

## **ITEM FOR FINANCE COMMITTEE**

### **HEAD 42 – ELECTRICAL AND MECHANICAL SERVICES DEPARTMENT**

#### **Subhead 700 General other non-recurrent**

#### **New Item “Territory-wide Implementation Study for Water-cooled Air Conditioning Systems in Hong Kong”**

Members are invited to approve the creation of a new commitment of \$13.6 million for conducting a study to facilitate the territory-wide implementation of water-cooled air conditioning systems in Hong Kong.

### **PROBLEM**

We need to ascertain and define the environmental, financial, institutional and health control requirements to facilitate phased implementation of Water-cooled Air Conditioning Systems (WACS) in Hong Kong.

### **PROPOSAL**

2. The Director of Electrical and Mechanical Services (DEMS), with the support of the Secretary for the Environment and Food, proposes to engage consultants to undertake a territory-wide study to formulate plans, a programme and the control requirements for the phased implementation of WACS in Hong Kong.

### **JUSTIFICATION**

3. Between 1988 and 1998, the energy demand for air conditioning in Hong Kong increased by about 79% from 22 358 Terajoule (TJ) to 39 975 TJ, i.e. from 29% to 32% of the total electricity consumption.

4. In quantitative terms, depending on the types of WACS used, the following environmental, financial and economic benefits<sup>1</sup> for converting air-cooled air conditioning systems to WACS are expected -

- (a) reducing greenhouse gas emissions per annum by 600 000 tonnes to 940 000 tonnes of CO<sub>2</sub> by 2018;
- (b) saving 7% to 10% of energy used for air conditioning in non-domestic buildings by 2018, equivalent to 1 085 to 1 666 gigawatt-hour per year. Taking the current unit price of electricity at about \$0.9 per kilowatt-hour, the monetary savings by 2018 will be about \$977 to \$1,500 million per year; and
- (c) potential to defer new electricity generation capacity from 286 to 446 Megawatt by 2018.

5. A number of concerns and constraints affect our ability to achieve these benefits. These include current restrictions on the use of potable water in WACS, the adequacy of water resources, water treatment capacity, water distribution system capacity, sewerage network capacity, and sewage treatment works capacity. The possible health impacts from wider use of fresh water cooling towers and the environmental impacts from their discharge also need to be considered. Furthermore, centralised systems such as District Cooling Systems<sup>2</sup> (DCS) and Centralised Piped Supply Systems for Condenser Cooling<sup>2</sup> (CPSSCC) would involve complex considerations including development, operations and maintenance liabilities, property rights, landuse, financing, private sector investment and confidence of users. These need to be assessed against their energy saving potential.

6. Before formulating plans for the phased implementation of WACS we need to examine in detail the associated environmental, health, regulatory, institutional, financial, technical and land administration issues. The proposed study will therefore -

- (a) collect and examine data including cooling capacities, cooling tower types, treatment methods used for water in cooling towers, water consumption rates, discharge volumes, and quality of cooling tower discharges;

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<sup>1</sup> The lower estimates are based on the assumptions of 100% fresh water cooling towers. The higher estimates are based on 80% fresh water cooling towers, 10% Centralised Piped Supply Systems for Condenser Cooling and 10% District Cooling Systems.

- (b) evaluate the demand placed on water supply, sewage system and future centralised WACS infrastructure;
- (c) identify and prioritise the implementation of DCS and CPSSCC as well as WACS using cooling towers in suitable localities;
- (d) assess the potential environmental impact of WACS discharges and recommend suitable mitigation measures;
- (e) assess the potential Legionnaires' Disease and other health risks associated with fresh water cooling towers and recommend a registration/licensing system for cooling towers to safeguard public health; and
- (f) formulate plans and a phased implementation programme for the infrastructure improvement and construction packages including scope, size, land requirement, cost estimate and timing.

7. DEMS has carefully assessed the capability of his department to undertake the study in-house. In addition to promoting energy efficiency in air conditioning systems, the study will cover other areas including environmental protection, drainage, building water supplies, lands and properties, as well as health issues. He has concluded that this wide range of issues fall beyond the expertise and knowledge of his department. In addition, the department would not be able to complete the study within the prescribed time frame of 12 months without affecting the delivery of its other commitments and services. If the study is deferred, we will not be able to lift the restriction on the use of fresh water for WACS and to introduce more energy-efficient and environmental-friendly systems including DCS and CPSSCC by 2001 to tie in with other major planned developments including the Southeast Kowloon Development.

## FINANCIAL IMPLICATIONS

8. We estimate the total cost of the study to be \$13.6 million, made up as follows -

	<b>\$ million</b>
(a) Consultant's staff costs	
(i) collecting and collating baseline data and information	2.89
(ii) demand, health risk and environmental impacts assessments	3.82

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\$ million

(iii) formulating plans, phased implementation programme and control requirements	3.12
(b) Hire of services for equipment, laboratory services and computer software	2.70
(c) Contingencies	<u>1.00</u>
Total	13.53
Say	<u>\$13.6 million</u>

Encl. 2 A detailed breakdown of the estimated study fees is at Enclosure 2. We will commission the study on a lump sum fixed price basis.

9. Subject to Members' approval, we plan to phase expenditure as follows –

Year	\$ million
2000-01	5.0
2001-02	8.6
Total	<u>13.6</u>

10. The proposal has no recurrent financial implications. DEMS will oversee the study with guidance from an inter-departmental steering group to be formed.

