

For discussion
on 16 December 2020

PWSC(2020-21)25

ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE

HEAD 705 – CIVIL ENGINEERING

Civil Engineering – Multi-purpose 51CG – District Cooling System at the Kwu Tung North New Development Area

Members are invited to recommend to the Finance Committee the upgrading of **51CG** to Category A at an estimated cost of \$5,787.7 million in money-of-the-day prices.

PROBLEM

We need to carry out the works of **51CG** for implementing a District Cooling System (DCS) at the Kwu Tung North New Development Area (KTN NDA) to provide air-conditioning and promote energy efficiency in this area.

PROPOSAL

2. The Director of Electrical and Mechanical Services, with the support of the Secretary for the Environment, proposes to upgrade the project of **51CG** at an estimated cost of \$5,787.7 million in money-of-the-day (MOD) prices for implementing the DCS at KTN NDA to Category A.

PROJECT SCOPE AND NATURE

3. The scope of works under **51CG** which we propose to upgrade to Category A comprises –

/(a)

- (a) chiller plants;
- (b) chilled water distribution pipes;
- (c) electrical and mechanical equipment at chiller plants;
and
- (d) connection facilities at user buildings.

4. The estimated cooling capacity of the proposed DCS is about 190 megawatt and the estimated total air-conditioned floor area is about 1.1 million square metres.

5. To tie in with the infrastructure works, we plan to commence the construction of the proposed works by phases upon obtaining funding approval from the Finance Committee, for substantial completion of the main works of the DCS in about 11 years. A layout of the DCS plant with pipe networks and an outline of the scope of works are at **Enclosure 1 and Enclosure 2** respectively.

JUSTIFICATION

6. DCS is a large-scale centralised air-conditioning system which produces chilled water at central chiller plants for distribution to user buildings for air-conditioning purpose. It is a major infrastructure in support of low-carbon development. The 2018 Policy Address stated that the feasibility of providing DCS at KTN NDA would be studied. Since the estimated cooling demand of non-domestic buildings and facilities at KTN NDA would be sufficient to support the development of DCS, we propose to construct DCS at KTN NDA to promote energy efficiency and conservation.

7. The energy efficiency of DCS is generally better than that of traditional central air-conditioning systems in individual buildings. The maximum annual saving in electricity consumption upon full utilisation of the DCS plant is estimated to be 42 million kilowatt-hour, with a corresponding reduction of about 29 400 tonnes of carbon dioxide emission per annum.

8. Apart from energy saving, the DCS will bring about the following environmental benefits –

/(a)

- (a) reduction in users' upfront capital cost, as chiller plants are not required at user buildings. The reduction is about 5% to 10% of the total building cost;
- (b) more flexible building designs for user buildings;
- (c) reduced heat island effects at KTN NDA, and no noise and vibration arising from the operation of heat rejection equipment and chillers of air-conditioning plants in user buildings; and
- (d) a more adaptable air-conditioning system as compared to individual air-conditioning systems. Individual buildings can adjust their cooling capacity to meet air-conditioning demands without having to carry out extensive modification or retrofitting works.

Ensuring timely implementation

9. The construction of the proposed DCS will be carried out in two phases to tie in with the development programmes of infrastructure and building projects at KTN NDA. The construction of the DCS will have to match with the programme of ongoing and upcoming road construction under First Phase development (**7747CL**)¹ and Remaining Phase development (**7828CL**)² of KTN NDA as far as possible to minimise the need for road excavation and diversion of completed utility services and roads. This coordinated approach will also save project cost.

10. The works for the chiller plants, including construction of the plant buildings, installation of electrical and mechanical equipment and associated pipes, will be implemented under a "Design, Build and Operate" contract. Tasking a contractor with both detailed design and construction works will help expedite the project to tie in with the commissioning of the developments. Incorporating the operating requirements into the design of the DCS will also facilitate smooth commissioning and operation as well as subsequent management and maintenance of the facilities.

