For discussion on
23 February 2016

Legislative Council Panel on Development

45CG – District Cooling System at the Kai Tak development

PURPOSE

This paper seeks Members' support for the proposed Phase III (Package C) (Phase IIIC) of **45CG** – District Cooling System (DCS) at the Kai Tak development (KTD), at an estimated cost of about $153.7 million in money-of-the-day (MOD) prices, to dovetail the latest progress of infrastructure developments at Kai Tak.

DCS at KTD

2. The DCS is one of the major infrastructure facilities in support of the sustainable and environmentally-friendly development at Kai Tak. To promote energy efficiency and conservation, and with the support of the Legislative Council (LegCo), the Government is constructing a first-of-its-kind DCS at KTD to serve a planned total of about 1.73 million square metres of non-domestic air-conditioned gross floor areas, requiring about 284 megawatt of refrigeration cooling capacity.

3. The DCS is an energy-efficient air-conditioning system, consuming 35% and 20% less electricity as compared with traditional air-cooled air-conditioning systems and individual water-cooled air-conditioning systems (WACS) using cooling towers respectively. The technology has been widely adopted in other parts of the world, such as Singapore, Europe and the United States.

4. As reported to the LegCo in June 2015 vide PWSC(2015-16)29, on the basis of the latest development schedule of KTD, the project cost for all phases (including the remaining works under Phase III[1]) of the

[1] The scope of the remaining works under Phase III includes the installation of electrical

DCS is estimated to be $4,945.5 million in MOD prices. Funding approval from LegCo has been secured for Phases I, II, III (Package A) and III (Package B) of the project at an Approved Project Estimate (APE) of $3,752 million in MOD prices under **45CG**.

5. The construction works for Phases I and II of DCS were completed in the first quarter of 2013 and the third quarter of 2014 respectively. The works for DCS Phase III (Package A) and III (Package B) are on schedule and within the APE, and are expected to be completed by the end of 2017 and end of 2018 respectively.

SCOPE OF PHASE IIIC

6. The DCS Phase IIIC project comprises the laying part of chilled water distribution pipe networks at a length of about 1 600 metres (m) at a section of the Road D1 and 600 m at a section of the Road L7, scheduled to commence in the third quarter of 2016, to match with the programme of Road D1 (Part) and Road L7 in KTD. This arrangement enables coordination with the installation of other underground utilities, and can minimise the need for utility diversion, and/or re-opening of newly completed roads for installing DCS pipes.

7. To achieve better co-ordination and interface, the DCS pipe laying works to be funded under Phase IIIC will be entrusted to the Civil Engineering and Development Department (CEDD)'s contract for implementation together with the infrastructure works at the former north apron area at the Kai Tak Airport[2] whereby funding will be sought separately.

8. An outline of the scope of works and a layout of DCS pipe networks under various phases are set out at **Annex 1** and **Annex 2** respectively.

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and mechanical equipment and pipe laying for remaining KTD Packages II and III.

[2] CEDD plans to seek funding approval from FC within the current legislative session for upgrading part of **7469CL**, entitled 'Kai Tak development – infrastructure at north apron area of Kai Tak Airport'.

9. Subject to the Finance Committee (FC)'s funding approval, we plan to commence the construction of Phase IIIC works in the third quarter of 2016 for completion in the first quarter of 2020.

JUSTIFICATION

10. Implementation of a DCS in the KTD will bring about significant environmental benefits. Due to better energy efficiency, the maximum annual saving in electricity consumption upon completion of the entire DCS project is estimated to be 85 million kilowatt-hour, with a corresponding reduction of 59 500 tonnes of carbon dioxide emission per annum. As such, DCS is expected to contribute to air quality improvement and carbon reduction.

11. Apart from energy saving, the DCS will bring about the following benefits for individual users –

(a) reduction in upfront capital cost for installing chiller plants at their buildings. The reduction is about 5-10% of the total building cost;

(b) more flexible building designs for user buildings as they do not need to install their own chillers and the associated electrical equipment;

(c) reduced heat island effects in KTD and no noise and vibration arising from the operation of heat rejection equipment and chillers of air-conditioning plants in buildings, as such equipment will no longer be necessary for buildings subscribing to district cooling services. Also, DCS can contribute to air quality improvement and the vision of achieving low carbon economy; and

(d) a more adaptable air-conditioning system to the varying demand as compared to individual air-conditioning systems. For each individual building, cooling capacity

can be increased by requesting additional cooling capacity from the DCS without carrying out extensive modification works for the building in question.

