



## INFORMATION PAPER

# DEVELOPMENTS IN THE SINGAPORE ELECTRICITY TRANSMISSION NETWORK

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## **DEVELOPMENTS IN THE SINGAPORE ELECTRICITY TRANSMISSION NETWORK**

### **AIM**

In recent months, we have seen an increase in new generation planting proposals by power generation companies (Gencos). EMA welcomes these proposals, as they will add new capacity to meet growing demand in the future. However, we note that the surge of new plants may lead to a situation of excess supply in the initial years, as well as some constraints in the transmission network because of the surplus generation capacity. This paper therefore seeks to inform the industry about the likely transmission constraints, and how we see these constraints being resolved in the coming years.

### **OPEN ACCESS PRINCIPLE**

2 Under the Transmission Code, the Transmission Licensee SP PowerAssets (SPPA) is required only to plan for generation connection, such that a Genco has 100% export capacity from its switchhouse to SPPA's connecting substation under normal operations. Beyond the connecting substation, the Genco will have to compete with the other Gencos for network resources, should there be a constraint. This is the principle of "open access" (as opposed to "firm access"), which was clarified in EMA's circular to the industry of April 2003 (see [Annex A](#)).

3 Network planning in Singapore is executed on this principle of open access. Hence there is no obligation on SPPA to reinforce the network, whether to mitigate transmission constraints beyond the connecting substation or otherwise. In other words, there is no guarantee that the transmission network will always be constraint-free. If SPPA were to cater to surges in generation capacity, and guarantee firm access for every Genco, this is likely to result in overcapacity in the transmission system and increase the grid cost, at the expense of consumers' interests.

4 In this open competitive market environment, EMA would largely leave it to the market to decide when to plant. If a potential investor finds it viable to plant, EMA generally will not reject or withhold the generation licence application simply on account of over-supply of generation capacity, so long as the investor has met the necessary pre-requisites for its new plant (e.g. access to land and feedstock, and connection to the grid). In a competitive market, the marginal generating plants will be displaced by the more cost-efficient ones. If a Genco decides to build early which results in a surplus of generation capacity in the system, the Genco will then have to bear the risk of competing with the other Gencos as well as the risk of facing localised transmission constraints.

## **TRANSMISSION CONSTRAINTS IN THE SOUTH-WEST 230kV BLOCK**

5 Keppel Merlimau Cogen (KMC) and Sembcorp Cogen have recently announced plans for 2 x 400 MW and 2 x 400 MW plants respectively. These new proposed generation connections are in addition to Island Power Company's (IPC) new 2 x 400 MW plants. Currently, amongst these three companies, only IPC has secured a connection agreement with SPPA for its plants.

6 SPPA had originally planned to construct a new 230kV substation to enhance the fault current capacity of the South-West (SW) block of the network, (see [Annex B](#) for map of Singapore showing the transmission planning zones, and sites of existing and planned power plants). The substation is targeted to be completed in 2014. Once the substation is ready, it will enhance the fault current capacity of the SW block, and enable the connection of new plants by KMC and/or Sembcorp Cogen.

7 However, there will be constraints in the SW transmission network limiting the amount of total generation that can be exported to the mainland (see [Annex C](#)).

8 EMA has carried out studies to model the likely extent of the transmission constraints. Based on 4 x 400 MW of new generation plantings and our current projections of electricity demand in Jurong Island segment of the SW transmission network in 2014, and assuming that 97% of installed generation capacity in the SW transmission network is being offered into the electricity market for injection into the grid, we estimate that the percentage export capacities at Constraint A and Constraint B will be 90% (or 1220 MW<sup>1</sup>) and 91% (or 2440 MW<sup>2</sup>) respectively under normal operating condition.

9 In the event of a single contingency operating condition (i.e. planned or forced outage of a single transmission network element) in the 230kV network of the SW block, further constraints have to be imposed to maintain system security, in which case, the percentage export capacities at Constraint A and Constraint B will be 47% (or 650 MW) and 67% (or 1820 MW) respectively.