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¹ Public Works Programme Item No. **7747CL** – Advance Site Formation and Engineering Infrastructure Works at Kwu Tung North New Development Area and Fanling North New Development Area

² Public Works Programme Item No. **7828CL** – Remaining Phase of Site Formation and Engineering Infrastructure Works at Kwu Tung North New Development Area and Fanling North New Development Area

11. The installation of connection facilities will be implemented through separate contracts in due course as the design and construction can only be worked out after the relevant developers or building owners have finalised their building designs.

FINANCIAL IMPLICATIONS

12. We estimate the capital cost of the proposed works to be \$5,787.7 million in MOD prices, broken down as follows –

	\$ million (in MOD prices)
(a) DCS plant building ³	674.6
(b) Civil and pipe laying works ⁴	1,283.2
(c) Electrical and mechanical installation and associated plant equipment ⁵	2,739.9
(d) Environmental mitigation measures	57.6
(e) Additional energy conservation measures	7.2
(f) Consultants' fees	25.8
Made up of fees for –	
(i) contract administration	11.4
(ii) management of resident site staff (RSS)	14.4
(g) Remuneration of RSS	476.1
(h) Contingencies	523.3
Total	5,787.7

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³ Design and construct DCS plant building to house the electrical and mechanical installations and associated plant equipment of DCS.

⁴ Design and construct the chilled water pipes and associated accessories.

⁵ Design and construct electrical and mechanical installations including chilled plants, chilled water pumps, electrical system and associated plant equipment, and connection facilities at user buildings.

A detailed breakdown of the estimates for the consultants' fees and RSS costs by man-months is at **Enclosure 3**.

13. Subject to funding approval, we plan to phase the expenditure of the works as follows –

Year	\$ million (in MOD prices)
2021-2022	127.1
2022-2023	186.9
2023-2024	224.2
2024-2025	637.8
2025-2026	620.1
2026-2027	226.3
2027-2028	221.9
2028-2029	547.1
2029-2030	865.5
2030-2031	825.9
2031-2032	274.9
2032-2033	265.2
2033-2034	236.4
2034-2035	266.3
2035-2036	21.3
2036-2037	22.1
2037-2038	23.1
2038-2039	95.9
2039-2040	99.7
	5,787.7

14. We have derived the MOD estimates on the basis of the Government's latest set of assumptions on the trend rate of change in the prices of public sector building and construction output for the period from 2021 to 2040. The contracts will provide adjustments for price fluctuation as appropriate.

15. The estimates of the recurrent cost arising from this project are at **Enclosure 4**. The District Cooling Services Ordinance (Cap. 624) provides that the recurrent cost arising from this project, including the operation and maintenance fees for engaging a contractor and utility charges for operating the DCS plant, be offset by the district cooling services charges collected. The Ordinance also sets out the tariff calculation and adjustment mechanism.

16. Following the practice of the existing DCS at the Kai Tak Development, private non-domestic developments will be required by their land lease to connect to the DCS. The tariff for using DCS at KTN NDA will be set at a competitive level, comparable to the cost of using individual water-cooled air-conditioning systems using cooling towers (WACS), which is one of the most cost-effective air-conditioning systems available in the market. Our preliminary assessment shows that the proposed DCS is financially viable, as the capital and operating costs for the DCS can be recovered through charges collected from DCS consumers over the project life of 30 years. The estimated unit cost of air-conditioning provided by DCS for all types of buildings is lower than that of WACS. The Electrical and Mechanical Services Department plans to propose amendments to the District Cooling Services Ordinance (Cap. 624) in due course to promulgate the tariff level.

PUBLIC CONSULTATION

17. We have consulted the following parties. They all expressed support for the provision of DCS at KTN NDA –

- (a) the Subcommittee on Energy Efficiency and Conservation and Renewable Energy under the Energy Advisory Committee (15 January 2020); and
- (b) the Committee on Land Development, Housing and Works of the North District Council (18 May 2020).

