Wimalasurendra Commemoration Lecture 1994

WIMALASURENDRA
His Perceptions and Our Hopes

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Preamble

My thanks to the Institution, and to its Electrical Engineering Sectional Committee, for the honour paid to me by inviting me to deliver this prestigious lecture.

Wimalasurendera was born on 17th September 1874 - tomorrow is thus his 120th birth anniversary. We commemorate him because in colonial times he fought for and initiated almost single-handed the use of our hydro resources for generating electricity. At our Annual Sessions 1918 - 76 years ago - he argued in a paper on "Economics of Power Utilization in Ceylon", that cheap power would facilitate the:

Electrification of the up-country railways,

Manufacture of fertilizer and other chemicals, and

Upliftment of the poor by the creation of industries.

Many engineers have since emphasized the imperative need to accomplish these very tasks, but we seem unable to get them done. His perceptions are thus our hopes. But before seeking ways and means of achieving these goals of development, it is necessary to look at the man in the context of his times.

The perfecting of the steam engine in the 1780s, by James Watt a mechanic, gave momentum to the industrial revolution. Engineering which had been primarily dedicated to making the "engines of war", blossomed out as the "art of directing the great forces of power in nature for the use and convenience of man" as exemplified by the charter of the Institution of Civil Engineers in 1828.

In the following decade Michael Faraday - who had trained as a book binder and been deemed not to be fit for much else - enunciated the principles of electromagnetism. But it was only in 1873, an year before Wimalasurendera was born, that James Clerk Maxwell formulated the mathematics needed to quantify the empirical relationships established by Faraday. This was the true beginning of electrical engineering.

Wimalasurendera passed out as a Graduate of the Institution of Civil Engineers and was appointed a Junior Engineer in the Public Works Department (PWD) in 1898.

Wimalasurendera was no doubt inspired by his visits abroad: that he should have recognized that his people too - though a subject race - could uplift themselves by developing their hydro resources and infrastructure; and set about pursuing these desirable ends despite opposition, is the true measure of his greatness. He was a great engineer as well as a great patriot. We should not commemorate him as anything less.

Introduction

Wimalasurendera's world was vastly different to ours. We have no colonial masters, but our political independence is constrained by economic dependence, and the hope of a better life dimmed by claims that the common environment of all, polluted and continuing to be polluted by the affluent, should not be polluted by others - by even those seeking basic needs. Moreover, we now face the prospect of power cuts in 1995 and a collapse of the economy. This paper will look therefore, at the whole supply industry instead of limiting itself to hydropower.

Electric traction is now seen as a necessary measure, and railways are being electrified worldwide. In 1978, a Seminar on "Railway Electrification - Now or Never"[A1], stressed the need to electrify the Colombo suburban railways, as it was the ideal way to handle the high and rapidly increasing commuter traffic and relieve congestion on the roads. In 1980, a Seminar on "Energy in Sri

[1] J. Varnakulasinghe - "The Inherent Advantages of Electric Traction" Note - A,B, ... see Bibliography.

Lanka"[B2], dwelt on the advantages of electrified transport in general. Since then the electrification of the suburban railways has been often mooted, but the lack of foreign funding has stayed progress. Both railway and road vehicle electrification will therefore be commented upon here.

Industrialization is a means of seeking NIC status. One measure of such status is a high per capita consumption of electricity. But industrialization is too wide a subject to be dealt with in a short paper, so the comments here will centre on industrial support for the all important supply industry.

The Supply Industry - A Brief History

Boustead Bros, already operating an electric tramway system, were the first to obtain a license - under the first Ordinance (No 5 of 1895) for regulating the generation, distribution and supply of electricity - and establish a supply system in Colombo.

A new Ordinance (No 36 of 1906) and the success of Bousteads encouraged local authorities to set up supply systems in areas under their jurisdiction. The government also set up its own. The regulatory authority for the Ordinances was the PWD. In 1928 the government purchased Boustead Bros, and set up the Department of Government Electrical Undertakings (DGEU) to take over the multiplicity of electrical undertakings of the PWD including the construction of Laxapana. The DGEU also became responsible for ensuring that licensees operated within the law; verifying from annual returns of licensees - all local authorities - the viability of their undertakings; advising them about improvements and extensions to their systems; and approving the granting of government loans for such work.

