

ENERGY ADVISORY COMMITTEE

Electricity Market Review: Interconnection

The Issue

To inform and seek members' views on the key issues which would need to be considered in connection with the findings of the technical Study, commissioned by the Electrical and Mechanical Services Department (EMSD) on increasing interconnection between the two power companies.

Background

2. The Study, commissioned by EMSD in 2001 to examine the technical feasibility of increasing interconnection between the two power companies, concluded that the addition of a new interconnector between CLP Power and HEC is technically feasible, and provided estimates of project costs and time framework. The findings were presented to Members, and subsequently presented to the LegCo Panel on Economic Services at the meeting on 28 July 2003.

3. The Study is regarded as one of the building blocks in the post-2008 electricity market review. The Study findings together with other important issues, such as business, financial, legal and liability related aspects, need to be considered in their totality.

Existing Arrangement

CLP Power – HEC Interconnection

4. The transmission grids of the two local power companies, CLP Power and HEC, have been interconnected since early 1980's. This interconnector was jointly funded by the two power companies and comprised three cable circuits. It is primarily used for emergency mutual support, some reserve capacity sharing and small-scale economy power exchange where desired. The two power companies have entered into an interconnection agreement that stipulates the responsibility and liability of each party as well as the commercial arrangements for power transfer. In the past, the two power companies had made occasional economy power exchange. However, after the

retirement of oil-fired generating units and the commissioning of natural gas-fired generating units in CLP Power, such power exchange has been reduced.

5. Due to constraints in the transmission circuits feeding the existing interconnector as a result of load growth and other limitations such as imbalance loading among the three cables, the actual firm capacity of the interconnector has been gradually decreasing over time. Because of its limited capacity, the interconnector cannot support large-scale power exchange between the two power companies to realize significant mutual economic benefits. It also limits the level of coordination on planning and operation between the two power systems for more efficiency gain in operating costs and capital investments that could benefit both the investors and the consumers. It should be noted that the existing CLP Power–HEC interconnector may have to be retired around year 2011, subject to detailed assessment on whether the life of the interconnector cables could be further extended.

CLP Power – Guangdong Interconnection

6. The transmission network of CLP Power is also interconnected with the Guangdong power system. The interconnectors are mainly used to transmit power from the Guangdong Nuclear Power Station at Daya Bay and the Guangzhou Pumped Storage Power Station at Conghua to CLP Power’s system, and to transfer CLP Power’s electricity to Guangdong.

Increased interconnection

A. Objectives

7. The objectives of increasing interconnection between the two power companies should be to enhance supply reliability, provide economic benefits to both consumers and the investors, and facilitate future market development if and when desired.

Increased reserve capacity sharing and economy power exchange to provide economic benefits

8. Increased interconnection can bring about investment savings arising from deferring the need for new generation capacity through enhanced sharing of reserve capacity between the two power systems and from a

reduction in running costs of generation put on-line to meet the reserve capacity requirement. The amount of reserve capacity sharing (excluding spinning reserve as the existing interconnection capability already allows for full sharing) will, however, depend on the degree of coordination in planning and operation between the interconnected parties.

9. Increased interconnection should allow one power company to increase power purchase from its interconnected counterpart(s) to supply its customers if such a purchase is deemed more cost-effective than running its own generation. This can be conducted under two possible scenarios –

- (a) Economy purchase where the saving in generation costs is split between the purchasing party and the selling party for mutual benefit; or
- (b) Central dispatch of the least cost generation resources for the whole interconnected system based on mutual agreement between interconnected parties.

10. Savings in terms of facility investment and generation costs should translate into lower tariff for the consumers.

Increased mutual support to enhance supply reliability

11. Increasing interconnection between the two power systems allows the two power companies to place greater reliance on each other to provide mutual support to ensure supply reliability especially in an emergency situation, such as sudden loss of generation. Mutual support could serve as a ‘back up’ to a generation contingency in the form of instantaneous power transfer from interconnected partner(s) to restore the power system’s supply/demand balance, or a sustained power delivery on a longer-term basis in the event that the lost generation not be fully recovered by the system that suffers the loss.

Obtaining power supply from external sources

12. External generation sources such as the Independent Power Producers (IPPs) and those owned by other power companies (PCs) can supply local customers via the interconnectors. This can be achieved in the form of power purchase agreements between the IPPs/PCs and local suppliers. By

importing power from external sources, the locally installed generation capacity requirement can be reduced. An extension of this application is that a supplier can install extraterritorial generators to supply local customers.

Enable competition from external supply source and customers choice to facilitate future market development

13. Interconnection may serve in the long run to provide a conduit via which external supply sources can compete for supplying local customers, and contribute to mitigating locational market power where it exists, providing consumers with alternative choices of suppliers.

B. Issues for detailed consideration

14. A number of complex and interrelated issues would need to be addressed in considering increased interconnection of the power systems in Hong Kong. The more significant issues include -

Cost and potential benefits

15. Major capital investments will be required to build the new interconnector and reinforce the two networks. The Study estimated the overall cost of the new interconnection to be in the order of HK\$2.1 billion including the cost of the proposed interconnector at around HK\$1.6 billion at 2002 prices and the cost¹ of rescheduling the necessary network reinforcements in HEC's and CLP Power's systems (at around HK\$0.5 billion) to accommodate the new interconnector. The increase in interconnection capacity could bring about potential savings in the longer term, vide paragraphs 9-14 above applications. Thus, parties with vested interest i.e. the two power companies would necessarily have to consider the commercial viability of increased interconnection while the amount of savings to consumers and the investors would, however, depend on the specific uses.