18. We consulted the Legislative Council Panel on Development on 24 November 2020. The Panel supported the submission of the proposal to the Public Works Subcommittee for consideration.

/ENVIRONMENTAL

ENVIRONMENTAL IMPLICATIONS

19. The project is not a designated project under the Environmental Impact Assessment Ordinance (Cap. 499). We completed a Preliminary Environmental Review (PER) for the project. The PER concluded, and the Director of Environmental Protection has agreed, that the project would not cause long-term adverse environmental impacts with the implementation of the recommended environmental mitigation measures, which include acoustic louvres and silencers to mitigate operational fixed plant noise.

20. For mitigating short-term construction impacts, we will implement measures recommended in the PER to control noise, dust and site run-off nuisances, in order to comply with established standards and guidelines. These measures include the use of quality powered mechanical equipment, movable noise barriers, noise enclosure and acoustic mats for noisy construction activities, frequent cleansing and watering of the site, and provision of wheel-washing facilities. We will also carry out site inspections to ensure that these mitigation measures and good site practices are properly followed and implemented. We have included in the project estimates the costs of implementing these mitigation measures.

21. At the planning and design stages, we have considered the piping alignment, design and construction method of the proposed works to avoid generating construction waste where possible. We will require the contractor 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 facilities⁶. We will encourage the contractor to maximise the use of recycled or recyclable inert construction waste, and the use of non-timber formwork to avoid generating construction waste.

22. 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 operations on site comply with the approved plan. We will require the contractor to separate the inert and 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.

/23.

⁶ 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 at public fill reception facilities requires a licence issued by the Director of Civil Engineering and Development.

23. We estimate that the proposed works will generate about 86 410 tonnes of construction waste. Of this, we will reuse about 61 178 tonnes (70.8%) of inert construction waste on site and deliver about 24 972 tonnes (28.9%) of inert construction waste to public fill reception facilities for subsequent reuse. We will dispose of the remaining 260 tonnes (0.3%) of non-inert construction waste at landfills. The total cost for disposal of construction waste at public fill reception facilities and landfill sites is estimated to be about \$1.8 million for the proposed works (based on a unit charge rate of \$71 per tonne for disposal at public fill reception facilities and \$200 per tonne at landfills, as stipulated in the Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N)).

24. The Government will continue to take the lead in promoting green buildings. We aim at achieving the second highest rating under the BEAM Plus for the DCS plant building which will incorporate green features and renewable energy systems such as photovoltaic panels. The proposed plant building roof greening ratio will be over 20% of the roof area, and the overall greening ratio will be over 30% of the overall site area.

ENERGY CONSERVATION MEASURES

25. Apart from being an energy-efficient air-conditioning system itself, the DCS is designed to include various forms of energy efficient features and renewable energy technologies, including –

- (a) light-emitting diode (LED) general lighting and occupancy sensors for lighting control;
- (b) LED type exit signs; and
- (c) photovoltaic system.

26. Regarding greening features, there will be landscaping, roof greening and vertical greening in appropriate areas for environmental and amenity benefits.

27. The estimated additional cost for adopting the above features is around \$7.2 million, including \$0.7 million for energy efficient features. This has been included in the cost estimate of the project. The energy efficient features will achieve 5% energy saving in the annual energy consumption of building services in the plantrooms, with a payback period of about seven years.

HERITAGE IMPLICATIONS

28. The project will not affect any heritage sites, i.e. declared monuments, proposed monuments, graded historic buildings, sites of archaeological interest, and government heritage sites identified by the Antiquities and Monuments Office.

