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Panel on Environmental Affairs

Meeting on 4 July 2012

Updated background brief on the provision of a District Cooling System at the Kai Tak Development prepared by the Legislative Council Secretariat (Position as at 27 June 2012)

Purpose

This paper sets out the background to and progress of the provision of a District Cooling System (DCS)[note1] at Kai Tak Development (KTD) (formerly known as South East Kowloon Development (SEKD)), as well as gives a brief account of the views expressed by Members on the subject.

Background

2. Air conditioning accounts for 32% of Hong Kong's electricity consumption. The use of more efficient air conditioning systems would be an effective measure to conserve energy. In October 1998, the Electrical and Mechanical Services Department (EMSD) commissioned a Preliminary Phase Consultancy Study for Wider Use of Water-cooled Air Conditioning Systems in Hong Kong, which established the viability as well as economic and environmental benefits of the water-cooled air conditioning system (WACS) as compared with the conventional air-cooled air conditioning system (AACS). Of the three basic concepts of WACS, viz Centralized Piped Supply System for Condenser Cooling, Centralized Piped Supply System for Cooling Towers, and DCS, the Study found DCS most energy efficient as it could save up to 35% of energy when compared with ACCS. The Study also recommended conducting

note[1] District Cooling System is a very large-scale centralized air conditioning system. It consists of one or more chiller plants to produce chilled water, and a closed loop network of underground pipes for distributing the chilled water to buildings within its service area for air conditioning purpose. The chilled water is pumped to individual buildings for use in their air conditioning systems and is then returned to the central chiller plant for re-chilling.

territorial and district implementation studies to allow early realization of the potential energy saving. One of the studies proposed was on the implementation of DCS at the then SEKD.

3. KTD, with a total site area of over 461 hectares including mainly the former Kai Tak Airport, will be one of the largest urban redevelopment programmes in Hong Kong in the coming years and will be developed in phases. As KTD will be a new district under planning, it offers an excellent opportunity for implementing the more energy-efficient DCS to meet the demand of air conditioning in the area. With the approval of funding by the Finance Committee (FC) in May 2000, EMSD commissioned the "Implementation Study for a District Cooling Scheme at South East Kowloon Development" in January 2001. The Study aimed at examining detailed technical, environmental, regulatory, financial, institutional, contractual, infrastructural, and land use requirements for implementation of DCS, and to draw up an implantation plan. Previous discussions on the key findings and recommendations of the Study before 2008 are summarized in **Appendix I**.

Implementation of DCS at KTD

4. Given its high energy efficiency (35% more energy-efficient than traditional air-cooled air-conditioning system), the implementation of DCS in KTD can achieve a maximum annual saving in electricity consumption of 85 million kilowatt-hour (or about $85 million if translated into monetary terms), with a corresponding reduction of 59 500 tonnes of carbon dioxide emission per annum for the planned total public and private non-domestic air-conditioned floor area of about 1.73 million square meters. This will contribute to air quality improvement and the vision of achieving low carbon economy.

5. The proposal to upgrade the DCS project at KTD to Category A was discussed by the Panel on Environmental Affairs in December 2008. The Panel noted that the private sector would be engaged for the design, construction and operation of DCS under a Design-Build-Operate (DBO)[note2] model contract spanning over 17 years. The project would be developed and commissioned for operation in three phases to suit the three major groups of developments with potential of using DCS services. All public developments in KTD would connect to DCS if their implementation could match the development schedule of DCS. The connection to DCS for private developments would be on a voluntary basis. Some members were concerned that it would be difficult to

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Note[2] Under the proposed "design-build-operate" contract, the DCS operator would be required to design, construct and operate DCS for 17 years. The ownership of DCS will remain with the Government throughout the contract duration. DCS will be handed back to the Government free of any charges upon expiry of the operational phase specified in the contract.

work out the design capacity of DCS if connection to it was on a voluntary basis. Besides, it would be a waste of resources if only public developments would connect to DCS. To attract more private users, the tariff should be set at a reasonable level and incentives should be provided to encourage connection to DCS. Consideration might also be given to making the use of DCS mandatory. The relevant funding proposal at an estimated capital cost of $1,671 million in money-of-the-day (MOD) prices was endorsed and approved by the Public Works Subcommittee (PWSC) and FC on 6 May and 5 June 2009 respectively.