10 It should be noted that these are projections and that there are inherent uncertainties around these projections, depending on the assumptions used. For example, if the percentage of installed generation capacity being offered into the market is lower than what we have assumed, or if the electricity demand in Jurong Island segment of the SW transmission network is higher than projected, then the percentage of generation capacity that can be despatched would increase accordingly. Alternatively, if the actual demand turns out to be lower, then the percentage of generation capacity that can be despatched would be lower. Over time, as electricity demand in Jurong Island segment of the SW transmission network continues to grow, the constraints in the network would also be alleviated.

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<sup>1</sup> Including the projected demand of 70 MW at Tembusu 230kV substation in 2014

<sup>2</sup> Including the projected demand of 380 MW at Jurong Island 230 kV substation in 2014

## **FUTURE PLANS**

11 In the longer-term, SPPA had planned to develop a 400kV substation on Jurong Island, with a connecting undersea cable tunnel to strengthen the transmission links between Jurong Island and the mainland. This will significantly enhance the export capacity of the Gencos in the SW transmission network.

12 The 400kV substation is presently being scheduled for completion in 2017/2018. Once this 400 kV substation is in place, EMA does not foresee any problems with network constraint in Jurong Island, even with all the new plantings by IPC, KMC and Sembcorp Cogen combined. However, with the open access principle, there is no guarantee that the network will always remain constraint free.

13 Other than the projects by IPC, KMC and Sembcorp Cogen, EMA is currently not aware of any plans for other new power plants in Jurong Island. In fact, we are keen to have new plants located outside of Jurong Island, and have set aside land for this purpose in Lorong Halus. But the situation is a dynamic one, and new planting proposals in Jurong Island may emerge in the future as demand grows. If so, we will update the industry accordingly, through the Generation Planting Schedule published in our annual Statement of Opportunities.

## **CONCLUSION**

14 In an open liberalised market like what we have in Singapore, we will never be able to perfectly match new generation capacity to future demand. If new generation capacity exceeds demand, then there may be periods of localised transmission constraints for such time until demand grows to absorb the excess supply, or the grid is expanded to free up the constraints. Investors seeking to build new plants or to expand existing generation capacity have to recognise these realities of the electricity market in Singapore. For its part, EMA will endeavour to provide as much information as possible to industry players, so that they can take these into account when making their investment decisions.

## **INTERPRETATION OF THE PROVISION IN THE TRANSMISSION CODE WITH REGARD TO GENERATION CONNECTION**

### **BACKGROUND**

1 PowerGrid Ltd is responsible for transmission system planning and expansion. Under the Transmission Code, it is required to plan for 100% export capacity under normal conditions and 90% export capacity under single contingency conditions such as when a transmission circuit is out of service, for all the gencos.

2 In designing the generation connection for a genco recently, PowerGrid had interpreted the above requirement in the Transmission Code differently from that of the genco.

3 PowerGrid interpreted that the Transmission Code requires it to plan for a constraint-free transmission network to enable all gencos to operate at full output subject only to their bid prices being able to secure dispatch. For the purpose of this paper, we refer to PowerGrid's interpretation as "firm access".

