

Response to CLP's Comments on
Research Paper RP02/95-96

Research and Library Services Division
Legislative Council Secretariat
December 1995

Response to CLP's Comments on Research Paper RP02/95-96

At the request of LegCo Panels on Environmental Affairs and Health Services, a research was conducted by the Research & Library Services Division in October 1995 to study the urgency of providing electricity supply to Tseung Kwan O and East Kowloon districts.

2. A research paper, RP02/95-96, has been prepared and discussed at the joint panel meeting on 13 December 1995. It studies the justifications behind the completion schedule of the Tseung Kwan O Substation and its link with Tsz Wan Shan Substation when the project was planned in the early 1990's; and examines whether they are still valid today.

3. China Light & Power Company, Limited has commented on the research paper. It has also arranged for Ontario Hydro to provide its professional view on the subject. CLP's comments, together with the report by Ontario Hydro, have been circulated to Members vide PL 386/95-96 dated 12 December 1995. CLP further tabled a summary of its comments at the joint panel meeting on 13 December 1995.

4. This paper aims to respond to CLP's and Ontario Hydro's comments on the research paper.

CLP's comment:

Whilst load growth may have slowed to below the 92 forecast we still have significant growth in many localities - including Tseung Kwan O and East Kowloon

RLSD's response:

5. According to figures provided by CLP, the peak demand for East Kowloon and Tseung Kwan O in 1996 is forecast to be 1052 MVA, which is 17.3% lower than the figure projected for 1996 when the Tseung Kwan O Substation was planned in 1992.

The figures as given on page 3 in RP02/95-96 is reproduced below:

Peak Demand (in MVA) in East Kowloon/Tseung Kwan O					
	1993	1994	1995	1996	1997
Demand envisaged in 1992	974	1070	1191	1272	NA
Actual demand and latest forecasts	912	948	995	1052	1148
Deviation from 1992 forecast	-6.4%	-11.4%	-16.5%	-17.3%	NA

Source: CLP

NA: Not available

6. In 1992, CLP believed that the Tseung Kwan O Substation was required in 1996 when the peak demand of East Kowloon and Tseung Kwan O was expected to be over 1200 MVA. Now that the revised projected peak demand for 1996 is only 1052 MVA, it follows that there is no need to adhere to the original commissioning schedule.

CLP : China Light & Power Company, Limited

RLSD : Research & Library Services Division, Legislative Council Secretariat

CLP's comment:

Proposed solutions not practicable - EMSD agrees

7. CLP stated that RLSD proposed the following solutions:-
1. To connect all six transformers at Tsz Wan Shan 400/132 kV substation in parallel, and
 2. To transfer some of the load currently supplied from Tsz Wan Shan Substation to the neighbouring 400/132 kV substations.

RLSD's response:

Comments relating to the first solution

8. This is not a solution proposed by the RLSD but was the way transformers of Tsz Wan Shan Substation were grouped in 1992, according to CLP's Environmental and Visual Impact Assessment (EIA) Final Report published in October 1992. The report is on the environmental and visual impacts of the project but information contained therein is used for the research because:

- the Section referred to is on the justification for the Tseung Kwan O Substation. It does provide information on the capacity and grouping of transformers in Tsz Wan Shan Substation and the need to transfer its excess load to a new Tseung Kwan O Substation; and
- no other sources of information on the justification for the Tseung Kwan O Substation are available.

9. At the request of CLP, Ontario Hydro International Inc. has recently reviewed the operation of the present Tsz Wan Shan Substation and advised that it is not feasible to operate the six transformers in parallel (i.e. as a group). The report however fails to address the following:-

- (a) In 1992 when the Tseung Kwan O Substation was planned, CLP forecast that the peak demand for the area in 1994 would be 1070 MVA,

increasing to 1272 in 1996. If the capacity of the Tsz Wan Shan Substation, which supplies electricity to this area is around 1000 MVA, why did CLP plan to complete the Tseung Kwan O Substation in 1996 but not in 1994?

- (b) The operation of six transformers working as a group as described in CLP's EIA report published in October 1992 should have reflected the working of the Substation at the time. Did Ontario Hydro study the grouping of transformers, and in turn the capacity of Tsz Wan Shan Substation in 1992? Why was it feasible to have all six transformers working as a group in 1992 but not now?
- (c) Information on the grouping of the transformers, and hence the capacity of the Tseung Kwan O Substation, given by the Ontario Hydro's report differs from that given by CLP in 1992 and in September 1995 when the research was conducted. The major differences are summarised below and the details are given in Appendices I - III. What has led to the changes, especially between CLP's own version given in September 1995 and Ontario Hydro's in December 1995?