Shortly after Independence, a new and more detailed law, the Electricity Act (No 19 of 1950) came into effect. The Act spelt out the provisions in the Ordinance and gave legal status to the established practices. It created the office of Chief Electrical Inspector (CEI), thereby removing the regulatory functions from the DGEU. It gave the CEI wide powers over licensees and the DGEU; and the responsibility for the administration of the Act, for ensuring the safety of the public, and for fair treatment of consumers by Supply Authorities. The Electricity Regulations 1951 under the Act, approved by Parliament, further strengthened the CEI's authority. The Head of the DGEU was however appointed the CEI, negating the independence vital to the CEI's authority.

Every Municipal and Urban Council, and a good many Town and Village Council areas had been provided electricity by 1960. Not surprisingly people outside these areas began to clamour for a supply of electricity. Again the easy way out was taken - adding rural electrification to the undertakings of the DGEU!

The need to commercialize the industry for obtaining foreign funding led to the creation of the CEB by the Ceylon Electricity Board Act (No 17 of 1969). But the CEB took over all functions of the DGEU, except those of the CEI.

Consumer dissatisfaction with the poor quality, and un-reliability of supply by local authorities and the CEB, made the government set up Lanka Electricity Co. (Pvt) Ltd (LECO) in 1983. LECO obtained a license and started operations, taking over local authority systems and improving them. But now only the CEB is taking over local authority systems. This policy reversal is not surprising, as at least 51% of LECO's shares are owned by the CEB: the balance by other state organizations.

The Supply Industry - Status and Prospects

The CEB is the sole statutory authority for generation and transmission: it shares with LECO the right to distribute and sell electricity. The industry is thus a government monopoly. The industry is profitable, but consumers think the price too high.

Transparency and accountability are claimed to be the hallmark of state industry. Regrettably, the supply industry has not been run on these principles: complaints of the lack of data and information particularly on projects have been made time and time again. The comments made here are thus based on the limited data available.

In certain years, over the period 1983 to 1992, the lack of adequate rain made it necessary for the CEB to provide energy from its thermal plant as shown below [C3,D4], : the added cost was recovered as the "fuel surcharge".

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[2] J. Varnakulasinghe - Electrification of Transport

[3] The figures have been taken from the CEB's annual Statistical Digests, and from the Master Plan Main Report.

[4] see MP Executive Summary - Annex 14

Yeer	Total GWh	%	Hydro GWh	%	Thermal GWh	%	Rs./kW Sale Price	Fuel Cost	Power Cut GWh	Losses %1
1983	2114		1217	58	897	42	1.56	2.56	16.8	0.9
1987	2707		2177	80	530	20	1.66	2.20	40.6	1.8
1991	3377		3116	92	261	8	2.40	1.76	-	-
1992	3540		2900	82	640	18	2.72	2.59	37	1.0

The most economical thermal generation plant available to the CEB, is the Diesel Station at Sapugaskande, the fuel cost per kWh being between Rs 0.79 to Rs 1.28. This plant, though in operation since 1984 has only generated 703 GWh, out of a total of 1941 GWh of thermal generation for the period 1984 to 1992. The 4 units of 20 MW each could have provided a total of 560 GWh at low cost in any year, if they could have been operated for 7000 hours, but they were in no condition for such long hours of operation. The CEB might then have been able to levy a lower fuel surcharge.

The Master Plan (MP)[E5], indicates that with the commissioning of Samanalawewa the hydro potential would be 3400 GWh. The energy demand as forecast in 1992 by the CEB, in GWh is:

1993-3804[5] 1994-4067 1995-4371 1996-4705

These figures exceed the hydro potential by 404, 667, 971 and 1305 GWh respectively, and hence the urgency to commission economic and more dependable thermal plant. But as things stand the unpleasant prospect of more power cuts and a much higher fuel surcharge loom large.