Alternative procurement strategy

6. Tender procedures for the project were initiated in July 2009 upon funding approval by FC. According to the Administration, the returned tender prices of both project costs and operation costs have far exceeded the original estimates. In view of the tender outcome and having reviewed the latest development plan of KTD, the Administration has refined the work requirements and adjusted the original procurement strategy by implementing DCS with three work phases i.e. Phase I, II and III. Under the alternative procurement strategy, the Administration would commence with the overall design of DCS to ensure the integrity of the system, but would implement DCS with separate works contracts to better cater for the progress of major development and infrastructural projects at KTD. The revised approach to procure the DCS development and operation by phases would provide fairer and more reasonable costs though the actual project estimates would be subject to the outcome of the tendering. Details of the alternative procurement strategy are set out in LC Paper No. CB(1) 2324/09-10(05) which is hyperlinked below for ease of reference.

7. When the development of DCS at KTD and the revised procurement strategy were discussed at the Panel meeting on 28 June 2010, members found it difficult to support the alternative procurement strategy in the absence of information, including tender prices under the original procurement mode, the cost estimates for different phases under the alternative procurement strategy etc. They also questioned the viability of adopting DBO procurement mode for DCS given that the DBO approach had been found to be problematic in a number of sewerage projects. Noting that the relevant funding proposal would only be submitted for endorsement by PWSC/FC in the next legislative session, members considered that there was ample time for the Administration to provide the requisite information. They also agreed to hold an informal meeting on 12 July 2010 to consider any confidential/sensitive information relating to the tender of DCS at KTD. At members' request, the Administration had provided further information on DBO model, financial viability of DCS and mandatory subscription to the DCS service by all non-domestic projects in KTD.

8. In gist, the Administration was to prepare the scheme design of DCS (covering key components of the system, including the location of the northern and southern chiller plants as well as the seawater pump-house, and the alignments of major pipelines). The contractor would mainly be responsible for the required detailed design (based on the scheme design by the Administration), building and operation of DCS. Being responsible for the detailed design, the contractor would enjoy a greater flexibility in revising the design during the construction stage in view of any change in circumstances. Moreover, as the contractor would be responsible for both building and operation, the DBO model would prevent the constructor from shifting certain costs to the operator in order to reduce construction cost. To maintain the competitiveness of DCS, the Administration had pledged to set the tariff at a level comparable to the charge of WACS despite any increase in the construction and operating charge. Tariff would be introduced through legislation to facilitate monitoring by the Legislative Council. The Administration would also actively explore how best to implement the requirement for all non-domestic projects in KTD to subscribe to the DCS service, including the appropriate avenue, means of enforcement, and sanctions against any breach of the relevant conditions.

9. When the subject was discussed at the Panel meeting on 21 July 2010, members noted that the Administration had also written to FC explaining the revised phasing approach in procuring DCS. While supporting the concept of DCS, some members remained of the view that the use of DBO approach in procuring the DCS development and operation which spanned over a period of more than 10 years was undesirable, lest the cost of DCS under the revised phasing approach would way exceed the original estimate of $1,671 million.

Returned tenders for Phases I and II

10. In August 2010, the Administration initiated the tendering procedures for works under Phases I and II. Based on the returned tenders, the Administration estimated that the capital cost of Phases I and II was about $1,870 million in MOD price, which had already exceeded the approved project estimate (APE) for the whole DCS project by about $200 million. Together with the estimated capital cost of Phase III at about $1,780 million in MOD prices, the estimated total project cost was about $3,650 million in MOD prices, which would exceed the APE by about $1,980 million. The significant increase in the estimated project cost was due to (i) the latest market situation for major materials, electrical and mechanical equipment and construction works which are specifically adopted for DCS, (ii) the additional costs of works due to project design development and changes in construction requirements, (iii) unexpected site constraints, and (iv) higher provision of price adjustment as a result of the increase in the overall project estimate and rising adjustment factor.