	Information given by CLP in		Ontario Hydro
	<u>October 1992</u>	<u>September 1995</u>	<u>December 1995</u>
Capacity of Tsz Wan Shan Substation	1200 MVA	1000 MVA	960 MVA
Basis for arriving at capacity	Six 240 MVA transformers connected and work as a group; Capacity = 5 x 240 MVA, assuming 1 transformer out of service	Six 250 MVA transformers divided into two groups - each handling 500 MVA; Capacity = 2 x 500 MVA	Five 240 MVA transformers connected and work as a group; 1 transformer <u>never</u> connected; Capacity = 4 x 240 MVA, assuming 1 transformer out of service

- (d) According to Ontario Hydro, the capacity of Tsz Wan Shan Substation is 960 MVA (five 240 MVA transformers working as a group but allowing for one transformer being out of service). If the load exceeds 960 MVA, major supply outages may result. The actual peak demand in the summer of 1995 was 995 MVA, exceeding the capacity of 960 MVA as calculated by Ontario Hydro by 35 MVA. Were there any outages and problems encountered by CLP in 1995? Were there any contingency measures taken by CLP?

- (e) Tsz Wan Shan Substation has all along been equipped with six transformers. It has now been pointed out for the first time that one transformer has never been connected. What has led to the idling of the sixth transformer? Is there any way this transformer could be used so that the capacity could be raised by 240 MVA?
- (f) As it seems that transformers can be grouped in different ways, a comparison of the Tsz Wan Shan Substation and other 400 kV substations would be useful. CLP should provide a list of all its 400 kV substations, with information on the grouping of the transformers in each of these substations. If there are other 400 kV substations operating all six transformers in parallel, it would be useful to know why this arrangement cannot be applied to the Tsz Wan Shan Substation.

Comments on the second solution

10. This was actually an option considered by CLP in 1992 but found to be not feasible at the time (see Appendix I). Now that the neighbouring substations (Tai Wan and Shatin) of Tsz Wan Shan Substation are not operating at full capacity as illustrated by the following table, this option could be re-considered.

Peak Demand (in MVA) for Tsz Wan Shan's Neighbouring Substations			
	1995	1996	1997
Tai Wan 400 kV Substation	718	679	706
Sha Tin 400 kV Substation	546	585	618

Source : CLP

11. It must be pointed out that if it is accepted that the capacity of Tsz Wan Shan Substation is 1200 MVA, as stated by CLP in 1992, there is no need to transfer the excess load from Tsz Wan Shan Substation to its neighbouring substations in 1996 and even in 1997.

CLP's comment:

CLP has provided the full information required by the researcher of the study

RLSD's response:

12. CLP has been requested by the Research & Library Services Division of the Legislative Council Secretariat to provide information on several occasions and replies were given promptly. However, not all information required was provided and on issues related to the grouping of transformers, information given was very brief and general. Also, as pointed out in paragraph 9(c), information on the working of the Tsz Wan Shan Substation given by CLP changes, even within months.

RP07/95-96
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Extract from "Tseung Kwan O 400kV Substation Environmental and Visual Impact Assessment Final Report", October 1992

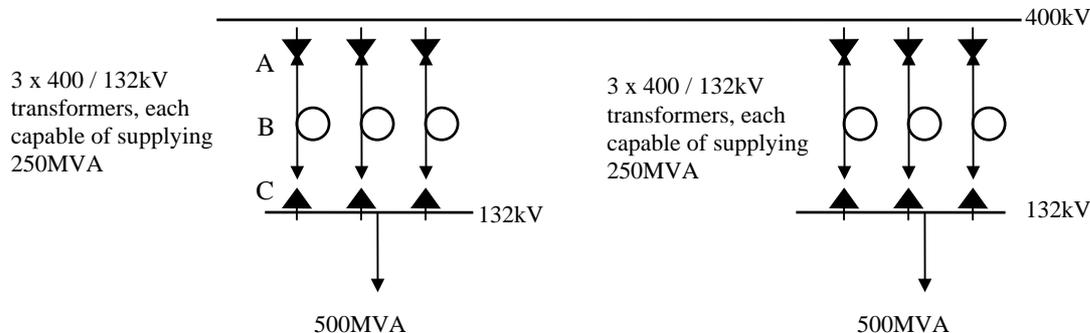
1.2 Justification for the Substation

The bulk of the electricity demand of the East Kowloon area from Kai Tak and Tsz Wan Shan to Tseung Kwan O is supplied from the 400kV substation in Tsz Wan Shan. From current load forecasts, the estimated loading of Tsz Wan Shan Substation would be approximately 1200MVA and 1300MVA in 1995 and 1996 respectively.

