Implementation of Energy Efficient Water-cooled Air-conditioning Systems in Hong Kong

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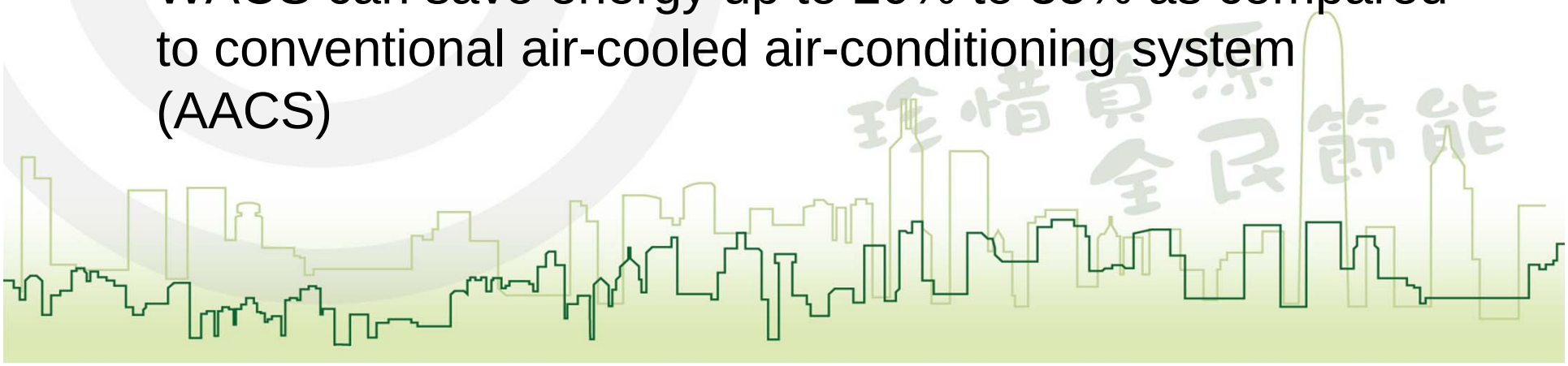
Energy Efficiency EMSD

Content

- Introduction
- Implementation of Water-cooled Air-conditioning Systems in Hong Kong
- Fresh Water Cooling Towers Scheme
- District Cooling System in Kai Tak Development
- Concluding Remarks

Introduction

- Air conditioning in buildings accounts for about 30% of the total electricity consumption in Hong Kong
- Wider use of energy-efficient water-cooled air-conditioning system (WACS) in non-domestic buildings is an effective measure to conserve energy
- WACS can save energy up to 20% to 35% as compared to conventional air-cooled air-conditioning system (AACS)

