technical notes

A Serious Error in the Planning of the Proposed 220 kV Transmission System

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This is a short technical note which will serve as a forerunner to a full length paper on planning philosophy for the proposed 220 kV transmission system in Sri Lanka that the authors intend to publish in a forthcoming issue of the Quarterly Journal. The advance publication of this note, which deals with one matter only, was necessitated by the authors view that an error has been made in a recent major technical decision and the hope that an early warning may generate sufficient interest in the matter to make a change possible.

Problem Statement

The matter that is being raised here is the method that is to be used to connect the proposed Kotmale 220 MW power station to the grid system. It has recently been confirmed that the relevant authorities in consultation with foreign consultants have decided to connect Kotmale power station to the 132 kV side of the transmission system.[1] The power system group at the University of Peradeniya have informally advised that this is an error and that Kotmale power station should be connected to the 220 kV side of the system. Since tenders have been called for a 132 kV switchyard it appears that the authorities were unable to accept the proposal.

A simplified description of the two proposals is shown in the figure.

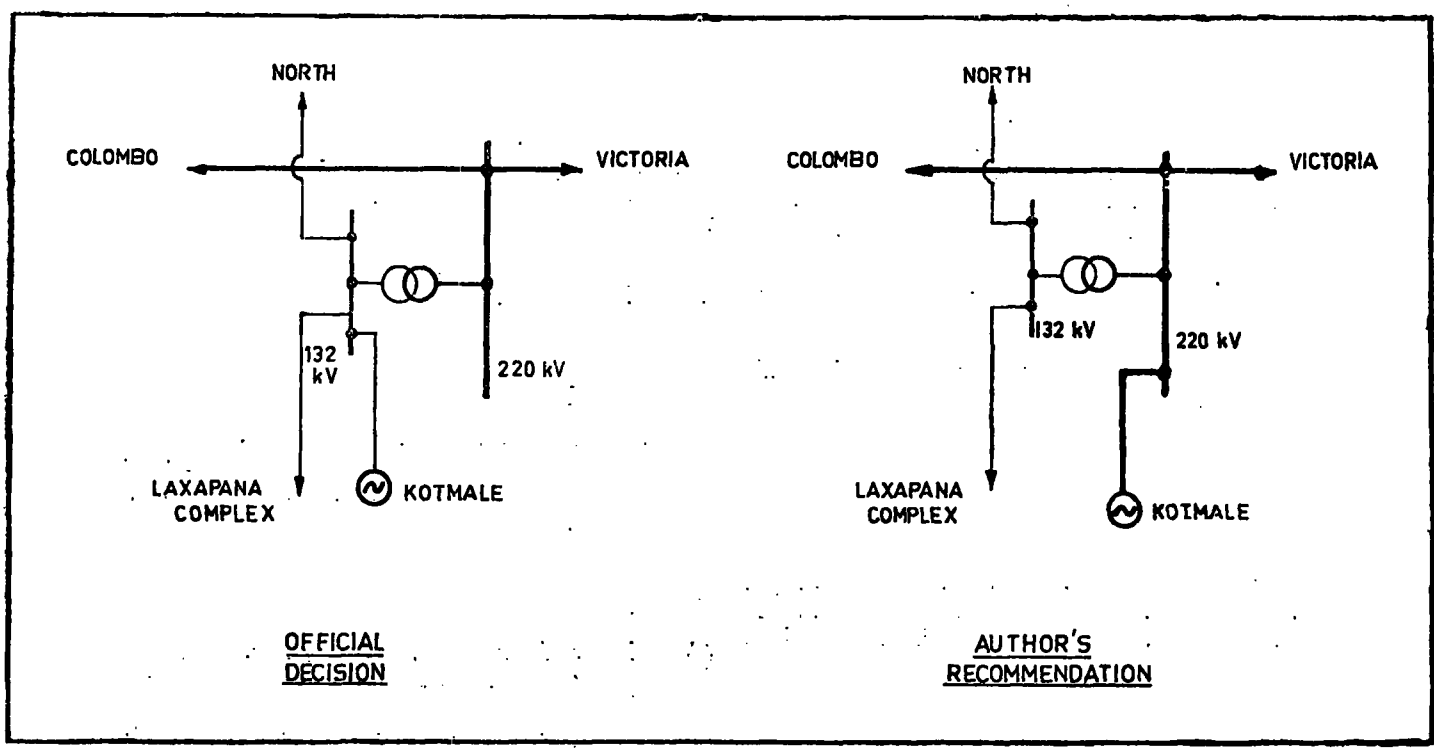

Figure: Alternative proposals for connection of the Kotmale 220 MW power station at the proposed Gampola 220 kV/132 kV switching station.

