For information
on 28 June 2010

Legislative Council
Panel on Environmental Affairs

District Cooling System at the Kai Tak Development

PURPOSE

This paper updates Members on the latest development of the capital works project **45CG** – District Cooling System (DCS) at the Kai Tak Development (KTD) and the revised procurement strategy to be adopted.

BACKGROUND

2. On 5 June 2009, the Finance Committee (FC) approved the upgrading of DCS at KTD to Category A at an estimated cost of $1,671 million in money of-the-day (MOD) prices.

3. The scope of works under **45CG** comprises –

(a) construction of a northern chiller plant;

(b) construction of a southern underground chiller plant cum underground seawater pumphouse and above-ground operational facilities;

(c) laying of seawater intake and discharge pipelines;

(d) laying of chilled water distribution pipe networks; and

(e) provision of connection facilities (including heat exchangers) at user buildings at KTD.

Environmental Benefits of DCS

4. Implementation of a DCS in KTD will bring about significant environmental benefits. Given its high energy efficiency (35% more energy-efficient than traditional air-cooled air-conditioning system), the maximum annual saving in electricity consumption will be 85 million kilowatt-hour (kWh), 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. As such, DCS can contribute to air quality improvement and the vision of achieving low carbon economy.

5. For individual user buildings, connecting to DCS will remove their need to install their own chillers and the associated heat rejection equipment. This will minimize the heat island effect in the district caused by hot air emitted from individual air-conditioning plants and will release the space in the buildings for other usages, such as roof garden or greening. DCS will also minimize noise and vibration caused by the air-conditioning plants in individual building.

6. There are strong public expectations that KTD is to become a green web at the centre of Victoria Harbour. Various environmentally friendly initiatives will be introduced and adopted in the design of KTD thereby providing tangible benefits to the environment. The Cruise Terminal building (CT), which is amongst the first batch and most prominent public projects being developed at KTD, has been designed on the basis that DCS will be available for air-conditioning services.

Review of Original Procurement Strategy

7. As proposed to the Public Works Subcommittee (PWSC) (vide PWSC(2009-2010)24) and FC in May and June 2009 respectively, we intended to carry out the project under a single Design, Build and Operate (DBO) contract spanning over 17 years (from commencement of design and construction works of the first phase of DCS in 2010/11 to operation up to from 2026/27). Upon funding approval by FC, we initiated the tendering procedures in July 2009 and the tender application was closed on 27 November 2009. The returned tender prices of both the project

costs and the operation costs far exceed the original estimates. After a critical assessment of the tender returns, we consider that the tenderers might have included a very high risk premium in the tender price to -

(a) cater for uncertainties including price inflation exceeding that allowed under the price adjustments mechanism in the long operation period of 17 years;

(b) provide allowances for any unexpected site constraints such as possible interfacing issues with underground facilities in KTD; and

(c) provide allowances for any unexpected complication in design and construction of DCS, which is first-of-its-kind in Hong Kong. There is a lack of local experience for developing such a complicated engineering system covering 1.73 million square metres of service area.

8. Another contributing factor is the higher than originally estimated prices for meeting design development and construction requirements from interfacing works between DCS system and the other underground utility facilities (e.g. deeper excavation for DCS branch pipes laying from mains crossing under ducts of utilities, and additional pipe jacking required for DCS pipes below utilities), as well as the reinforcement works to allow room for future developments on the ground level.

9. In view of the tender outcome, we have reviewed the original procurement strategy. Given the scale of KTD, there are bound to be adjustments not only in timing but also the design of various projects. As such we consider it important to revise the original procurement arrangements so as to build in flexibility to meet with future adjustments in the development of individual projects. On the other hand, we aim to ensure that the following objectives of the DCS will continue to be met under the revised strategy -

(a) its service delivery should be effective and have adequate capacity to serve the cooling demand of all non-domestic

developments in KTD; and

(b) its provision of service should be timely and in line with the pace of the service need. Demand for DCS service will first arise from the cruise terminal (CT) project and the projected completion of the non-domestic area of a public housing estate in 2013. Subsequent increase in the demand will arise in phases in line with the development programmes of other public projects and land uses at Kai Tak.

10. Specifically, we propose to adjust the procurement strategy in the following manner–

(a) reducing the risk premium over the extended project period, and alleviating concerns over the adequacy of price adjustments; and

(b) better catering for changes in the development schedule of KTD such that greater flexibility and improved adjustments can be achieved.

ALTERNATIVE PROCUREMENT STRATEGY

11. The latest development programme of KTD is broadly grouped into three packages with reference to their scheduled completion dates, as follows –

(a) Package 1 – scheduled for completion in 2013, including mainly CT and non-domestic areas of a public housing estate;

(b) Packages 2 and 3 – scheduled for completion in 2016 and thereafter, including Tourism Node, hotels, private commercial and residential developments etc..