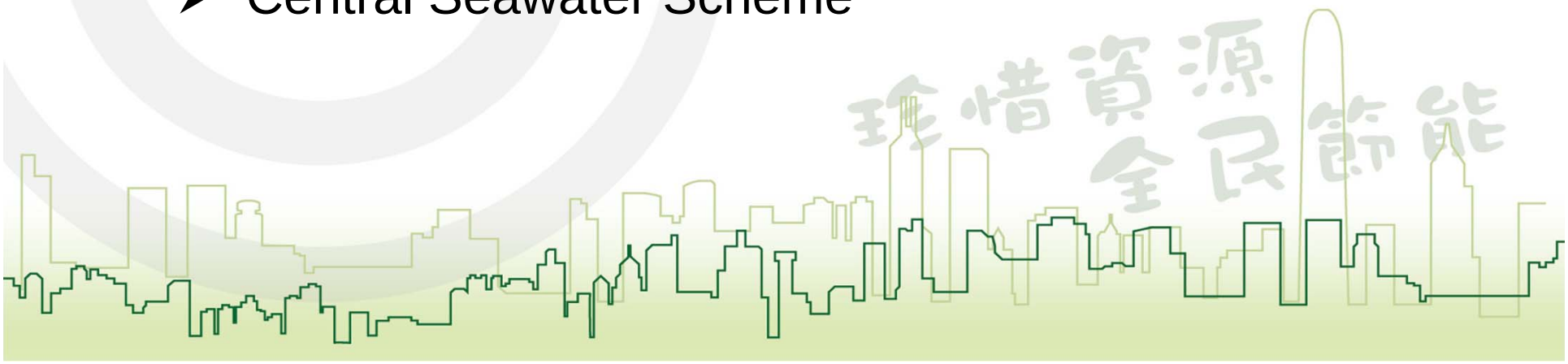


Implementation of WACS

- In 1999, a consultancy study commissioned by EMSD has established that WACS has greater environmental, economic and financial benefits than AACS
- In 2000, a territory-wide implementation study for WACS was commissioned by EMSD

Types of WACS

- Three types of WACS were identified as attractive and having potential for wider adoption and implementation in Hong Kong
  - ➢ *Cooling Tower Scheme* 👍 *recommended*
  - ➢ *District Cooling Scheme* 👍 *recommended*
  - ➢ Central Seawater Scheme



Benefits and Constraints of WACS

Energy savings

Space saving / layout

Reduced capital Investment/ O&M

Better environment/ reliability

Adequacy of water resources

Adequacy of mains water supply infrastructures

Health risk of Legionnaires' Disease (LD)

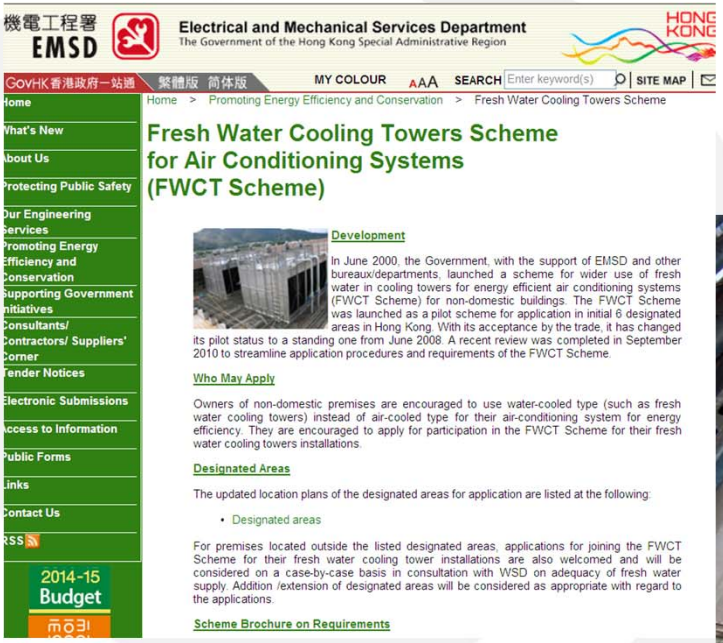
Effluent discharge/ sewerage infrastructure