The CEB is said to be adopting the suggestion in [E6]

> "... It is recommended that the CEB provide incentives to the owners to maximize private generation in times of imminent power shortage."

with a view to reducing the shortfall. An island-wide survey of privately owned plant with a capacity of 50 kVA and more, carried out in 1987, showed a total capacity of 130 MW, mainly of small diesels[7]. Whether the CEB had made the same arrangements for the running of this plant in 1991 or 1992 is not clear. If they had, why it became necessary to have power cuts needs close scrutiny. It is to be noted that a unit "not-supplied" is said to be worth US$ 0.56 [E8] (Rs 28) when the unit supplied was being sold at less than Rs 2.00.

A matter of relevance to the shortage of power as well as of significance to the economy of the industry is "system losses". The MP [E9], draws attention to the high losses and indicates the level to which they could be reduced:

> "Total 1987 electricity sales of the CEB amounted to 2250 GWh indicating losses of 16.7% in CEB's own system. Actual losses are higher at about 23%, because power sold to the local authorities which absorb some 25% of the CEB's output, supplied in bulk and losses within the local authorities networks are generally between 20% and 35%."
>
> "All four demand forecasts assume that distribution losses will be considerably reduced. Distribution losses at peak demand are assumed to decrease to 17% by 1990 and 12% by 2000. Energy losses are assumed to reduce to 15.5% by 1990 and 7.5% by 2000. This would reduce overall energy losses including HV transmission, from the present value of 23.5% to 9.1% by the year 2000."

The losses on the CEB system in 1992 was 21.3% - an increase of 4.7% on the 1987 figure of 16.7%. Therefore, there has apparently been no improvement. A rough estimate of the cost of the energy that could have been saved in 1994, at the present price of Rs 4.60 a kWh, is over Rs 2.5 billion.[10] It is to be noted that if the losses are not reduced, an increasing amount of money would be wasted annually.

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[5] The Statistical Digest 1993 indicates that the actual gross generation in 1993 was 3979 GWh - 175 GWh in excess of the predicted figure of 3804 GWh. Also that the gross hydro generation was 3796 GWh - 396 GWh above the hydro potential of 3400 GWh.

[6] see MP Executive Summary

[7] see Annex 1 of this paper

[8] see MP Executive Summary

[9] see MP Executive Summary

[10] 14.4% of the projected gross generation of 4067 GWh in 1994 (as given in the Statistical Digest 1992) is 586 GWh or 586 x 106 kwh. At Rs. 4.60s kWh the cost of these units works out to 2694 mRs.

The Electricity Supply Industry - Fashioning a Future

Electricity has been called "the lifeblood of development" -thus an adequate supply is vital for industrial development and for improvement in the standard of living of people. This will be the prime consideration here.

The high system losses are indicative of the poor quality and reliability of the transmission and distribution network. The shortcomings of the network and how they may be redressed - and billions saved - will therefore be the second matter discussed.

The industry was fashioned to be a set of regulated, discrete and separately owned units, a 100 years ago. Despite the framing of legislative enactments to regulate the industry more closely[11], and to ensure that the industry served the public better[12], the industry has drifted into a state monopoly and is not in good shape: the time is more than ripe therefore to consider the rehabilitation of the industry.

Adequacy of Supply

The need for additional thermal generating capacity was foreseen, but nothing has come of the steps taken to add plant at Sapugaskande because of a dispute with the Asian Development Bank (ADB) as to which tenderer should be given the award. This has led to the ADB refusing to fund new work, and the CEB having to negotiate with the private sector for a coal power station on a BOT (Build, Operate, Transfer) basis. But as time is of the essence and a new government is in power, it is to be hoped that the problem of "who gets what" will be settled, and work on the 40 MW addition started early.

The delay in installing additional plant makes it imperative to work out plans to meet power shortages in 1995 and 1996 - the imposition of power cuts will not only be detrimental to the industry, more importantly it will discourage foreign direct investments (FDI) coming into the country.

It is worth noting that the 40 MW extension at Sapugaskande run 24 hours a day for 30 days would have provided 29 GWh: if the owners of 130+ MW[13] of plant could be persuaded to generate as much per month the country would be no worse off than with the 40 MW installed: the situation will then not be so desperate as it appears. The 130+ MW of private generating plant is a large national asset that is presently idle: importing more plant only adds to the value of the idle asset. Utilizing the existing plant to circumvent the looming national power crisis is a necessary measure to be pursued with vigor. Merely asking the private owners to use their plant for their own needs and so relieve the burden on the CEB system is totally inadequate.

