District Cooling System at Kai Tak Development

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Background

- 2008-09 Policy Address pledged to implement a District Cooling System (DCS) at Kai Tak Development (KTD) to further promote energy efficiency and conservation, and to reduce carbon dioxide emission substantially.
- DCS - produces chilled water at central chiller plants and distributes the chilled water to user buildings through underground pipes for air-conditioning purpose
- DCS - common in overseas jurisdictions (Singapore, France, the U.S.A., etc.)

Benefits of DCS

1. Better Utilization of Building Space
   - No chiller and heat rejection equipment plant space required
   - Only heat exchangers of much smaller size are to be installed
   - The space saved can be used for other purposes
2. Benefits to the District Environment
   - Eliminate noise & vibration arising from local chillers inside buildings
   - Eliminate nuisances to occupants & adjacent buildings from heat rejection equipment
   - Reduce 'heat island' effect of the district

Benefits of DCS

3. Savings in Electricity Consumption

- Individual Building –
  - Consumes 35% less electricity than air-cooled A/C system
  - Consumes 20% less electricity than water-cooled A/C system using cooling towers

- Society - saving up to 85 million kWh per annum (and a reduction of 59,500 tonnes of carbon dioxide emission per annum) for the KTD, when fully developed

Benefits of DCS

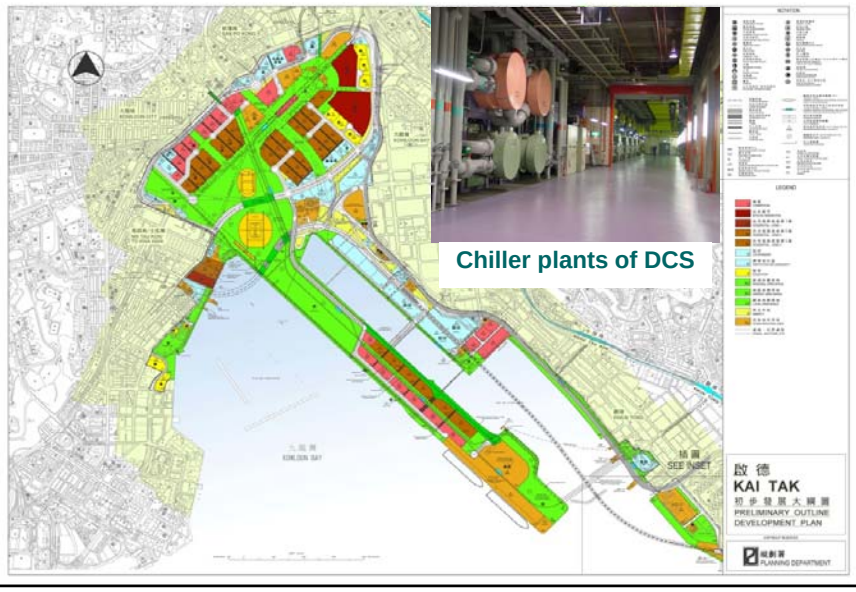
4. Others

- Reduce upfront capital cost for installing chiller plants at buildings

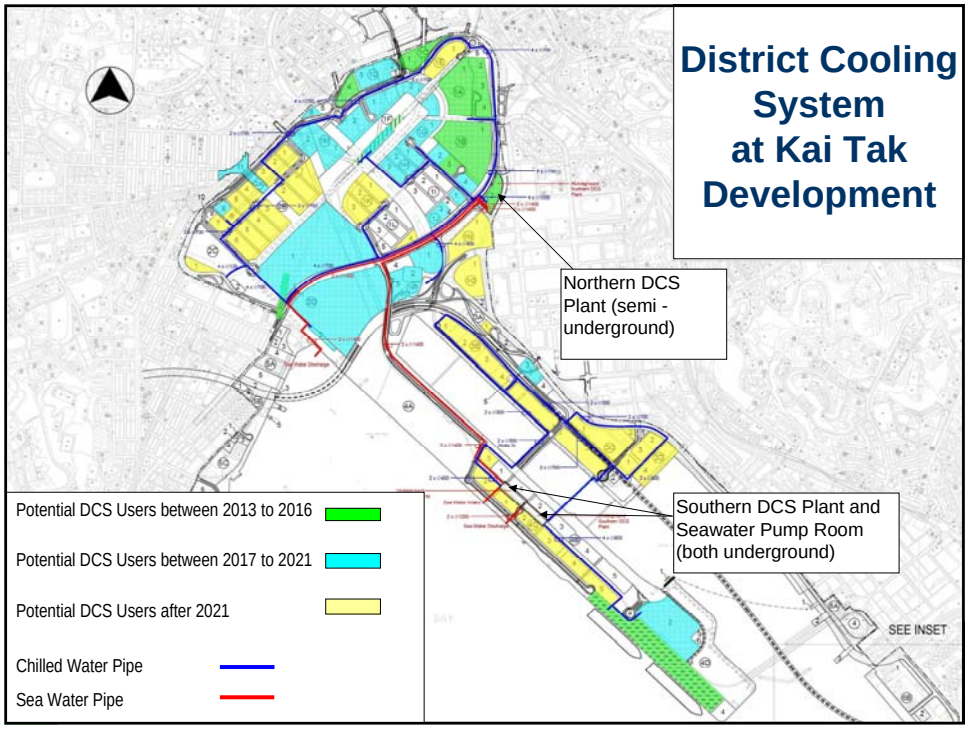
- More adaptable than individual A/C system to varying cooling demand