11. To ensure the financial viability of DCS, the Administration had actively explored the feasibility of increasing the subscription rate of the project by requiring all private non-domestic projects in KTD to connect to DCS through inclusion of such a requirement in the land lease conditions. It was estimated that DCS would break even with 25 years [note3] (instead of the original estimate of 30 years) if all air-conditioned floor area of private non-domestic projects in the KTD were required to use the DCS service. Relevant stakeholders would be consulted on the relevant requirement and arrangements.

12. The proposal to increase the APE for implementing Phases I and II of DCS from $1,671 million to $1,861 million was discussed at the Panel meeting on 20 December 2010. While supporting the provision of DCS given its environmental benefits, members expressed grave concern about the significant increase in the estimated project cost to about $3,650 million, let alone the operating cost which was unknown at the present stage. Some members stressed that if Phase III was an essential part of DCS, this should be implemented as soon as practicable as further delay would only result in further increase in the project cost. Some other members however were concerned that with the evolving technology in cooling system, Phase III might become obsolete. These members also questioned the cost-effectiveness of DCS if the annual electricity savings to be achieved was only $85 million as opposed to the total project cost of DCS at around $3,650 million. Apart from DCS, efforts should be made to identify other equally environment-friendly options, including those which could be applied on a localized basis rather than a district basis and provision of financial incentives to encourage reduction in energy consumption.

13. On the proposed inclusion in the land lease condition a requirement for private non-domestic projects in KTD to connect to DCS, some members expressed concern about possible legal challenges by private developers who were unwilling to abide by the mandatory subscription to DCS under the land lease. Given the uncertainties over the proposed mandatory subscription to DCS by private non-domestic projects in KTD, the compatibility of construction requirements for buildings at KTD, and the need to resolve the back-up systems for DCS with developers, some other members questioned the basis upon which the projection that DCS was expected to break even within 25 years was arrived at. To increase the subscription rate of DCS, consideration should be given to extending DCS to residential premises, including public housing estates in KTD.

14. The relevant funding proposal was endorsed and approved by PWSC and FC on 19 January and 18 February 2011 respectively.

Note[3] Counting from 2010/11 with a 100% subscription rate for connection to DCS at KTD.

Latest development

15. The Administration proposes to brief members on the proposed charging mechanism for DCS services and related legislative proposal at the upcoming Panel meeting on 4 July 2012.

Relevant papers

16. A list of relevant papers is at **Appendix II**.

Council Business Division 1
Legislative Council Secretariat
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Appendix I

Implementation Study for a District Cooling Scheme
at South East Kowloon Development

The Study found the District Cooling System (DCS) project technically viable. Energy saved at Kai Tak Development (KTD) as a result of the use of DCS was estimated to be 90 000 MWh per year, equivalent to roughly 0.24% of the total electricity demand in Hong Kong in 2001. The estimated energy saved would also result in an annual reduction of about 53 000 tonnes of carbon dioxide, equivalent to about 0.15% of the total carbon dioxide emission in Hong Kong in 2000. The estimated total capital investment for the DCS project was $655 million at 2001 price level. The private sector could be involved in taking forward the DCS project, possibly by means of a "build-operate-transfer" (BOT) contract[Note]. However, there would be a number of risks and uncertainties that the DCS operator and DCS users might encounter. From the operator's prospective, its major risks would be the uncertainty in the subscription rate, the intensive upfront capital outlays, and the long payback period. For DCS users, the main concerns would be their limited bargaining power and control over the services provided by the operator once they opt to subscribe to the DCS service. In order to ensure that the project can remain reasonably attractive to the private sector, the consultant suggested that the Government should consider providing some support, for instance, by reducing the project risk through requiring all Government, Institution or Community facilities under the Government's direct control to subscribe to the DCS service, and by waiving the land costs for the DCS facilities and distribution pipes.

2. When the key findings and recommendations of the consultancy study as well as the progress of development of DCS at KTD were discussed at the Panel meetings on 10 February 2000, 2 March 2000, and 20 December 2002, members raised questions on the environmental, technical and financial aspects of DCS. Some members pointed out that the BOT approach was at variance with the prevailing arrangement whereby a new facility would be operated by the Government at first and transferred to a private operator at a later stage. There were also questions on the basis upon which the contract period of 30 years was arrived at, limited bargaining power of DCS users, cost-effectiveness of the DCS project given the heavy subsidies on land cost, and opportunity cost incurred by the Government if the land cost for DCS facilities on Government land was waived.