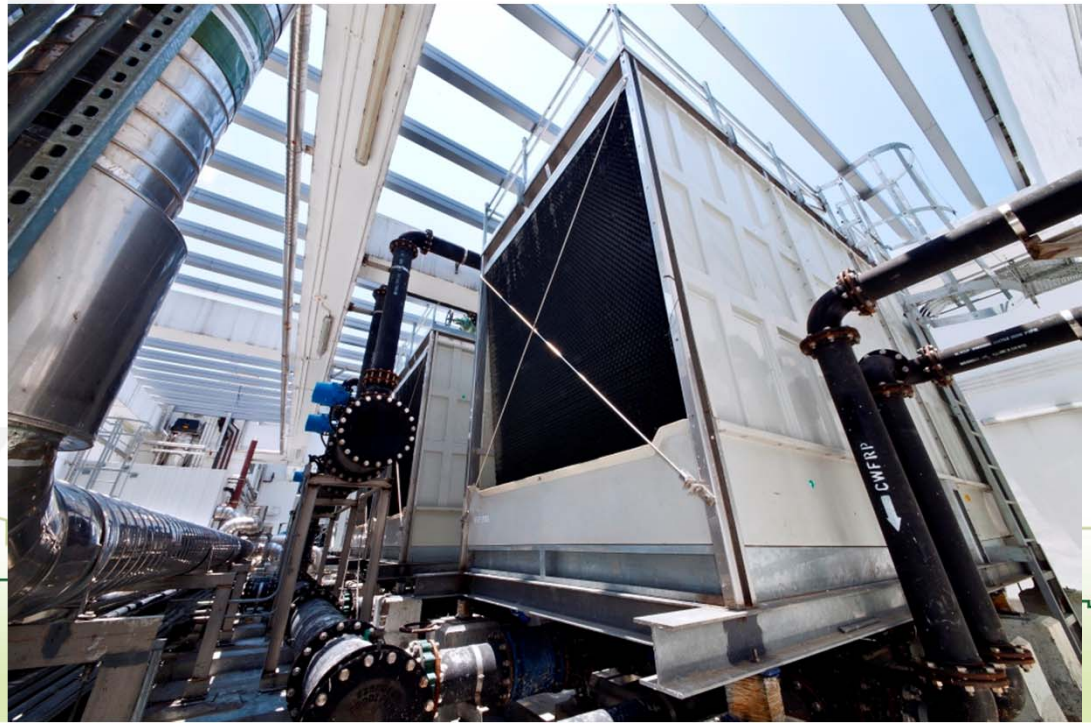
Benefits

Constraints

FRESH WATER COOLING TOWERS SCHEME

FWCT Scheme





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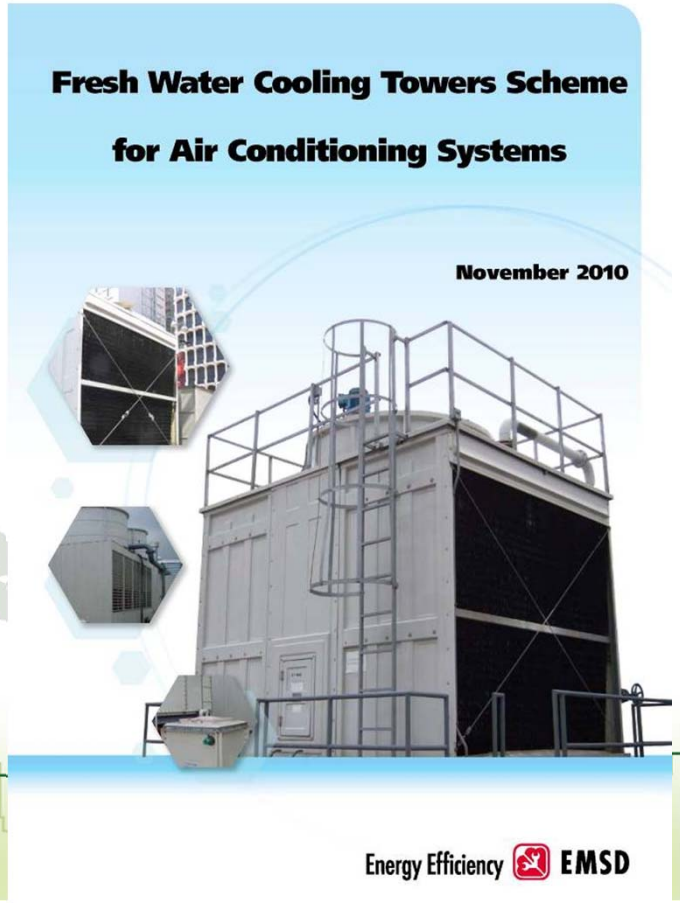
Scheme for Wider Use of FWCT

- In June 2000, the Government launched a ***Scheme for wider use of fresh water*** in evaporative cooling towers for energy-efficient air-conditioning systems for non-domestic buildings
- The FWCT Scheme was launched as a pilot scheme for application initially in 6 designated areas in Hong Kong
- The pilot status was changed to a standing one from June 2008



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Basic Requirements for joining the Scheme

Only for non-domestic buildings

Within Designated Areas?