The planning criterion for establishing new 400kV substations is that the loadings of existing 400kV substations (each of which can accommodate up to six 240MVA transformers) should be restricted ultimately to around 1000MVA as far as practicable. This 1000MVA limit is set to avoid widespread loadshedding on a catastrophic loss of a 400kV substation (or the circuits feeding it), and to ensure that the subsequent restoration of supply would be within the capacities of neighbouring substations.

It can be seen from the forecasts that the loading at Tsz Wan Shan Substation exceeds the 1000MVA planning criterion in 1995. The loading in 1996 also exceeds the total firm capacity of 1200MVA (i.e. the capacity of the remaining five transformers at Tsz Wan Shan should one of the six 240MVA transformers be out of service). As neighbouring 400kV substations (e.g. Tai Wan) will also be heavily loaded, relieving Tsz Wan Shan by transferring part of its load to other 400kV substations via new 132kV circuits would not only be expensive but also impractical. A new substation will, therefore, be required in 1996 to relieve the heavily loaded Tsz Wan Shan Substation. CLP proposes to build this new substation in Tseung Kwan O.

Information on Tsz Wan Shan 400 kV Substation
Provided by China Light and Power Company, Limited in September 1995



The total maximum load of 100MVA handled by Tsz Wan Shan Substation is supplied via two groups of 400/132kV transformers with three transformers in each group as shown in the above diagram, each group catering for half the maximum total load, i.e. 500MVA. Separation of the transformers into two groups is necessary in order to ensure that the fault rating of the 132kV switchgear (the capability of the 132kV switchgear to isolate successfully any fault in the 132kV transmission system connected to the 132kV switchgear including cables, overhead lines and transformers) is within the switchgear manufacturer's design limit.

Should a fault occur on a component within either group shown in the diagram, such as a 400kV switch (A), a transformer (B) or a 132kV switch (C), the electrical protection system will automatically isolate the faulty component, leaving the remaining two transformers in the affected group to handle the load of 500MVA. The system will still remain stable since the two transformers can jointly supply 500MVA.

If the total load handled by Tsz Wan Shan Substation exceeds 100MVA, each or at least one group of transformers must supply over 500MVA of load. Under the circumstances, should a fault occur on any component (400kV switch, transformer or 132kV switch) associated with the group(s) supplying over 500MVA, the automatic isolation of the faulty component by the electrical protection would leave the two remaining transformers in an overloaded situation, supplying over 500MVA of load. This in turn could result in automatic tripping of the two remaining units (with the total loss of 500MVA of load) or forced load shedding to correct the overloaded situation.

Extract from Page 1, Ontario Hydro's Report

Review of East Kowloon Supply Security - 1996

Following this review, CLP requested OHII to conduct further studies to evaluate two interim supply arrangements that have been proposed for meeting the immediate load increases in the East Kowloon area.

At present, the load in the East Kowloon area is supplied from the Tsz Wan Shan 400/132 kV Substation, which is the only 400/132 kV substation in this part of the system. While this Substation is equipped with a total of six 400/132 kV, 240 MVA transformers, only five transformers are ever connected in parallel to supply the local load because of limitations imposed by the fault interrupting capability of some of the 132 kV switchgear in the area.

With a total of five transformers in-service, the substation is theoretically capable of handling a power transfer of up to 1200 MVA (5 x 240 MVA) to supply the local load. However, in practice, the load supply capability is restricted to a maximum of only 960 MVA to respect the loss of any one of the five transformers, in accordance with CLP's planning and operating criteria. This figure of 960 MVA, which represents the 'firm' capacity of the 400/132 kV substations on the CLP system, is therefore consistent with the approximate limit of 1000MVA that is used by CLP when planning new transmission facilities.

According to CLP's estimates, the load in the East Kowloon area, that is currently supplied from the Tsz Wan Shan Substation, is forecast to increase to 1052 MVA by the summer of 1996. This would therefore exceed the 960 MVA 'firm' capability of the Tsz Wan Shan Substation.