Moreover, the CEB's approach of not encouraging connection of private plant to its system, needs to give way to encouragement of such interconnection. A private owner's plant may or may not be adequate to meet his needs: if it is he will probably be willing to keep off the national system when he has a load that will be economic for him to operate his plant, for at other times he could take supply from the system; if his plant cannot meet his needs he will be faced with the problem of how to take the balance needed from the system and in that case he might not be enthusiastic about using his plant except when there is no supply on the system. The owners attitude is thus guided by his own needs: in fact that is why he bought the plant. Encouraging owners to connect their plant to the system will benefit the owner and the system:

> those with plants adequate for their own needs will be contributing energy to the system when their own needs are below the full load output of their plant; and
>
> those with plant not adequate for their own needs will have no problem as they will be taking their additional needs automatically from the system.

Further both parties might be persuaded to add energy to the system during some additional hours, if not all hours, when operating their plant to meet their own needs is not economically justified. There will be difficulties and problems, but engineers cannot afford to see them as insoluble, for connecting small plant to the system is a well established practice.

There is without doubt an urgent need for additional thermal plant. Some engineers stress the urgency and advocate the installation of gas turbines: others see this as ignoring the heavy burden that will be placed on consumers and advocate the deployment of diesel plant: yet others believe that it is foolish to go in for thermal plant and that an accelerated small-hydro construction programme would serve the nation best. It is to be hoped that the new government will address this most urgent question, bearing in mind both the short term and long term needs of this country.

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[11] The creation of the CEI under the Electricity Act

[12] The creation of the CEB and LECO

[13] The + sign is intended to draw attention to the fact that since 1987 there would have been additions to privately owned generating plant.

The above predicament in regard to thermal plant highlights the folly of the endless debate on establishing a coal fired generating station. The need for coal plant was apparent when oil prices escalated in the 1970s. Then learned men, untutored in the particular problems of the supply industry, advised that we go nuclear! It took some time for the government to be convinced that the national system was too small, that small nuclear plant is disproportionately expensive, and that ensuring the safety of those working would be expensive and very difficult. Since then concerned citizens have protested at the setting up of the coal plant on environmental grounds and keep suggesting that economizing would be adequate. We needs must economize on electricity, but much more electrical energy than could be saved is needed to improve the quality of life of the people. All those who protest would do well therefore to inquire why the state of California with more cars than people, has brought in legislation that effectively forces the motor car industry to produce and sell a larger number of electric cars in the state - to operate on energy from coal plant!

Water has been the life blood of this land and the art of storing it the pride of generations of its peoples. More water and more electrical energy are now needed for economic betterment: unless everyone accepts this, continued development is not practicable. This does not mean that environmental concerns are secondary. It merely accepts that man has changed, and needs must change, the environment; and that in changing it he will be causing damage. Such acceptance imposes upon him the responsibility of continuously monitoring the effect of what he has done, and is doing, and sustaining the quality of the environment he lives in.

The MP study draws attention to the fact that a further 3400 GWh of hydro power could be developed, though this would be somewhat expensive and difficult. It suggests a steady hydro power construction programme to systematically carry out this work. Some demand that these should all be run-of-the-river plant as providing storage will have detrimental effects: they ignore the fact that there will be a drop in the total energy harnessed; and more importantly that the supply of water in these areas will be seasonal.

Reduction of Losses

A nation which can ill afford what it needs cannot be complacent about waste of the order of 2.5 bRs annually: its elimination will enable the industry to fund much of its own development with little or no foreign aid.

High system losses are often the result of not having an adequate network - transmission and distribution lines and substations. Two decades ago there were only 132 kV transmission lines. As this was inadequate for the growing demand, the need for 400 kV lines to feed the 132 kV lines was mooted[F 14], but the idea seems to have got lost as 220 kV lines have been used to feed from the Mahaweli power complex into Colombo.

Transmission lines are like main highways, for they transmit energy in bulk to the centres of population and industry: thus transmission lines too must be designed to link the centres of population and industry, so that energy fed into the system can flow to any of the centres as demanded. But in Sri Lanka, such lines have been built merely as a means of connecting generating stations to the system.

