TRANSPORT

Electrification of Sri Lanka Railway

The Government's decision to go ahead with an electrification project of the suburban railway and its approval of Rs. 200 million for this project is the ultimate result of moves in this direction initiated nearly 60 years ago. The case for electrification for part of our railway has been presented competently and consistently by many advocates starting with Wimalasurendra in 1918 and most recently by A. R. P. Wijesekera.

Wimalasurendra presented his proposal to the Engineering Association of Ceylon in 1918 in a paper entitled "The Economies of Power Utilisation in Ceylon". After discussing available sources of energy for industrial, domestic and traction uses, and identifying about 250 MW (193,000 Bhp) of non-storage run-of-river hydro power he argued:

> "Power derived from one or more of these sources could be utilised for operating some sections of our railway system electrically, especially the hill section, and that most economically. For the purpose of this paper, we will select for consideration the section from Polgahawela to Bandarawela, including the branch line from Kandy to Matale".

His selection of this upcountry section in his comparative analysis was because of proximity to the source of power, and the possibility of using descending trains on down grade to generate electricity as part of their breaking effort and so replenish power to the line. However in the same paper Wimalasurendra also showed the usefulness of:

> "an electrically operated urban train service in Colombo tramway services in Colombo, Kandy and other towns, railless traction (trolley buses) as feeders to tram and train".

Wimalasurendra was motivated by his knowledge first that central generation of electricity (even using fossil fuels) is more efficient than separate generation at each place of use and second that the water of this country ran down from mountain to sea free of any cost whatsoever. He also drew on his immense knowledge of world developments at that time including electrification of railways. Wimalasurendra was scoffed at then by his British colleagues in the Association who had neither Wimalasurendra's knowledge of the world or of electric science, nor any intention of upsetting existing ways by electrifying the railway.

But the question arises for consideration as to why railway electrification escaped commitment, let alone implementation, until 1977. The chief advantages from 1900 until now have remained basically the same, namely:

1. **flexibility of primary energy source (and hence the chance to use nationally available and/or renewable resources in any country).**
2. **possibility for regenerative breaking.**
3. **less moving parts on the train (especially reciprocatively moving parts) and hence less maintenance, longer life, and greater loco availability.**
4. **comparative silence and smoothness of running.**
5. **complete absence of air pollutive exhausts.**
6. **easier scheduling because there is no need for refuelling or watering.**
7. **greater instant availability of enhanced power.**
8. **opportunity to place tractive force on all axles of the train.**
9. **better accelerative and decelerative capability for the same cost or same weight of machine.**

These are among the reasons which have impelled both coal surplus countries (Britain, Germany) and oil-surplus countries (Romania, USSR) to electrify their railways. Indeed today two countries most intensively engaged in rail electrification are OPEC members ,Venezuela and Iran. Moreover USSR and China, both reputed to hold enormous reserves of oil, are both electrifying railways just as vigorously as are Germany, France, Holland, Spain and Italy.

How is it then that other countries, such as Britain, were painfully slow in this advance, and still others, such as US and Canada, not only failed to electrify but even de-electrified some lines? It is interesting that in USA the big privately owned railways

were disinterested in electrification even after 1973, whereas the State Governments of Massachusettes, New Jersey, New York, Pennsylvania etc. which had taken over the urban railways and the federally controlled AMTRAK (passenger trains) are all committed to and urging more electrification.

An even more intriguing question is why successive governments of Sri Lanka, (and even successive railway administrations) until now have opposed, or parried proposals for electric power. In this the CGR could be the only railway outside USA which has of itself opposed electrification from 1918 until 1976. Most state-owned railways (such as British Rail) have pleaded for electrification but have been refused money by their governments.