LAND ACQUISITION

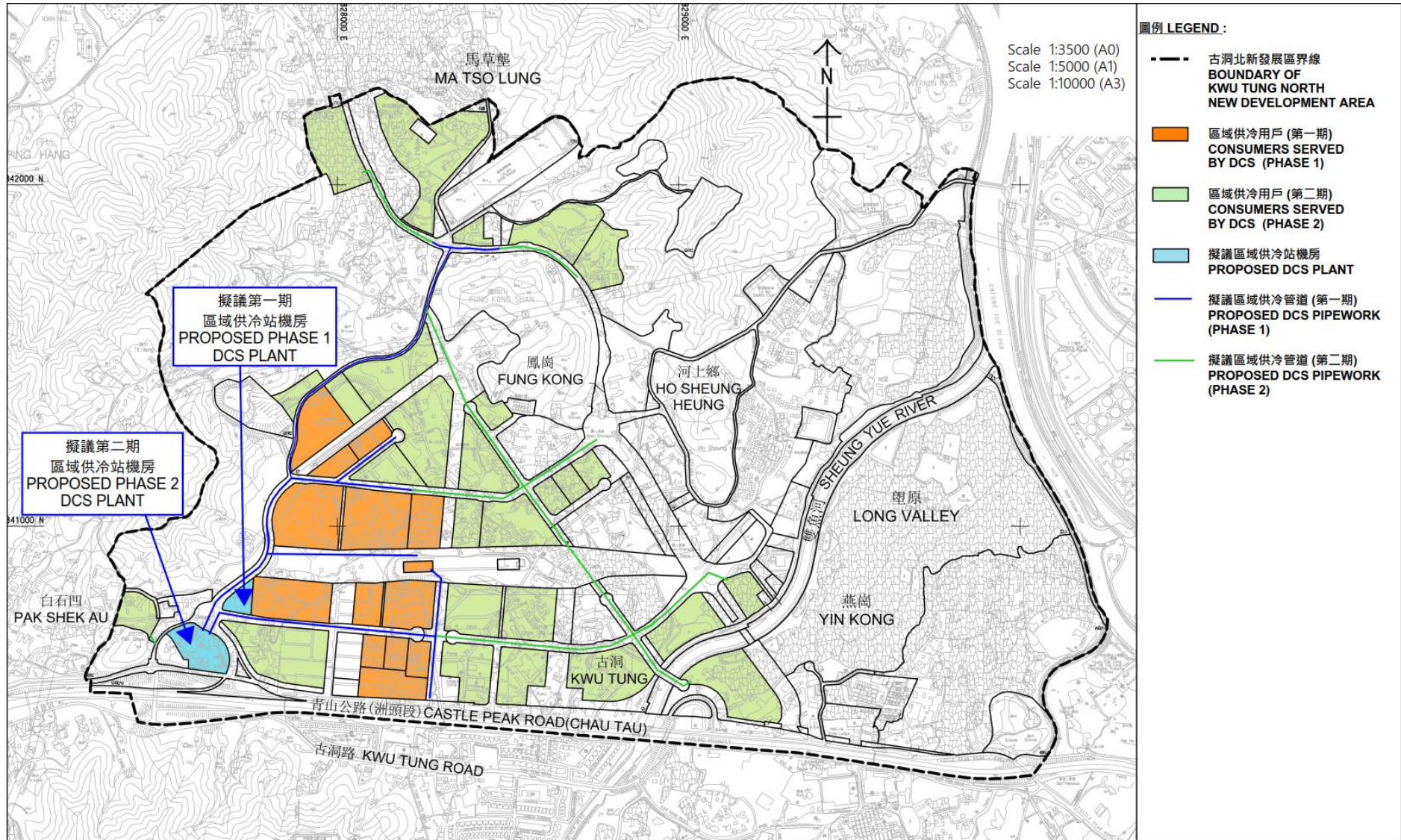
29. The first phase of the proposed works does not require resumption of private land. For the second phase, the details and scope of land acquisition will be ascertained and proceeded with as appropriate upon substantial completion of the detailed design for PWP Item No. 7828CL “The Remaining Phase of the Kwu Tung North and Fanling North New Development Areas”. Land acquisition will not be carried out under 51CG.

BACKGROUND INFORMATION

30. We upgraded 51CG to Category B in September 2018.

31. The proposed works will not involve tree preservation and removal proposals.

32. We estimate that the proposed project as a whole will create about 215 jobs (177 for labourers and another 38 for professional or technical staff) providing a total employment of 23 064 man-months.