- Enhanced system reliability
  - multiple chiller sets, dual feed electricity supply, ring (or redundant) main pipe circuits, leakage detection system, etc.
  - secured chilled water supply with suitable allowance of flexibility for maintenance.
  - service quality and reliability will be overseen by EMSD.

DCS at Kai Tak Development

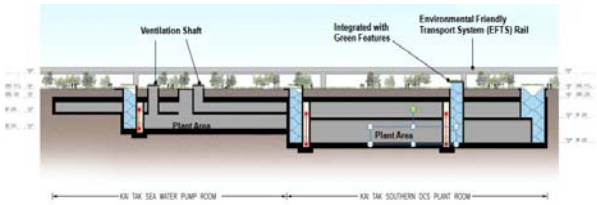


Chiller plants of DCS



DCS at Kai Tak Development

- Key infrastructure :
  - a Northern DCS Plant
  - a Southern DCS Plant & a Seawater Pump Room

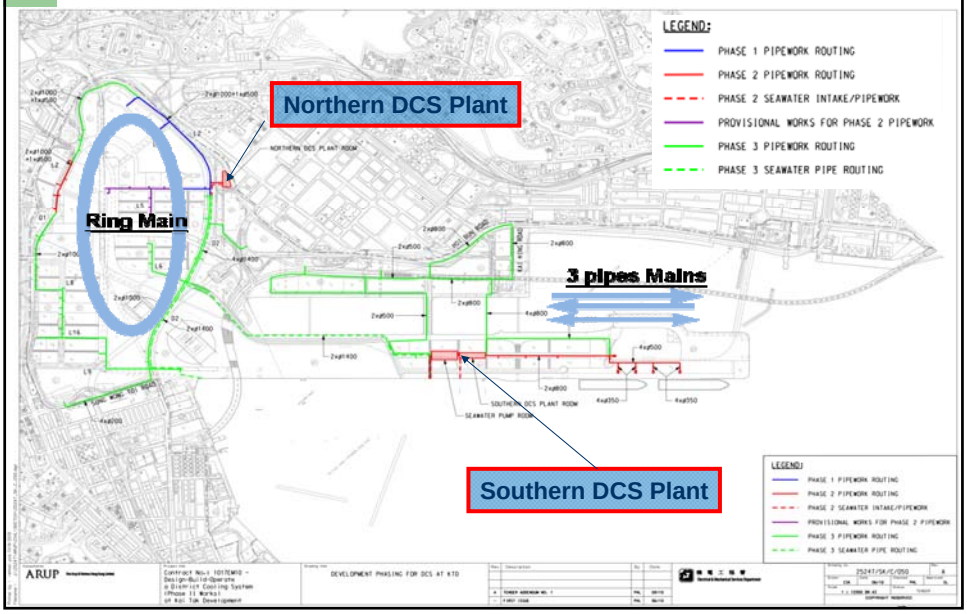


Access Hatch for Northern DCS Plant

  - a distribution piping network covering the whole KTD

- Cooling Capacity : 284 MW (About 81,000 RT)
  (Northern DCS : 46,000 RT
  Southern DCS : 35,000 RT)
- To serve all public and private non-domestic developments

DCS at Kai Tak Development



DCS Connection

- The Government will implement DCS in KTD as a requirement for -

  (a) environmental protection and energy efficiency reasons;

  (b) enhancing overall cost effectiveness of the infrastructure.

- Required connection to DCS in all non-domestic projects in the KTD by attaching requirements in land leases

Land Lease Conditions

Key approach –

- For developments which adopt central A/C system using chilled water;
- Landlord to design and construct DCS substations for connection to DCS and thereafter maintain them all at his own cost;
- Reserve right of access for the purpose of installing, inspecting, testing, operating, maintaining, repairing and carrying out replacement of DCS equipment/installation

Land Lease Conditions

- Floor space for DCS substations will be excluded from calculation of total GFA
- Floor space for back-up central air-conditioning systems, subject to the approval by DEMS, will be excluded from calculation of total GFA (but shall not in the aggregate exceed 10% cap)
- Floor space for central air-conditioning systems not regarded as back-up shall be included in the calculation of total GFA

DCS Connection

- LandsD, based on the advice of EMSD, would check compliance with the land lease conditions before the issue of Certificate of Compliance
- Proposal Supported by Lands Sub-Committee in December 2010
- EMSD will issue technical guidelines listing out the installation requirements for DCS connection and Supply Rules for District Cooling Services