Once the Kotmale generator transformers and the Kotmale-Gampola line are manufactured or constructed respectively to 132 kV voltage specifications, it will not be possible to change the connection pattern at a future date except by discarding these items and obtaining replacements. If the decision is reversed at the present stage it will be possible to obtain the correct equipment straightaway.

Computer studies carried out by the authors indicate that the connection to the 132 kV side is erroneous both from the short-term and long-term points of view. These points are briefly described below.

Short-term factors

(a) Due to 132kV/220kV inter-transformer impedance the division of bulk power transfer between the 220 kV (Gampola-Mahara) and 132 kV (Polpitiya-Kolonnawa) lines will be different in the two cases. The loadings when considering peak load conditions in about 10 years time will be as follows.

	Kotmale to 132 kV bus	*Kotmale to 220 kV bus*
220 kV lines ...	355 MVA	385 MVA
132 kV lines ...	220 MVA	180 MVA

The capacity of 220 kV transmission is 300 MVA per circuit while that of the 132 kV transmission is 85 MVA per circuit. Not only is 40 MVA, (220/180), of additional power being unnecessarily carried by the 132 kV system but also the most heavily loaded 132 kV circuits, those between Polpitiya and Thulhiriya, will be carrying 65 MVA each which is close to their operating limit and undesirable from several points of view. Apart from this the general voltage and power flow profile is also better with Kotmale connected to the 220 kV side.

(b) The two alternatives should be compared not only under normal conditions but also under conditions corresponding to certain credible significant outages. The authors hage examined system load flow for single outage of trunk 132 kV and 220 kV lines and it is clear that undesirable overloads and the contingent danger of cascade tripping are present when Kotmale is connected to the 132 kV side.

(c) The transmission losses on a system wide basis for the two cases are as follows:

Kotmale to 132 kV bus	*Kotmale to 220 kV bus*
42.5 MW	39.0 MW

Costing at a prospective future value of 70 cts. per unit[3], and a load factor of 53% this works out at an additional cost of Rs. 6.1 million, annum in ten years time.

Long-term Factors

It is the view of the authors that there is a serious blind spot in respect of 220 kV transmission system planning on the part of the authorities. It is clear that no long-term 220 kV plans have been made and there are no general perspective in respect of the structure of the 220 kV as it will evolve over the years. In the absence of such perspectives the connection of the 220 MW Kotmale power station, which will be the largest power station in the country for several years until Victoria Stage 2 extension is commissioned, is treated as an adhoc decision. (Even the ad-hoc decision is incorrect as has been discussed under short-term factors above).

Had a proper 20-year or longer perspective plan for the evolution of the 220 kV system been worked and the role of the supergrid system properly identified it would have been clear that major generating stations must feed directly into the supergrid. Hence long-term (20 to 30 years) planning would also have shown that Kotmale power station should, advantageously, be connected to the 220 kV system. It is regrettable that the relevant planning authorities do not engage in long-term planning and hence ensure that each stage of the short-term plan dovetails into wider perspectives. This could give rise to further errors as well in impending further decisions.

Conclusion

The authors intend to publish a paper developing their views of the future role and configuration of 220 kV system in Sri Lanka as a matter of academic and technical interest. This technical note is based on findings that have already become clear from the material that is being accumulated for this purpose.

Acknowledgements

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References

(1) Primary Transmission Development. Hydro Development Branch. Ceylon Electricity Board. Oct. 1979.

(2) J. Diandas, *Some Aspects of Determining the Cost of Hydro-Electric Energy*, NAS,SLAAS,SLOF Seminar Jan. 1980. (Equivalent thermal energy cost at *current prices*).