工務計劃項目第51CG號

在古洞北新發展區提供區域供冷系統 - 平面圖

PWP ITEM NO. 51CG

DISTRICT COOLING SYSTEM AT THE KWU TUNG NORTH NEW DEVELOPMENT AREA - DCS LAYOUT PLAN

Enclosure 2 to PWSC(2020-21)25

**District Cooling System
at the Kwu Tung North New Development Area**

Scope of Works

Works Arrangement	Scope of Works
Pipe laying	<ul style="list-style-type: none">- Laying of chilled water distribution pipes
DCS core services under “Design, Build and Operate” arrangement	<ul style="list-style-type: none">- Design for the DCS plants;- Building and engineering works of the DCS plants to support the operation of DCS;- Supply and installation of electrical and mechanical equipment for meeting the cooling demand of user buildings; and- Provision of connection facilities (including heat exchangers) <p>[Note: The operation period of DCS is around 10 to 15 years tentatively]</p>
Electrical and mechanical installation	<ul style="list-style-type: none">- Supply and installation of electrical and mechanical equipment for meeting the cooling demand of user buildings; and- Provision of connection facilities (including heat exchangers) at user buildings

Enclosure 3 to PWSC(2020-21)25

51CG – District Cooling System at the Kwu Tung North New Development Area

Breakdown of the estimates for consultants' fees and RSS costs (in September 2020 prices)

		Estimated man- months	Average MPS* salary point	Multiplier (Note 1)	Estimated fee (\$ million)
(a) Consultants' fees for contract administration (Note 2)	Professional				5.2
	Technical				3.6
				Sub-total:	8.8#
(b) RSS costs (Note 3)	Professional	1 130	38	1.6	155.2
	Technical	3 910	14	1.6	189.2
				Sub-total:	344.4
Comprising –					
(i) Consultants' fees for management of RSS					10.0#
(ii) Remuneration of RSS					334.4#
				Total:	353.2

* MPS = Master Pay Scale

Notes

1. A multiplier of 2.0 is applied to the average MPS salary point to estimate the cost of staff to be employed in the consultants' offices. A multiplier of 1.6 is applied to the average MPS salary point to estimate the cost of RSS supplied by the consultants. (As at now, MPS pt.38 = \$85,870 per month, and MPS pt.14 = \$30,235 per month.)
2. The consultants' staff cost for contract administration is calculated in accordance with an existing consultancy agreement for the provision of contract administration of 51CG. The construction phase of the assignment will only be executed upon Finance Committee's approval to upgrade 51CG to Category A.
3. The actual man-months and actual costs will only be known after the completion of the construction works.

Remarks

The cost figures in this Enclosure are shown in constant prices to correlate with the MPS salary point of the same year. The figures marked with # are shown in MOD prices in paragraph 12 of the main paper.

Enclosure 4 to PWSC(2020-21)25

**51CG – District Cooling System
at the Kwu Tung North New Development Area**

Estimated recurrent costs (in MOD prices)¹

Year	Estimated recurrent costs² \$ million (in MOD prices)
2026-2027	50.09
2027-2028	18.67
2028-2029	12.68
2029-2030	12.68
2030-2031	12.68

¹ The estimated recurrent costs are tentative, subject to further evaluation.

² The Electrical and Mechanical Services Department plans to propose amendments to the District Cooling Services Ordinance (Cap. 624) in due course to promulgate the tariff level. The charges and fees received for the provision of district cooling services can be used to settle the operation and maintenance fees for a DCS operator as well as utility costs for operating the DCS plants. Therefore, the estimated recurrent cost shown in the table above is the shortfall in income to meet the operating expenses incurred, taking into account the charges and fees received in that particular year. It is estimated that starting from 2031-2032, the charges and fees received would be sufficient to settle all the operation and maintenance fees for the DCS operator as well as utility costs for operating the DCS plants.