Funding

16. It is a common practice in the industry that the costs involved are shared among the interconnected parties but alternatively, funding by a third party such as another commercial entity or the government may also be

¹ This is the time value of money in advancing the reinforcement works that will be required in future for HEC's and CLP Power's systems in order to maintain system security as load demand grows.

considered. The total costs of establishing the interconnection can either be recovered through regulated tariff or use-of-network charges. Two potential funding options (not exhaustive) are -

(i) Funded jointly by the two power companies

HEC and CLP Power are the co-owners and operators of the existing electricity infrastructures in which termination/connection facilities and associated network reinforcement to cope with the new interconnector could be incorporated. Interconnection agreement between them has been in place for years to provide a framework of interconnected system operation. This option thus makes the technical interfaces simpler, and operation and utilisation of the new interconnector more straightforward. A pre-requisite for this option, however, is the willingness of the two power companies to invest and cooperate.

(ii) Funded by a Third Party

The new interconnector could be funded by investors, other than the existing power companies, provided that there are means for the necessary investment to be recovered, under terms and conditions that are attractive enough for the investors. The advantages of this option are less dependence on the two existing power companies and it paves the way for competition in electricity supply. The disadvantages include:

- Liability, responsibility, business and commercial arrangement, legal and regulatory issues associated with a third party as discussed in para. 18 to 21 below may arise; and
- Reliance on the two power companies' agreement to advance the network reinforcement programme, and to have the new interconnector 'hooked' onto the systems, or additional capital outlay would be incurred to fund this programme and administrative/legislative provisions would be required should either or both power companies refuse to co-operate.

- More governance costs will be involved, in tendering, execution of contracts and monitoring of performance of the new interconnector owner;

Liability and responsibility issues

17. The new interconnector may be funded by the two power companies or by a third party. In the former case, the responsibility and liability issues could be taken care of in a fashion similar to the existing interconnection agreement. However, if the new interconnector is built and/or operated by a third party, the responsibilities and liabilities of all and respective parties would need to be clearly stipulated and agreed. Areas that require clear demarcation of responsibility will include, inter alia, operation authority, interface and protocol, maintenance schedule coordination, fault attendance, repair cost allocation, etc. Liability and redress thereof, in incidents such as delivery interruption, reduction in reserve sharing capability, equipment damage, interruption to customers, etc. due to negligence or unintended interconnector operation, will need to be laid down in clear and specific terms.

Business and commercial arrangements

18. Should the vertically integrated structure of the Hong Kong electricity market continue as it is, the use of increased interconnection raises questions on reserve capacity sharing, economy power exchange and mutual emergency support at higher levels. These usages involve prior commercial arrangements between the two interconnected parties. The terms and conditions, obligations of each party and the settlement method would have to be established and enforced via legally binding agreements such as an interconnection agreement. Should a third party also get involved (as owner and/or operator of the interconnection) then a number of multi-party agreements would need to be established to stipulate these terms and conditions, including the interconnector usage charge and operational protocol.

19. Should the structure of Hong Kong's electricity market be changed, charges for the use of interconnection, now a part of the integrated power grid, and non-discriminatory grid access to all market participants would have to be considered and explicitly provided for. These might entail two sets of commercial arrangements – one for the use of interconnector and the other for power transactions.

Legal and regulatory considerations

20. Previously the two power companies, under the SOC Agreements, constructed the existing interconnection between the two networks in the early 1980's and are jointly responsible for its operation. If the power companies were to fund, build and operate the new interconnector, then there appears to be few, if any, legal issues associated with the ownership, connection interface, operation and maintenance aspects. Government would nevertheless need to consider the means, regulatory and others, to ensure that benefit arising from increased interconnection would accrue and be shared by the community. In the event that a third party were to build the new interconnector, agreement of the power companies would be required to connect it to the two privately owned networks, and to advance the network reinforcement programme to enable the full transfer capability of the new interconnection. In the absence of such agreement, Government would need to assess appropriate arrangement, administrative/legislative/legal, to bring the interconnector into operation and regulate its use, having regard to private property rights.

Technical constraints

21. The Study identified the suitable interconnector size (2 x 700 MW cables), preferred cable route, installation method, landing sites, connecting substations and associated system reinforcements required. Some five years would be required to complete the new interconnection project. The earliest commencement date for the site work would have to tie in with the availability of land associated with the Central-Wan Chai Reclamation project and the West Kowloon Cultural District development project. While there does not appear to be any technical issues associated with laying the cables and connecting them to the terminal stations at both sides of the harbour, any delays in either of the two major civil projects could have significant implications for the implementation of the proposed new interconnection. Furthermore, as reinforcements of the two power networks are essential to achieving the intended transfer capability, any delays in their completion would also have implications on realizing the capability of the interconnection.

Observations

22. The technical Study concluded that increased interconnection between CLP Power and HEC is technically feasible. An earlier consultancy report undertaken by ERM in 1999 concluded that there should be overall net

economic benefits arising from possible deferment of new generation capacity additions in the future. Prima facie, there should also be other benefits such as improvements in system reliability and ability to exchange power between the interconnected systems. Nevertheless, to take forward the proposal of increasing interconnection, it would be necessary to consider the business and regulatory models for the project, covering for instance net economic benefit, funding arrangement, legal and liability matters, interface between the new interconnector and the networks owned by the two power companies, actual application of the new interconnector, the structure of the electricity supply market reviewed in the light of the expiry of the current Scheme of Control Agreements in 2008.

Advice Sought

23. Members are invited to advise on the objectives and issues identified for detailed consideration for taking forward the proposed increase in interconnection in Hong Kong.