilizer — should also be encouraged.

NEEDS SUMMARY

In summary we note :

1. A gap would arise beginning around 1988 between demand for electricity and planned hydro energy development which will widen towards the end of this century. This gap has to be bridged by electricity generation from non-hydrosources.

2. Secondary refining processes should be introduced in the refinery to optimise the use of crude oil imports.

3. The replacement of the use of petroleum products for industrial heating should be pursued.

4. Conservation measures should be introduced in the use of petroleum for transport.

5. We should devise and popularize a more efficient domestic fuel wood cooker.

6. We should embark on a planned reforestation programme.

ALTERNATIVE ENERGY SOURCES AVAILABLE TO US

We now examine the alternative sources of energy that are available to us.

Sri Lanka has so far not discovered any coal, oil or natural gas. Some peat resources in Muthurajawela have been analysed. The availability of peat in other parts of the country have not been analysed. Being a tropical island we receive plenty of sunshine. Certain parts of the country experience strong wind regimes. Uranium and thorium deposits are found in some parts of the country. We encounter small tides. Only about half of our hydro power resources have already reached a level of planning and exploitation.

(i) **Hydro resources.**

The remaining hydro resources should be systematically planned for its exploitation in the 1990's in quick succession.

(ii) **Peat resources.**

A systematic study should be made on the available peat resources in the country.
An analysis of peat resources in the Muthurajawela reveals that about 2 million tons of peat of 40% moisture and of a calorific value of about 2,600 K cals/kg is available. Peat may be used to supplement coal in a coal fired power generating plant. It may also be

converted into briquettes of 15% moisture and calorific value 5,600 K cals/kg for domestic use.

(iii) **Nuclear Resources.**

Sri Lanka has some uranium and thorium resources. There will be a scarcity of uranium resources to meet the world need for nuclear reactors in the commercial burners in the 1990's. However commercial nuclear power plants that could compete with oil fired plants are of the size of 600 MW (e) or more. The Sri Lanka electricity grid will not be large enough to accommodate a 600 MW (e) nuclear power plant even by the year 2000. A 300 MW (e) nuclear plant may be accommodated in the grid by about the year 1995. However a series of feasibility studies and other scientific studies have to be conducted before a nuclear power plant can be recommended for the grid. Sri Lanka does not possess qualified scientific staff to carry out these studies. The staff should be familiar with basic nuclear physics and be trained in nuclear power technology. The lack of qualified staff does not permit Sri Lanka to introduce nuclear reactors before the year 2000. The alternative, of course, is to depend on foreign expertise which will make nuclear power generation prohibitively expensive.

(iv) **Solar Energy Resources.**

The average solar insolation per day in a dry region of Sri Lanka is about 5 KWh per square metre. Central Solar Energy electricity generating stations will not be developed for commercial use before the year 2000. However solar energy may be used in decentrallised systems for various uses even today. Photo-voltaic cells are expected to come down in price in about five years. This subject deals with the interaction of photons with matter and therefore calls for a deep understanding of theoretical physics. Photo-voltaic cells may be used to power VHF radio links between remote post offices and rural exchanges. Solar panels may be used for heating and cooling in buildings. Solar stills may be used to produce potable water for remote households and distilled water for car batteries and science laboratories. Solar refrigeration may be developed to preserve fruit and vegetables. Solar driers may be used for drying grains, cashew nuts, copra, pepper, tea and timber. Solar pumps may be used to lift water for irrigation purposes. These technologies require some capital investment in hardware for collection and conversion into useful forms.

(v) **Wind Energy.**

There are certain areas in Sri Lanka with strong winds. Wind energy is best used for lifting water from the underground for irrigation purposes.

(vi) **Biomass.**

Biogas generators may be used to recycle animal and agricultural wastes to generate methane and a higher value fertiliser. Methane may be used for domestic heating or small scale electricity generation. The use of biogas generators is now becoming popular in Sri Lanka.

(vii) **Ocean Thermal Energy Conversion (OTEC).**

The use of the temperature difference in the surface and bottom waters of the oceans to generate electricity is still in its early experimental stages. Commercial plants could be expected only in the next century. Preliminary investigations indicated that Sri Lanka could possess possible OTEC sites.

CONCLUSION

The need therefore arises for us to make a complete study of the alternative sources of energy that will be available to us. Of course, we should determine what our priorities are. At present, we have a 1980 to 1984 investment programme. It is a rolling programme revised every year. The 1981 to 1985 investment programme is in the making. We should, at least in the energy field:

1. Ensure that the manpower and financial resources are available to complete the current plans in the first instance.
2. Plan a proper reforestation programme. These plans would yield results only after many years.
3. Plan the optimum use of remaining hydropower resources and their phasing.
4. Introduce secondary processing facilities in the oil refinery.
5. Plan for the use of coal/peat/wood for electricity generation in 1990 to 2000, to bridge the gap that would arise between electricity demand and the availability of hydropower.
6. Plan the use of alternative sources of energy for industrial heating.
7. Plan on a conservation programme for oil, electricity and firewood.

The first priority is to have a comprehensive plan at least in the energy sector for the decade 1980 to 1990. When the manpower and financial resources are determined for the decade 1980 to 1990, then the next priority should be to plan for the decade 1990 to 2000. When the manpower and financial resources are determined for the decade 1990 to 2000, only then should one plan for the decade beginning 2000. The 'R + D' allocation in any plan should be confined to areas that would be considered priority areas 10 or 15 years hence but are not considered priority areas today.

The views expressed by the author are personal and need not reflect the views of either the Ministry of Finance and Planning or the Government of Sri Lanka.