FINANCIAL IMPLICATIONS

12. We estimate the capital cost of proposed works for Phase IIIC to be about $153.7 million in MOD prices. We plan to seek the endorsement and funding approval from the Public Works Subcommittee (PWSC) and FC in the second quarter of 2016 to increase the APE of **45CG** from $3,752 million by $153.7 million to $3,905.7 million.

13. The DCS tariff has been set at a competitive level comparable to the cost of WACS using cooling towers, which is one of the most cost-effective air-conditioning systems available in the market. We also intend to recover both the capital and operating costs from users over the project life, which is estimated to be 30 years, as taxpayers should not subsidise such air-conditioning charges. The level of tariff is now set out in the District Cooling Services Ordinance (Cap. 624) which was passed by LegCo in March 2015. The unit cost of DCS calculated on the basis of the tariff set out in the Ordinance is lower than the unit cost of an individual WACS, which is in line with the expectation that long-term energy savings would translate into a reduction in cooling costs. The charging level of the DCS and a comparison of the unit costs of DCS with those of WACS are at **Annex 3**.

PUBLIC CONSULTATION

14. We have consulted the following parties which supported the implementation of DCS at the KTD –

(a) the Energy Efficiency and Conservation Sub-committee of the Energy Advisory Committee on 24 October 2008; and

(b) the Environment and Hygiene Committee of the Kwun Tong District Council on 2 December 2008.

15. In addition, we consulted the following parties which had no objection to the DCS at the KTD –

(a) Wong Tai Sin District Council on 18 November 2008;

(b) the Housing and Infrastructure Committee of the Kowloon City District Council on 11 December 2008; and

(c) the Habourfront Enhancement Committee on 15 December 2008.

16. The Metro Planning Committee of the Town Planning Board (TPB) approved on 13 February 2009 the planning application for the underground DCS, including chiller plant cum seawater pump house, and above-ground operational facilities within the "Open Space", "Commercial (4)" and "Residential (Group C)" zones at the middle section of the ex-Kai Tak Airport runway. On 31 August 2012, Director of Planning, under the delegated authority of TPB, approved the minor amendments to the approved scheme regarding the change of gross floor area and disposition of the above-ground facilities of chiller plant, which were proposed to suit the design of the road situated above the related facilities.

17. As for the level of DCS charges, the District Cooling Services Ordinance provides for, among others, the district cooling services tariff and the tariff adjustment mechanism. The tariff, as stipulated in the Ordinance, has been set at a competitive level comparable to the cost of individual WACS using cooling towers, which is one of the most energy-efficient air-conditioning systems available in the international market. It seeks to recover both the capital and operating costs of DCS over its project life in 30 years. The Ordinance was passed by LegCo in March 2015.

ENVIRONMENTAL IMPLICATIONS

18. **45CG**, which forms part of the KTD, is not a designated project under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance (Cap. 499). The engineering feasibility study of the KTD is a designated project under Schedule 3 of the EIAO, requiring an EIA report to be approved under the EIAO. The environmental acceptability of the proposed DCS development has been addressed in the KTD EIA report, which was approved by the Director of Environmental Protection on 4 March 2009 and concluded that the DCS would not cause adverse long term environmental impacts.

19. For short term construction impacts, we will control noise, dust and site run-off nuisances to within established standards and guidelines through the implementation of mitigation measures. These include the use of quiet construction plant, silencers, mufflers, acoustic lining or shields for noisy construction activities, frequent cleansing and watering of the site, and provisions of wheel-washing facilities. We will also carry out site inspections to ensure that these recommended mitigation measures and good site practices are properly followed and implemented. We have included in the project estimates the cost for the implementation of these mitigation measures.

20. At the planning and design stages, we have considered the piping alignment, design level and construction method of the proposed works to reduce the generation of construction waste where possible. In addition, the contractors will be required to reuse inert construction waste (e.g. excavated soil) on site or in other suitable construction sites as far as possible, in order to minimise the disposal of inert construction waste at public fill reception facilities[3]. We will encourage the contractor to maximise the use of recycled or recyclable inert construction waste, and the use of non-timber formwork to further reduce the generation of construction waste.