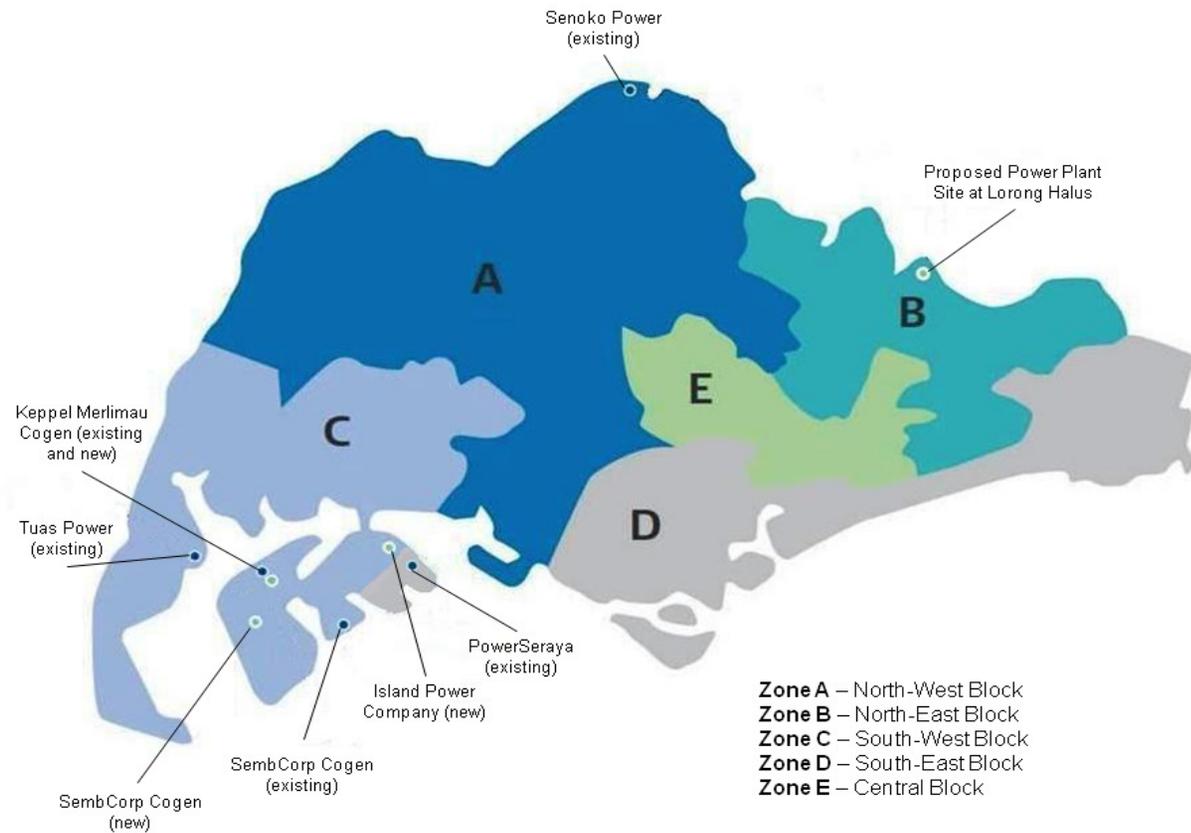
4 On the other hand, the genco interpreted the Transmission Code provision as requiring PowerGrid only to plan for the generation connection allowing a genco 100% export capacity from the genco switchhouse to PowerGrid's connecting substation under normal conditions and that the genco will have to compete with the other gencos for network resources beyond the connecting substation. We refer to this interpretation as "open access". Both PowerGrid and the genco had sought EMA's clarification on this matter.

### **EMA's CLARIFICATION**

5 The approach of "firm access" may lead to inefficient planning and expansion of the transmission system. When demand for electricity can already be adequately met by the existing generation plants with no constraints in the system, planning for "firm access" to cater for a new generation plant seeking connection would result in overcapacity in the transmission system and increase the grid cost. This is against consumers' interest.

6 The provision in the Transmission Code with regard to the export capacity for gencos is intended to mean "open access"; i.e. the interpretation as described in paragraph 4.

### MAP OF SINGAPORE SHOWING TRANSMISSION PLANNING ZONES, SITES OF EXISTING AND PLANNED POWER PLANTS, AND PROPOSED POWER PLANT SITE AT LORONG HALUS



### TRANSMISSION CONSTRAINTS IN THE SOUTH-WEST 230kV BLOCK OF THE TRANSMISSION NETWORK