Technical Guidelines for DCS Connection

To give technical details for -

- Design and construction of DCS Substation (by Landlord)
- Builders' works for DCS pipes (by Landlord)

- Installation of Heat Exchangers (by EMSD)
- Installation of Metering (by EMSD)
- Provision of access for operation and maintenance (by Landlord)

Supply Rules for District Cooling Services

To give conditions for DCServ -

- Obligations of EMSD or service contractor and the Consumer
- Chilled Water Supply Temperature, Quality and Capacity
- Back-up Chiller Plants by Consumer
- Application Procedure for DCServ Connection and Changes
- Refusal and Disconnection of DCServ
- Accommodation for DCServ Equipment
- Metering of Chilled Water Supply, etc.

DCServ Charging Mechanism

Principles –

- The tariff level will be monitored/adjusted under the legislative framework
- Cost recovery in 30 years (incl. capital & recurrent costs)
- DCServ tariff is set comparable to the cost of individual water-cooled A/C system (WACS) using cooling towers
- Incorporate Internal Rate of Return (IRR)
- Simple charge structure to all customers
- Provide price stability

DCServ Charging Mechanism

- Two Tariff Components -
  - Capacity Charge
  - Consumption Charge
- Developed based on international practice

DCServ Charging Mechanism

- Capacity charge recovers -
  - cost of capital investment
  - cost of operations and maintenance (O&M) e.g. equipment operation & maintenance cost, staff cost and emergency repair cost

DCServ Charging Mechanism

- Consumption charge recovers –
  - cost of electricity
  - cost of water (negligible as compared with cost of electricity)
  - cost of variable O&M, e.g. consumables associated with lubrication, water treatment (included as part of fixed O&M cost)

DCServ Charging Mechanism

- Capacity Charge Rate – derived based on

$$\frac{\text{(NPV of cost of capital investment + NPV of cost of O\&M and other cost)}}{\text{NPV of cooling capacity (kWr)}}$$

NPV = net present value

DCServ Charging Mechanism

- Consumption Charge Rate – derived based on

$$\frac{\text{Cost of purchased electricity}}{\text{Cooling energy consumed (kWhr)}}$$

DCServ Charging Mechanism

Tariff Adjustment Mechanism

- Annual Adjustment on Capacity Charge Rate -

$C_{n+1} = C_n(1 + CPI_n)$

where

C_n = Capacity Charge Rate at nth period

C_{n+1} = Capacity Charge Rate at (n+1)th period

CPI_n = Composite Consumer Price Index (CCPI) at nth period

DCServ Charging Mechanism

Tariff Adjustment Mechanism

- Annual Adjustment on Consumption Charge Rate -

$EC_{n+1} = EC_n (E_{n+1} / E_n)$

where

EC_{n+1} = Consumption Charge Rate at (n+1)th period

EC_n = Consumption Charge Rate at nth period

E_{n+1} = average net electricity tariff rate chargeable by the power company providing power supply to the concerned DCS at (n+1)th period

E_n = average net electricity tariff rate chargeable by the power company providing power supply to the concerned DCS at nth period

DCServ Charging Mechanism

Tariff Adjustment Mechanism

- Regular Tariff review
  - apart from the annual tariff adjustment, a tariff review once every 5 years to account for possible deviations from projectsions, e.g. capital cost, development schedule, major technological advancement, CCPI, actual cooling demand, etc.

DCServ Charging Mechanism

Implementation

- Meter will be installed in each building DCS substation to measure cooling capacity required and cooling energy consumed
- Tariff will be collected monthly by the Government (EMSD)
- Other costs to be imposed:
  - Deposit
  - Capacity overrun charge : 10% extra for the overrun part (when the consumer's cooling demand exceeds the contract capacity on a short-term basis)
  - Financial penalties for unpaid charges

DCServ Charging Mechanism

- Capacity Charge

  = Capacity Charge Rate x Contracted Capacity

  If Measured Capacity > Contracted Capacity
  = Capacity Charge Rate x (Contracted Capacity +
  1.1 * (Measured Capacity – Contracted Capacity))

- Consumption Charge

  = Consumption Charge Rate x Consumed Energy

New Legislation for DCServ

The legislation will mainly cover –

- charges of DCServ
- mechanism of annual adjustment of tariff rate
- tariff review mechanism
- other charges, e.g. capacity overrun charge,deposit, financial penalties for unpaid charges
- right of access to buildings for inspection and maintenance
- improvement notice
- appeal to the Administrative Appeals Board
- future DCS – build in flexibility to cover charging for other DCS to be constructed by the Government

Way Forward

- Commence DCServ to first package of development in KTD in late 2012/13 (including Cruise Terminal and non-residential development in Housing Estates)
- Submission of the proposed legislation to LegCo in 2012/13 LegCo session

Views Invited

Thank You