The load the 132 kV line from Laxapana to Colombo presently carries is about 45 MVA. If a 400 kV line was deployed to feed into the mid point of that 132 kV line, each segment of the line would carry about 90 MVA. This means that the line would now provide 90 MVA (instead of 45 MVA to Colombo) and another 90 MVA to places between the mid point and Laxapana. Transmission line costs are moreover, not dependent on voltage but (for the same type of line) on the conductors used. The construction of the Mahaweli complex offered an opportunity for the building of a proper grid - 132 kV lines fed by 400 kV lines - by using the above considerations. The opportunity has been lost, but the need to build a grid has not diminished.

The voltages used in national networks in the early years of the industry were based on the state of technology at the time. This often resulted in having to replace one voltage system with another. In Sri Lanka it was decided to do away with 66 kV lines when 132 kV was introduced. A similar situation might well arise with the 220 kV lines when 400 kV lines are constructed. The choice of a single voltage between 132 kV and 230/400 volts posed a problem to the CEB. The CEB opted for 33 kV instead of having both 33 kV and 11 kV. But LECO has found it necessary to construct 11 kV lines because 33 kV was not adaptable for primary distribution in urban areas. The question of a single voltage for primary distribution, thus remains unresolved: 22 kV is an option which will serve both the CEB as well as LECO[G, 15].

System losses occur on lines and in transformers. As the losses are proportional to the square of the current flowing, it is best to keep the current as low as possible. When it comes to lines this is achieved by deploying lines at as high a voltage as is practicable. When it comes to transformers it

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[14] J Varnakulasinghe - A 132 kV Transmission Network

[15] J. Varnakulasinghe - Economy in the Design and Construction of Rural Networks

is best to use as few voltages as practicable on the network and so keep the number of transformations to a minimum.

The ideas enumerated above have been used in the UK to improve the grid and the high and low voltage distribution system. This country would do well to do likewise[16].

Organizational Structure

Generation and Transmission are the core functions of the industry: these require qualified, experienced, competent and dedicated engineers. The fact that the CEB is not geared to produce such engineers has been commented upon in the MP. The main reason seems to be the magnitude of the management involved in handling over 1,000,000 consumers and 10,000 rural schemes. This shows in the CEB's Organization Tree: engineers are at the bottom of the tree and everyone of consequence is a manager! Not surprisingly the CEB needs foreign experts even for rural electrification! One might in these circumstances ask: why select our cleverest youth, put them through the most arduous of courses in engineering science and then give them no option but turning their efforts to management whether they are adaptable or not.

In contrast the Distribution and Supply of electricity requires engineers who have an aptitude and a willingness to go outside the strict rigour of their discipline adopting to the flexibility necessary for acquiring managerial competence in the service sector - public relations, marketing, and sales.

But if this country is to be made attractive to foreign investors the supply industry must be rationalized, giving engineering pride of place. Only an abundance of engineering talent and enthusiasm, applied with meticulous care, supported by a modicum of understanding managers and the political will of government lifted poorer nations than ours to NIC status. The place to begin this approach is the electricity industry on which industrialization is founded.

The CEB is the only body with statutory authority to generate and transmit electricity. The country needs large blocks of generating capacity and an improved and extended transmission system, and that needs engineers of high calibre, so the CEB should be allowed to concentrate its efforts on generation and transmission and be relieved of all other responsibilities.

Distribution and sale should be the function of provincial or regional licensees each responsible for a specific area, no part of the country being without its licensee. The government should provide financial assistance on a long term basis to help these authorities extend their networks to rural areas and achieve the national objective of 'electricity for everyone'.

The Chief Electrical Inspector, the independent statutory regulatory authority for the supply and use of electricity exists only in name: an indication perhaps that a single individual cannot possibly regulate so pervasive an activity as electricity. It is time now to replace the CEI with an Electricity Commission which should include one nominee each from:

the Institution of Engineers Sri Lanka

the Institution of Electrical Engineers (Sri Lanka Centre)

the Institute of Chartered Accountants

the Chambers of Commerce, and

three others (one each from Merchant Banking, Law and representing consumer interests) as the government may see fit.