12. In the light of the development programmes, we propose to commence with the overall design of the DCS to ensure the integrity of the system, but to implement the DCS with separate works contracts to

better cater for progress of major development and infrastructural projects at KTD, as follows –

(a) Phase I - to proceed urgently with a works contract to provide for part of the pipe laying works for certain Package 1 users in the North Apron. This seeks to match the ongoing roadwork construction programme in North Apron and avoid subsequent re-opening of newly completed road for installing DCS pipes at a later stage;

(b) Phase II - to procure, in parallel with Phase I, under a DBO contract covering –

(i) the overall design of DCS for the whole KTD;
(ii) the construction of building and engineering work for the core, underground civil works components of DCS, namely a northern chiller plant room, a southern chiller plant room and a seawater pumphouse;
(iii) laying of chilled water distribution pipes not yet covered in Phase I, to serve Package 1 users;
(iv) electrical and mechanical (E&M) equipment (e.g. pumps and chiller plants) for meeting the cooling demand of developments arising from Package 1 users; and
(v) the operation of DCS up to 2018/19 with an option of extending the operation period to end 2026/27; and

(c) Phase III – to procure in due course works contracts for the installation of additional E&M equipment and laying of chilled water distribution pipes to serve Packages 2 and 3 users when their development programmes are firmed up at a later date. The Phase III works will run in parallel with the operation phase of the DBO contract (i.e. the Phase II works).

13. We consider the revised phasing approach in procuring the DCS development and operation will provide fairer and more reasonable costs though the actual project estimates will be subject to the outcome of the tendering. An outline of the proposed scope of work is set out at **Annex A,** which is the same as the scope as set out in the aforementioned PWSC

A

B

submission. A layout plan on the physical coverage of the three Phases of works arrangements are at **Annex B**.

Phase I

14. The Civil Engineering and Development Department (CEDD) has commissioned road works in the North Apron area. It was originally planned that the CEDD contractor should allow the DBO contractor of the DCS to commence the pipe laying works in July 2010 in the North Apron areas in conjunction with the road works. However, in view of the need to revise the procurement strategy for the DCS, there is a need to consider how best to co-ordinate the roadwork at North Apron with the pipe laying work. To avoid complications of traffic diversion and adverse impacts on the programme of other utilities, we recommend proceeding with the tendering of the DCS pipe laying work at the North Apron as soon as possible, to ensure better co-ordinated works programme at the North Apron, and that the cooling demand of Package 1 users in the North Apron can be met in time.

Phase II

15. Components of the works contracts for Phase II of the DCS project are spelt out in paragraph 12(b) above. To ensure design integrity of the DCS and seamless control of the engineering systems installed under different phases, we propose to complete system design at the beginning based on the best available information in hand.

16. In respect of building and construction work, we recommend providing for the underground chiller plant rooms and seawater pumphouse in their entirety at the early stage, for the following reasons –

(a) the marginal cost of expanding the chiller plant rooms and seawater pumphouse at a later stage to meet the future cooling demand might be much higher than constructing the whole chiller plant rooms and seawater pumphouse from the outset; and

(b) the chiller plant rooms and seawater pumphouse are the core facilities for the DCS. They should be made available and

ready to support future growth in cooling demand. As underground facilities, their construction will likely take long lead time. The alternative of phasing their construction will discourage potential customers of DCS from subscribing to the service as the required DCS capacity might not be available in a timely manner.

To avoid over investment at the early stage, only E&M equipment for Package 1 users will be covered in this Phase.

Phase III

17. Phase III works are to meet the cooling demand of the Packages 2 and 3 users. To cope with the development schedule of KTD, pipe laying and the supply and installation of E&M equipment for Packages 2 and 3 will be covered in this Phase. Phase III works will commence in around 2013/14 to meet the scheduled demand of DCS for Package 2 in 2016. Consideration will be given to further breaking up works in this Phase to suit the development schedule in KTD in due course.

Gainful Use of Waste Heat

18. The DCS would generate waste heat in its operation. As some of the proposed land uses and projects in KTD may have substantial heating demand (e.g. supply of heating services, shower etc.), there is scope for the waste heat to be recovered for gainful use for meeting such heating demand. We propose to examine the potential of providing heating services in DCS through gainful use of heat generated from the cooling service in the design of the DCS. If it is found to be feasible and cost effective, the costing implications will be incorporated in the submission to the PWSC and FC for funding approval.

Financial Viability

19. It was our original policy intention to ensure that the capital and operational costs can be recovered from users over the project life estimated to be 30 years[1]. We envisage that the Government should be

[1] E&M equipment normally has a service life of 30 years.

provided with sufficient flexibility to determine the charging structure, tariff levels and adjustment mechanism to ensure that the capital and operating costs can be recovered from users over the project life, while the tariff should be set at a competitive level comparable to the charge of individual water-cooled air-conditioning systems using cooling towers.

20. According to our latest review, taking into account the estimated increase in capital and operating cost and assuming that the tariff can be adjusted annually in the same pace with the price level changes of recurrent expenditure, DCS would stand a chance of breaking even within its service life (30 years) if it could attain an overall subscription rate of 58%. As stated in aforementioned PWSC submission, all public projects in KTD are mandated to subscribe to DCS service. Upon the completion of all Government-funded capital works projects currently planned for KTD, these projects will account for up to 35% of the total air-conditioned floor area in KTD. In addition, it requires subscription from about 35% of the private developments in KTD to reach the overall subscription rate of 58%. Given the competitiveness[2] of DCS over other forms of air-conditioning, DCS should be able to achieve a reasonably high subscription rate from the private sector.