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[3] Public fill reception facilities are specified in Schedule 4 of the Waste Disposal (Charges for Disposal of Construction Waste) Regulation. Disposal of inert construction waste in public fill reception facilities requires a licence issued by the Director of Civil Engineering and Development.

21. At the construction stage, we will require the contractor to submit for approval a plan setting out the waste management measures, which will include appropriate mitigation means to avoid, reduce, reuse and recycle inert construction waste. We will ensure that the day-to-day operations on site comply with the approved plan. We will require the contractor to separate the inert portion from non-inert construction waste on site for disposal at appropriate facilities. We will control the disposal of inert construction waste and non-inert construction waste at public fill reception facilities and landfills respectively through a trip-ticket system.

HERITAGE IMPLICATIONS

22. The proposed works would not affect any declared monuments, proposed monuments, graded historic sites or buildings, sites of archaeological interest and historic sites identified by the Antiquities and Monuments Office within the work site.

LAND ACQUISITION

23. The proposed works do not require any resumption of private land.

BACKGROUND INFORMATION

24. With the support of the Panel on Environmental Affairs, the Government sought FC's funding approval for implementing Phases I and II on 18 February 2011 at an APE of $1,861.8 million in MOD prices[4].

[4] FC approved the DCS at KTD at an APE of $1,671 million in MOD prices in June 2009. Given that the returned tender price far exceeded the original estimates, and having reviewed the latest development plan of KTD, we adjusted the procurement strategy by implementing the DCS in three phases, i.e. Phases I, II and III, which produced more reasonable cost estimates and could better tie in with the development plan of KTD.

25. The estimated cost of Phases I, II, III (Package A) and III (Package B) of 45CG is $3,752 million in MOD prices. Together with the estimated cost of $153.7 million in MOD prices for Phase III (Package C) under the project, the estimated project cost of 45CG up to current development is $3,905.7 million in MOD prices. The latest estimated cost for the remaining works under Phase III is $1,039.8 million in MOD prices. The estimated project cost up to current development for all phases of 45CG is therefore $4,945.5 million in MOD prices. This is the same as we last estimated when seeking additional funding for DCS Phase III (Package B) in June 2015 vide PWSC(2015-16)29.

WAY FORWARD

26. With Members' support to our proposal for Phase IIIC works, we plan to seek the endorsement from the PWSC and funding approval from the FC in the second quarter of 2016 for the Phase IIIC works, in tandem with **7469CL** "Kai Tak development – infrastructure at north apron area of Kai Tak Airport".