The government should nominate one of the seven as Chairman.

The Commission has been drawn up so that it has the know how to handle this highly technical industry for the benefit of this country. Presently the large funds deployed are spent solely on the advice of those within the supply industry, and this has raised many questions of transparency and accountability.

The government will have to amend Section 53 of the Electricity Act to transfer authority to the Commission. Then the Commission can update the Act and the Regulations and better regulate the industry. Long term local funds could then be used to ensure 'Electricity for Everyone', and a better regulated, dynamic and engineering based CEB could easily achieve the 8% return to assure itself of foreign funds. Moreover, the Commission will bring on an open policy on pricing and isolate the government from the sort of difficulty it is faced with at present[17].

[16] J. Varnakulasinghe - Electricity for Everyone by Year 2000

[17] J. Varnakulasinghe - Electricity for whom and at What Price

Railway Electrification

The seminars referred to earlier emphasized the inherent advantages of electric traction and the long term benefits of the use of tracked and road electric vehicles. The deploying of such vehicles has been held back on the ground that it is more profitable to continue to invest in diesel vehicles: that these diesel vehicles have only compounded the problems of transport in this country over decades is not the concern of financiers: it is a concern of the new government. Railway electrification will not become profitable in the short term ever! In fact it has now become less profitable than in 1978, because of the higher investment costs.

As some one pointed out, if our ancestors had been looking for short term profit they would never have left us such a valuable asset as our irrigation system! Perhaps, instead of wasting our time on trying to demonstrate that in the short term railway electrification will benefit this nation we need to list the necessary tasks, how to do them, and then how they are to be funded.

The engineers and technologists of this country have no direct experience of railway electrification. This could be overcome by seeking assistance from British Rail, for our railways were built by the British who are now electrifying similar lines: perhaps the British themselves might be persuaded to fund the consultancy! As the task of supplying energy to an electrified suburban service will be the responsibility of the CEB, the CEB could make its own arrangements to fund such costs and recover the costs by the adoption of a suitable tariff. The CEB is also well placed to assist the Railway Authority in the construction of the catenary system: CEB and railway staff may be sent to the UK to train in this work beforehand. The track, the signalling and telecommunication systems, and stations exist, though they will need some modification. There are several options for funding, the best perhaps, is a foreign commercial loan, guaranteed by the government. When the actual work is nearing completion the railways should change from the purchase of diesel coach sets to electric ones - the Indian Government and the Indian Railways could help in this regard. A prior requirement is of course that the government set up a suitable unit to examine and report on all these matters in detail.

Industrialization

Projects and Local Manufacture

The infrastructure development work of the supply industry has been funded by lines of foreign credit for the last two decades. This credit has invariably been given on a project by project basis and required the engagement of foreign consultants. The size of each project, the bulk buying and short time fixed for completion have made it necessary to engage foreign contractors for carrying out the work. This has understandably resulted in the introduction of capital and machinery intensive methods in the construction of transmission and distribution systems; and the consolidation of the idea that such methods are the only ones available for carrying out work.

The private sector was producing the bulk of the supports (wood and concrete poles), insulators, conductors and line hardware (crossarms, D-irons, shackle straps, bolts and nuts) required by the supply industry, but once the construction of overhead lines began to be let out on a project basis this sector of industry dwindled. As large areas of the country are yet without mains electricity and only about 30% of households have electricity many more miles of such lines will have to be built. Without local line hardware manufacturers, the task ahead will be time consuming and costly: the re-establishment of this industry is therefore vital. However, the private sector is unlikely to be enthusiastic if the work to be done continues to be on a project by project basis for then there is no assurance of work throughout the year: so there is a need to phase out the work.

As it is equally important to ensure quality and quantity of local production it is necessary to have standard specifications and drawings, as is done by reputed supply authorities the world over. To this end the CEB and LECO should have joint consultations with the Institution of Engineers Sri Lanka, the Institution of Electrical Engineers (U.K) Sri Lanka Centre, the Sri Lanka Standards Institution and private sector industrialists with a view to creating such standards.