Note Under the proposed "build-operate-transfer" contract, the DCS operator would be allowed to operate the facilities for 30 years. After the expiry of the contract, ownership of the whole system would be returned to the Government subject to the latter paying the residual value of the assets to the operator.

Appendix II

District Cooling System at Kai Tak Development

List of relevant papers

Council/ Committee	Date of meeting	Paper
EA Panel	10 February 2000	Information paper on "Energy Efficiency and Conservation Initiatives for 2000/01" provided by the Administration (LC Paper No. CB(2) 1020/99-00(03)) http://www.legco.gov.hk/yr99-00/english/panels/ea/papers/1020e03.pdf Minutes of meeting (LC Paper No. CB(2) 1604/99-00) http://www.legco.gov.hk/yr99-00/english/panels/ea/minutes/ea100200.pdf
EA Panel	2 March 2000	Information paper on "Water-cooled Air Conditioning Systems" provided by the Administration (LC Paper No. CB(2) 1232/99-00(06)) http://www.legco.gov.hk/yr99-00/english/panels/ea/papers/1232e06.pdf Minutes of meeting (LC Paper No. CB(2) 1605/99-00) http://www.legco.gov.hk/yr99-00/english/panels/ea/minutes/ea020300.pdf
EA Panel	20 December 2002	Information paper on "Implementation of District Cooling System at South East Kowloon Development" provided by the Administration (LC Paper No. CB(1) 548/02-03(03)) http://www.legco.gov.hk/yr02-03/english/panels/ea/papers/ea1220cb1-548-3-e.pdf Response to members' questions from the consultant (LC Paper No. CB(1) 930/02-03) http://www.legco.gov.hk/yr02-03/english/panels/ea/papers/ea1220cb1-930-e.pdf Minutes of meeting (LC Paper No. CB(1) 826/02-03) http://www.legco.gov.hk/yr02-03/english/panels/ea/minutes/ea021220.pdf

Council/ Committee	Date of meeting	Paper
EA Panel	15 December 2008	Information paper on "District Cooling System at the Kai Tak Development" provided by the Administration (LC Paper No. CB(1) 363/08-09(03)) http://www.legco.gov.hk/yr08-09/english/panels/ea/papers/ea1215cb1-363-3-e.pdf Minutes of meeting (LC Paper No. CB(1) 604/08-09) http://www.legco.gov.hk/yr08-09/english/panels/ea/minutes/ea20081215.pdf
EA Panel	28 June 2010	Information paper on "District Cooling System at the Kai Tak Development" provided by the Administration (LC Paper No. CB(1) 2324/09-10(05)) http://www.legco.gov.hk/yr09-10/english/panels/ea/papers/ea0628cb1-2324-5-e.pdf Minutes of meeting (LC Paper No. CB(1) 2956/09-10) http://www.legco.gov.hk/yr09-10/english/panels/ea/minutes/ea20100628.pdf
EA Panel	21 July 2010	Information paper on "District Cooling System at the Kai Tak Development" provided by the Administration (LC Paper No. CB(1) 2564/09-10(03)) http://www.legco.gov.hk/yr09-10/english/panels/ea/papers/ea0721cb1-2564-3-e.pdf Minutes of meeting (LC Paper No. CB(1) 31/10-11) http://www.legco.gov.hk/yr09-10/english/panels/ea/minutes/ea20100721.pdf
EA Panel	20 December 2010	Information paper on "District Cooling System at the Kai Tak Development" provided by the Administration (LC Paper No. CB(1) 782/10-11(05)) http://www.legco.gov.hk/yr10-11/english/panels/ea/papers/ea1220cb1-782-5-e.pdf Paper on the provision of a District Cooling System at the Kai Tak Development prepared by the Legislative Council Secretariat (updated background brief) (LC Paper No. 782/10-11(06)) http://www.legco.gov.hk/yr10-11/english/panels/ea/papers/ea1220cb1-782-6-e.pdf Minutes of meeting (LC Paper No. CB(1) 1229/10-11) http://www.legco.gov.hk/yr10-11/english/panels/ea/minutes/ea20101220.pdf