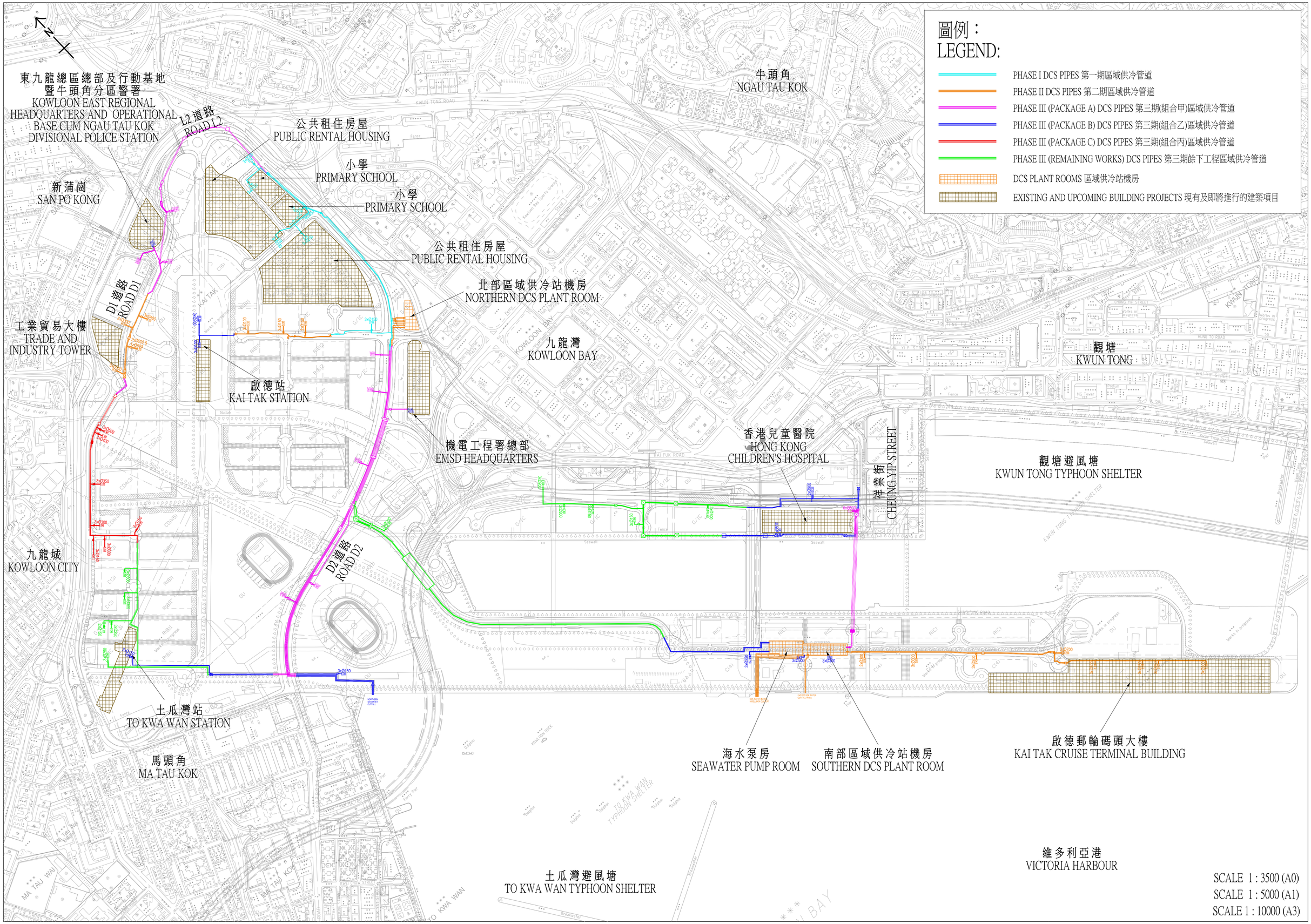
Environment Bureau
February 2016

Annex 1

District Cooling System (DCS) at the Kai Tak Development (KTD)
Scope of Works under Various Phases

Phases	Period	Scope of Works
Phase I – Works contract for the pipe laying work for part of KTD Package I	2010/11 – 2012/13	◆ pipe laying from northern chiller plant room for provision of chilled water to public rental housing site project to meet the roadwork programme in the North Apron.
Phase II – DCS core services under Design, Build and Operate arrangement	2010/11 – 2019/20 (with an option for extending the operation period for eight years)	◆ design for the whole DCS; ◆ building and engineering works, the northern chiller plant room, southern underground chiller plant room and the seawater pumphouse to support the operation of the entire DCS; ◆ laying of chilled water distribution pipes not covered in Phase I for Package I users (Kai Tak Cruise Terminal building); ◆ electrical and mechanical (E&M) equipment for KTD Package I users; and ◆ operation of DCS up to 2019/20, and possibly for eight more years (for users of all packages) assuming extension of operation contract.
Phase III (Package A) – E&M installation and pipe laying for part of KTD Packages II and III	2013/14 – 2017/18	◆ pipe laying works to match with the programme of road construction and upcoming building developments including Trade and Industry Tower and Hong Kong Children's Hospital; and ◆ provision of E&M equipment for the

Phases	Period	Scope of Works
		above building developments and two schools.
Phase III (Package B) – E&M installation and pipe laying for part of KTD Packages II and III	2015/16 – 2018/19	◆ pipe laying works to match with the programme of road construction and upcoming building developments including the Electrical and Mechanical Services Department Headquarters, To Kwa Wan Station and Kai Tak Station of the Shatin to Central Link, and Kowloon East Regional Headquarters and Operational Base cum Ngau Tau Kok Divisional Police Station; ◆ provision of E&M equipment for the above building developments; and ◆ consultancy services for pre-construction stage (design) of the remaining Phase III works to tie in with the ongoing and upcoming programmes on the developments and infrastructure works carried out by CEDD.
Phase III (Package C) – pipe laying for part of KTD Packages II and III	2016/17 – 2019/20	◆ pipe laying works to match with the programme of road construction of Road D1 and Road L7.
Other works under Phase III – E&M installation and pipe laying for remaining KTD Packages II and III	2017/18 – 2021/22	◆ pipe laying works for remaining works in KTD to match with the overall development programme; and ◆ provision of E&M equipment for the above developments.