Wood Poles

Poles are exposed to gusts (very high velocity short duration winds) and lightning (very high short duration voltages). Thus poles need to have flexibility to cope with gusts and high impulse impedance (an electrical characteristic) to cope with lightning. Steel and concrete supports are rigid, not flexible, and have low impulse impedance. Only wood poles have both flexibility and high impedance and that is why the affluent world - Scandinavian countries, UK, the Americas, Australia - use these almost exclusively for high and low voltage lines: some countries such as Finland and Sweden use them for voltages up to 220 kV. Further, poles are light, easy to transport, erect and maintain: thus construction does not require heavy equipment. Moreover, they are a renewable resource - a by product of the forestry sector

engaged in producing logs for the sawn timber trade - that could be better used than as fuel wood.

When in the early eighties the shortfall in the local supply of timber raised questions about the wisdom of using wood poles, the Institution of Engineers organized seminars at which foresters and officials of the State Timber Corporation, the CEB, LECO and the Department of Telecommunications participated - some by the presentation of papers. The seminars helped to establish that there was an adequate supply of thinnings that could be processed into wood poles. The Seminars also high lighted the need for a proper set of Sri Lankan Standards on Wood Poles. These standards have since been completed by the Sri Lanka Standards Institution with the active cooperation of the Forest Department, the Timber Corporation, the CEB and Telecom[J,18].

Local Enterprise

All the products needed for the construction of distribution infrastructure can be manufactured or fabricated locally, and we have the competence nationally to design and construct such infrastructure. Proper design will help to produce detailed specifications for the products and for construction. If this is supported by separating the distribution and sale of electricity, from generation and transmission, and creating regional licensees it will help both the supply industry and private industrialists to contribute to national well being.

Conclusion

In 1918 Wimalasurendera set out a path for economic development; and through years of colonial domination and political independence we have struggled to attain such development. As the foundation of such development is the supply industry, its growth and problems have been sketched out, and the following measures recommended:

1. Every effort must be made to ensure that there are no power cuts in 1995: this will mean much more intense canvassing for private generation.

2. A contract must be placed for the additional plant at Sapugaskande as desired by the ADB - adding gas turbines will be an unpardonable folly.

3. We need a coal fired base load power station - we have been talking about it since 1970! We should accept with grace the Japanese offer instead of squabbling over detail.

4. Alongside the above measures we should set immediately about taking steps to reduce the system losses to 9.1% as the nation is loosing over 2.5 bRs annually.

5. The supply industry consists of clearly separatable functions: one high tech - generation and transmission: the other with a technical component but mainly commercial - distribution and sale. Generation and transmission should be the sole focus of the CEB: distribution and sale that of regional licensees.

6. The reorganization of the supply industry will require the establishment of a proper regulatory authority, as the existing one has been swamped by the size of the supply industry and by electricity supply becoming a government monopoly. An Electricity Commission of competent Professionals from various fields is now a necessity.

Foreign funding and foreign expertise are not panaceas for all the problems of the electricity supply industry where they are indispensable, as for the extension to Sapugaskande and the coal plant, they should be gladly accepted. The losses on the system are a liability the nation cannot afford: it could be remedied by local funds and local expertise: it does not need foreign funds or foreign expertise. It is to be hoped that the new government will take the necessary measures in regard to this and the appointment of an Electricity Commission at the earliest.