In this country electrification has had various excuses put forward for postponing this measure. They include such arguments as:

1. **alleged shortage of power (which could be self-fulfilling if the same agents postpone hydro development).**
2. **Corrosion of overhead catenary and masts along the sea coast (a minor controllable problem).**
3. **necessity to raise bridge decks for electrical clearance (British Rail raised nearly four hundred bridges in 183 miles of electrification from London to Manchester in the 1960s; the number of bridges we would have to raise is comparatively negligible).**
4. **interference with colour light signals and with telecommunications. (This is a matter of the cost of adaptation, yet the first aspect could have been avoided by installing "non-interference" colour light signalling in the first place).**

The chief factor delaying railway electrification in some parts of the world has been the apparent cheapness, and hitherto assumed inexhaustability, of petroleum.. Another factor has been the attitude of bankers and of economists brought up in the banking philosophy, who have tended to judge enterprises, and investments in them by the narrow measure of their internalised book-keeping profits or losses. They have not counted social benefits, or social disbenefits which are external to the railway. And they have been reluctant to visualise benefits lasting into the future.

The electrification chosen now for the Colombo area extends from Kalutara to Veyangoda. Views are expressed that it would have been better to have gone as far as Kurunegala which is a significant and focal city in NWP and also to Negombo, but so long as some part is started, extensions should be able to follow. Likewise the restriction of the scheme to local suburban trains is being regretted. Once the catenary is installed, it should be used by all trains moving under it by means of loco switching at the electric limits. However, this too can follow once the suburban lines are commissioned.

Germany and France both have what are called "rolling programs" of electrification. That is to say a long term commitment so that design and survey and construction teams move on from one section to another without disbanding, when each section is done. This country too could benefit by such a commitment as would be inherent in government starting now that electrification will proceed over time all the way to Kurunegala, Matale, Badulla, Kochchikade and Matara. Once the first initial start up segment is ready, Sri Lankan technological teams set up and trained in all aspects under the first foreign contractors could takeover the planning and execution of continuous electrification mile by mile over the next few decades.

It is not worthy that technology has reduced the cost of electrification in real terms. High voltage (25,000 volts) AC electrification is cheaper than the 2,400 volt DC electrification proposed by Wimalasurendra because the higher the voltage the less current needed (and therefore less diameter and weight of copper wire to carry it) to convey the same energy. This was of course not unknown to Wimalasurendra, but in those days there were no easy solid state devices to step down and convert high voltage single phase current on board the train into low voltage DC or three phase current for the traction motors. Many other devices such as thyrister controls are making regeneration by braking more feasible and less costly, with great saving in energy, although A. R. P. Wijesekera with good reason tends to favour more robust techniques for the time being as long as hydro power is plentiful in our conditions.

The short-term advantage of electric trains is not solely economic. In five years time the whole quality of rail travel would have improved. With its characteristic advantages the electric train will be capable of giving faster, more frequent and more comfortable travel which will be attractive for off-peak as well as peak riders, and should be properly catered to by CTB feeder services to rail stations.

But the chief future advantage for which our descendants will have to thank the present decision-makers relates to energy. The world has approximately 98 billion tons of proven petroleum reserves which even now it is using up at the rate of 3 billion tons per annum. Other things remaining unchanged the oil woud be over in 33 years time. Today's most hopeful optimists expect another 140 billion tons of oil to be discovered, but then they expect world oil consumption to rise to at least 7 billion tons per annum. The increased use will partly come from persistent profligacy in OECD countries, but also from increased "reasonable" use in socialist and some Third World countries breaking through the poverty restraints. The net effect, according to forecasts, will be increased costs of extracting oil from deeper wells or less accessible places, and even more persistent pressure on prices due to demand acting against the increasing desire of oil producers to keep their stocks on the ground for future disposal at higher prices.

For Sri Lanka this may mean in terms of these estimates, an unbearable price of £100 (1977 dollars) per barrel of oil by the late 1990s as against a mere £12 today. Hence any viability comparison done today need to be based on a realisation that oil prices may increase up to eight times as fast as the general level of prices under inflationary conditions.

In this context it has to be noted that although the cost of hydro turbines will also go up somewhat, and the cost of electric rail equipment, and other associated costs, and indeed the cost of such foreign experts and contractors as we may need with the flight of our own talent to take up other countries "challenges", although all these things will go up, the cost of the water precipitated on our hills, and the cost of gravity compelling it down to the sea wil remain zero, with one qualification.

The qualification is that trees are maintained in the hydro catchments, to serve as the first and largest water retainer.