11. Subject to Members' approval, we shall offset any supplementary provision required in 2000-01 by deleting an equivalent amount from Head 106 Miscellaneous Services Subhead 789 Additional commitments.

## BACKGROUND INFORMATION

12. The Energy Efficiency and Conservation Sub-committee (EECSC) of the Energy Advisory Committee expressed the view in January 1997 that air conditioning in commercial premises is no longer simply for comfort but has become a basic requirement for business operations. EECSC urged the then

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Planning, Environment and Lands Bureau to accord high priority to a consultancy study which would support policy decision-making and address specific implementation problems relating to air conditioning and energy efficiency matters.

13. The preliminary phase of the consultancy study commenced in October 1998 and was completed in April 1999. It established the viability of the wider use of WACS and concluded that there are overall economic and environmental benefits for adoption of WACS. Detailed studies are required to examine the technical, financial, institutional and control requirements and to establish development priorities for the phased implementation of WACS throughout Hong Kong. The findings and recommendations of the study were endorsed by EECSC in October 1999.

14. At the Public Accounts Committee (PAC) hearing in December 1999 on the use of energy efficient air conditioning systems in Hong Kong, PAC Members concurred with the view of EECSC that air conditioning in commercial premises was no longer simply for comfort but has become a basic requirement for business operations. Members expressed concern that there was no plan to relax the restriction on the use of mains water for air conditioning purposes and recommended that the Administration consider ways to minimise the risk of Legionnaires' Disease. PAC has requested to be kept informed of the findings of the territory-wide implementation study.

15. We briefed the Legislative Council Environmental Affairs Panel on the proposed study on 10 February 2000 and 2 March 2000. Members supported the proposal.

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Environment and Food Bureau  
April 2000

## Enclosure 1 to FCR(2000-01)2

**Types of Water-cooled Air Conditioning Systems (WACS)**

The three basic concepts of WACS, namely Centralised Piped Supply System for Condenser Cooling (CPSSCC), Centralised Piped Supply System for Cooling Towers (CPSSCT) and District Cooling System (DCS), have been evaluated as part of the preliminary phase study. The following is a brief description of each -

- (a) CPSSCC is a system to supply sea water to the buildings' air-conditioning systems which are employing **once through condensers** having a large water consumption capacity. This system is most suitable for buildings near the sea water front;
- (b) CPSSCT is a system to supply sea water or fresh water to the buildings' air-conditioning systems which are employing **evaporative cooling towers**. The water consumption is much less than CPSSCC. For the fresh water CPSSCT, the fresh water can come from our water mains if our current policy of disallowing fresh water for air-conditioning purpose is changed; and
- (c) DCS is a system that may employ sea water cooled once through a condenser, or fresh water or sea water cooling towers to provide a **central supply of chilled water** to the connected building group. This system is suitable for large developments, where a large central chiller plant is normally located within close proximity of the district or buildings being served via a closed loop pipe network. The chilled water is pumped to individual buildings and then returned to the central chiller plant for re-chilling.

**Enclosure 2 to FCR(2000-01)2**

**Detailed Breakdown of the Study Fees**

**(A) Consultant's Staff Costs**

		Estimated man months <sup>2</sup>	Average MPS salary point <sup>1</sup>	Multiplier factor <sup>1</sup>	Estimated fee (\$million)
<b>Consultant's staff costs</b>					
<b>(a) Collection and collation of baseline information</b>					
1. Collection of information	Professional	6	38	2.4	0.83
	Technical	15	14	2.4	0.69
2. Collation of information	Professional	8	38	2.4	1.10
	Technical	6	14	2.4	0.27
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					2.89
<b>(b) Analysis of demand, environmental impact and health risk</b>					
1. Demand prediction	Professional	10	38	2.4	1.38
	Technical	5	14	2.4	0.23
2. Environmental impact prediction	Professional	8	38	2.4	1.10
	Technical	3	14	2.4	0.14
3. Health risk analysis	Professional	6	38	2.4	0.83
	Technical	3	14	2.4	0.14
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					3.82
<b>(c) Formulate master development plan and control requirements</b>					
1. Identifying WACS technology mix and district matrix	Professional	4	38	2.4	0.55
	Technical	4	14	2.4	0.18
2. Define and prioritise infrastructure packages	Professional	8	38	2.4	1.10
	Technical	8	14	2.4	0.37
3. Formulate control requirements	Professional	5	38	2.4	0.69
	Technical	5	14	2.4	0.23
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					3.12
<b>Total consultant's staff costs (A)</b>					<b>9.83</b>

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	<b>Estimated fee (\$million)</b>
<b>(B) Hire of Services</b>	
(a) Equipment for data collection and special investigations	0.90
(b) Laboratory services	0.90
(c) Computer software	0.90
<b>Total expenses for hire of services (B)</b>	<b>2.70</b>
<b>(C) Contingencies (C)</b>	<b>1.00</b>
<b>TOTAL (A) + (B) + (C)</b>	<b>13.53</b>
	<b>Say \$13.6 million</b>

**Notes -**

1. A multiplier factor of 2.4 is applied to the average Master Pay Scale (MPS) point to arrive at the full staff cost including the consultant's overheads and profit. The staff will be employed in the consultant's offices. (At present, MPS Point 38 is \$57,525 per month and MPS Point 14 is \$19,055 per month.)
2. These are only estimates. The actual man months and actual fees required will be known when we have selected the consultant through the usual competitive bidding system on a lump sum fixed price basis.