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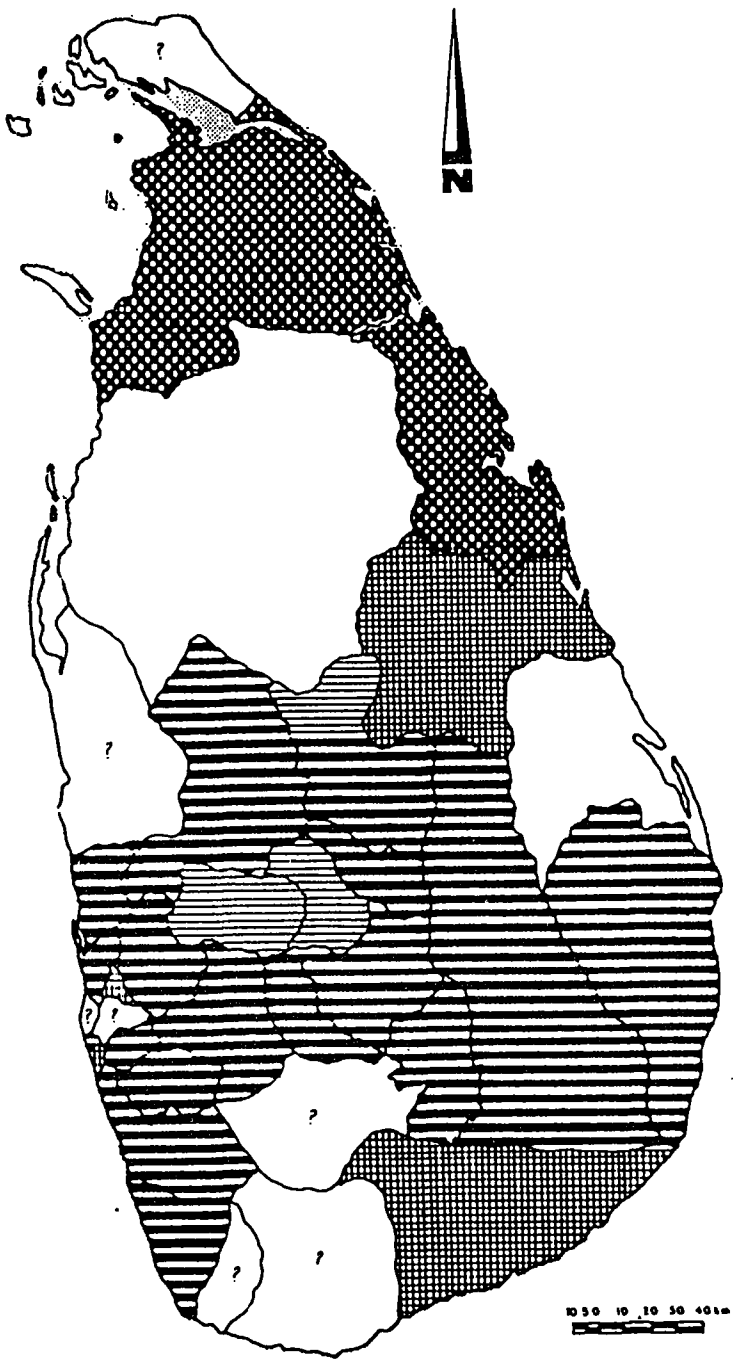
APPENDIX

PRIVATE GENERATION IN SRI LANKA



DIVISION		AREA	PRIVATE GENERATION CAPACITY (MW)
NORTHERN	1	JAFFNA	UN KNOWN
	2	KILINOCHCHI	2.25 MW
	3	ANURADHAPURA	0.00 MW
	4	TRINCOMALEE	13.35 MW
	5	MINNERIYA	2.70 MW
EASTERN	6	BATTICALOA	0.00 MW
	7	AMPARAI	2.55 MW
	8	BADULLA	2.65 MW
	9	DIYATALAWA	2.22 MW
	10	RATNAPURA	UN KNOWN
CENTRAL	11	KURUNEGALA	3.08 MW
	12	KANDY	0.61 MW
	13	KEGALLE	0.001 MW
	14	NORTON-BRIDGE	1.08 MW
	15	NUWARA ELIYA	5.23 MW
	16	MATALE	0.78 MW
	17	KUNDASALE	0.75 MW
SOUTHERN	18	GALLE	UN KNOWN
	19	AMBALANGODA	1.87 MW
	20	MATARA	UN KNOWN
	21	HAMBANTOTA	4.43 MW
NORTH WESTERN	22	NEGOMBO	13.37 MW
	23	JA-ELA	2.08 MW
	24	KELANIYA	11.04 MW
	25	CHILAW	UN KNOWN
	26	GAMPAHA	2.19 MW
WESTERN	27	AVISSAWELLA	2.59 MW
	28	RATMALANA	14.18 MW
	29	DEHIWALA	2.90 MW
	30	KALUTARA	5.01 MW
	31	SRI JAYAWARDENEPURA - KOTTE	UN KNOWN
	32	HOMAGAMA	2.65 MW
	33	HORANA	1.30 MW
COLOMBO	34	COLOMBO	UN KNOWN