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Annex 3

District Cooling System (DCS) at the Kai Tak Development (KTD) Charging level

The Electrical and Mechanical Services Department has commissioned a consultancy study to advise on the initial tariff and future review mechanism having regard to international practices and features of the DCS at the KTD. The opening tariff at 2012/13[1] as recommended by the consultant and the charging level for 2013/14, 2014/15 and 2015/16 calculated from the opening tariff are as follows –

Type of charge	**Charging level[2]**			
	Opening at 2012/13	**2013/14**	**2014/15**	**2015/16**
Capacity Charge ($/kilowatt per month)	102.96	107.80	112.11	116.03
Consumption Charge ($/kilowatt-hour)	0.17	0.18	0.19	0.1959

2. We have also made a comparison between the costs (including capital and recurrent costs) of DCS and the costs under WACS per unit of cooling energy in order to confirm that the DCS tariff is set at a competitive level comparable to the cost of individual water-cooled air-conditioning systems using cooling towers (WACS). When drawing this comparison, it should be noted that while the Government has undertaken to apply common charging rates for all buildings regardless of their load profiles, there is no single or uniform unit cost

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[1] 2012/13 is chosen as the base year as it marks the commencement of operation of the DCS.

[2] The tariff levels for 2013/14, 2014/15 and 2015/16 are calculated by applying the auto-adjustment formulae set out in the District Cooling Services Ordinance to the opening tariff at 2012/13. The Ordinance, passed by the Legislative Council in March 2015, stipulates the tariff in 2014/15 and the auto-adjustment formulae.

for both the DCS and the WACS. Reasons are set out below –

(a) different types of buildings require different designs of WACS, and hence there will be variations in the unit costs of WACS across different types of buildings; and

(b) there are also variations in the DCS unit costs among different types of buildings. The differences are largely the result of differences in the capacity charges for different types of building as well as the hours of operation. The capacity charge varies with the maximum cooling capacity of the building and tends to be higher for buildings which require higher cooling load, and the unit cost of DCS tends to be higher if the hours of operation of the cooling service are short.

3. A comparison of the unit costs of DCS and those of WACS for Government premises and public facilities, as well as commercial developments in KTD at the price level of 2012/13 is summarised below.

Types of buildings (weighted average)	% of air-conditioned floor area in KTD	Unit Cost of DCS[3]	Unit Cost of WACS[4]
All building types	100	0.635	0.791
Government premises	24	0.714	1.053
Facilities of public bodies	12	0.489	0.621
Commercial developments (e.g. private retail and offices[5] and hotels)	64	0.632	0.722

[3] The cost of DCS is equivalent to the capacity charge and consumption charge to be paid by a consumer for the use of the district cooling services. The unit cost of DCS is worked out by dividing the total annual charges paid by the consumer for a building (i.e. the capacity charge and the consumption charge) by the building's annual consumption of the cooling energy (i.e. the cooling energy, in the unit of kilowatt-hour refrigeration (kWrh), actually used for generating chilled water to be supplied to the building) over a year.

[4] The cost of WACS is the life-cycle cost, which is the present value of the current and future expenditures for the procurement, replacement, operation and maintenance of building materials and building services installation throughout the life span of the self-generated WACS for a particular building type in the KTD. The cost items include construction cost of plant rooms and equipment (i.e. chillers, pumps, cooling towers, transformers and low voltage switchboards) and pipework, operation cost (i.e. electricity cost, water cost and sewage cost) and maintenance cost (i.e. annual maintenance cost and maintenance staff cost). The WACS is assumed to have a project life of 20 years.

The unit cost of WACS is worked out by dividing the total discounted cash flow of the costs by the required cooling energy (i.e. the quantity of heat removed per second in the unit of kWrh, actually demanded for generating chilled water to be supplied to the building).

[5] For a typical office building of 60,000 square metres of gross floor area and 7,000 kW of cooling capacity, the monthly air-conditioning charge currently varies from $3 to $5 per square foot at the 2014/15 price level. On the other hand, the same for district cooling is estimated to be about $2 per square foot.

However, the amount of air-conditioning charges to be paid by the air-conditioning user needs to take into account the operation and maintenance fee to be set by the building owners or their authorized agents for the remaining parts of the central air-conditioning system for the building concerned.