21. However, there may be risk of failing to achieve that subscription rate and thus the financial viability. Despite the competitiveness of DCS over other forms of air-conditioning systems, whether the project would be financially viable is still subject to a number of uncertain factors. These factors include the actual capital and recurrent costs, the evolving development schedule of KTD, the changes

[2] The DCS system is very competitive as compared to alternative air-conditioning system for the following reasons –

(a) reduction of upfront capital cost for installing chiller plants at their buildings;
(b) user buildings do not need to install their own chillers and the associated electrical equipment thus allowing more flexible building designs;
(c) the DCS is more adaptable than individual air-conditioning system to the varying demand for air-conditioning; and
(d) the service quality and reliability will be overseen by the Electrical and Mechanical Services Department.

While there may be technological improvement of other types of air-conditioning system, the competiveness of DCS could be maintained over its project life. The DCS project will deliver the designed cooling capacity in accordance with the development plan of KTD. As the development plan will be implemented in three packages, major DCS plant equipment will be provided in stages. Advanced equipment models will be procured at the time when additional equipment is needed.

in relative tariff levels of DCS and cost of cooling using other forms of air-conditioning system, in particular the water-cooled air-conditioning system with which we have pledged to set tariff level of DCS at a competitive level, and the readiness of private sector users to embrace DCS as a new mode of supply to meet air-conditioning needs.

22. Notwithstanding, DCS is essentially an environmental project. In assessing the financial viability of this project, consideration should be given to its environmental benefits and overall benefit to the community. Any possible financial shortfall should be regarded as environmental investment in the event that the costs could not be fully recovered from the tariff over its service life.

Timeframe for Consulting PWSC and FC

23. We plan to invite tenders for the works under Phases I and II as soon as possible, so as to ensure that the DCS would be able to meet cooling demand of various developments in KTD in a timely manner.

24. If the returned tender prices for Phases I and II as well as the estimated contract sum for Phase III are expected to exceed the APE, we plan to update this Panel on the tender returns and seek PWSC/ FC's approval for implementing Phases I and II before awarding the respective contracts. We shall seek separate PWSC/ FC approval for increasing the APE to cover Phase III, scheduled for commencement in 2013-14 tentatively, after the return of relevant tender.

WAY FORWARD

25. Members are invited to note the latest development of DCS at KTD and the alternative procurement strategy as set out in this paper.

Environment Bureau
Electrical and Mechanical Services Department
June 2010

Annex A

Alternative Procurement Strategy
Scope of Works under Various Phases

Phases	Period	Scope of Works	Operation Service
Phase I – Works contract for the pipe laying work for part of KTD Package 1	2010/11 – 2012/13	• Pipe laying from northern chiller plant room for provision of chilled water to public housing estate project etc. to meet the roadwork programme in the North Apron	
Phase II – DCS core services under DBO arrangement	2011/12 – 2018/19 (8 years) (with an option for extending the operation period for 8 years up to end 2026/27)	• Design for the whole DCS • Building and engineering works, the northern chiller plant room , southern underground chiller plant room and the seawater pumphouse • Laying of chilled water distribution pipes not covered in Phase I for Package 1 users • E&M equipment for KTD Package 1 users	• Operation of DCS up to 2018/19, and possibly up to 2026/27 (for users of all package) assuming extension of operation contract

Phases	Period	Scope of Works	Operation Service
Phase III – E&M installation and pipe laying for KTD Packages 2 and 3 users	2013/14 – 2020/21 (Note)	• Laying works of chilled water distribution pipes for KTD Packages 2 and 3 users • Provision of E&M equipment for KTD Packages 2 and 3 users	

Note – Commencement date of the works under Phase III is subject to the finalised timetables for projects under KTD Packages 2 and 3.

北部供冷站
Northern DCS Plant Room

海濱道 Hoi Bun Road

啟興道Kai Hing Road

海水泵房 Seawater Pump Room

南部供冷站 Southern DCS Plant Room

宋皇臺道 Sun Wong Toi Road

KTAC

HOI BUN ROAD

KAI HING ROAD

SUNG WONG TOI ROAD

KWUN TONG TYPHOON SHELTER

TO KWA WAN TYPHOON SHELTER

KOWLOON BOCK

L2 L3 L2 L4 L5 D1 D2 L6 L8 L16 L9 D2 T2 D4 L18 L10 D4 D3 D3 L12

N

說明 LEGEND

- 第一期冷凍水配水管道網絡 Phase I Pipework Routing
- 第二期冷凍水配水管道網絡 Phase II Pipework Routing
- 第二期海水入水及配水管道網絡 Phase II Seawater Intake/Pipework
- 第三期冷凍水配水管道網絡 Phase III Pipework Routing
- 第三期海水配水管道網絡 Phase III Seawater Pipe Routing

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Rev	Description	By	Date
-	FIRST ISSUE	PHL	05/10

機 電 工 程 署
Electrical & Mechanical Services Department

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25247/SK/C/044			-
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