5 basic design/ installation requirements

1 Safe separation 7.5m

2 Effective drift eliminator (<0.005%)

3 Minimization of dead legs

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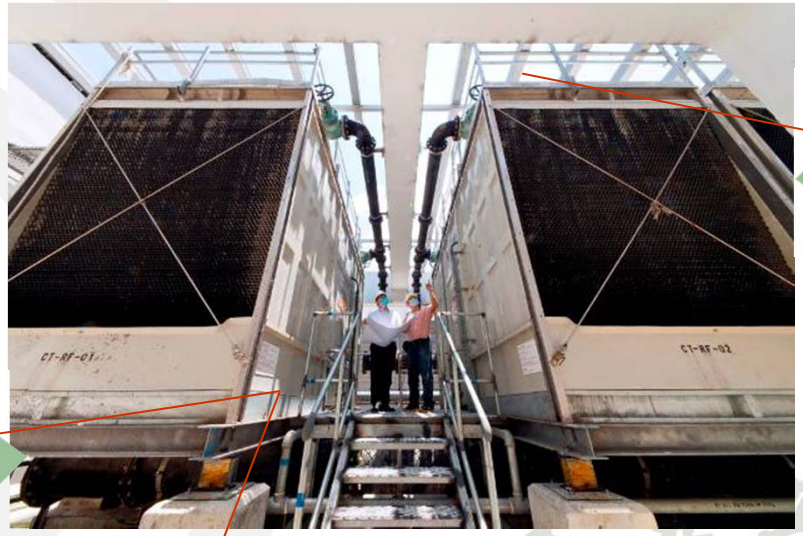
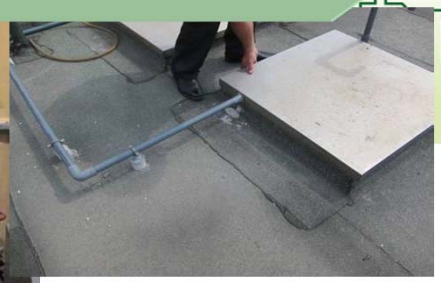
Basic Requirements for joining the Scheme (cont'd)



5 Adequate and safe access

4 Effective water treatment programme

Reuse of bleed-off water for flushing purpose



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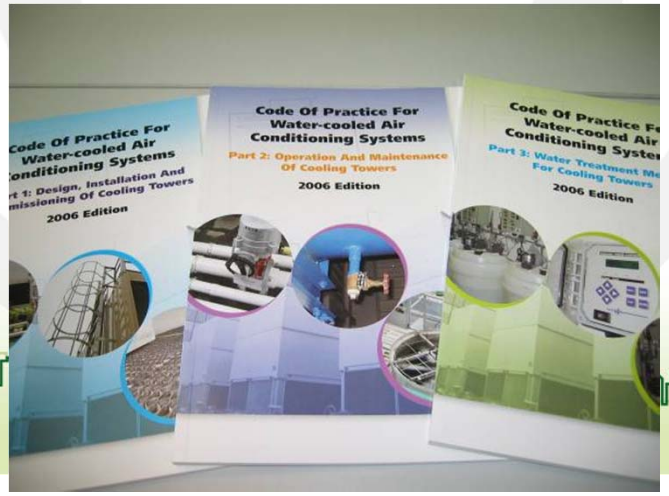
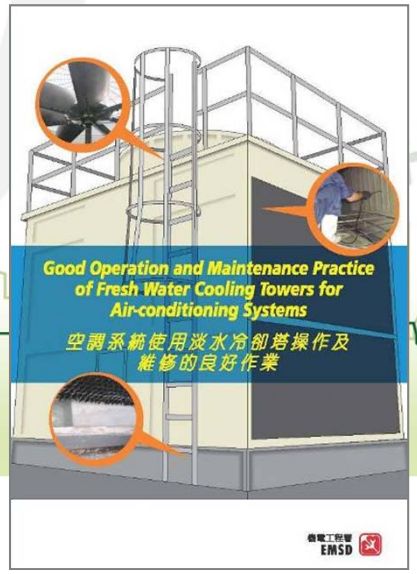
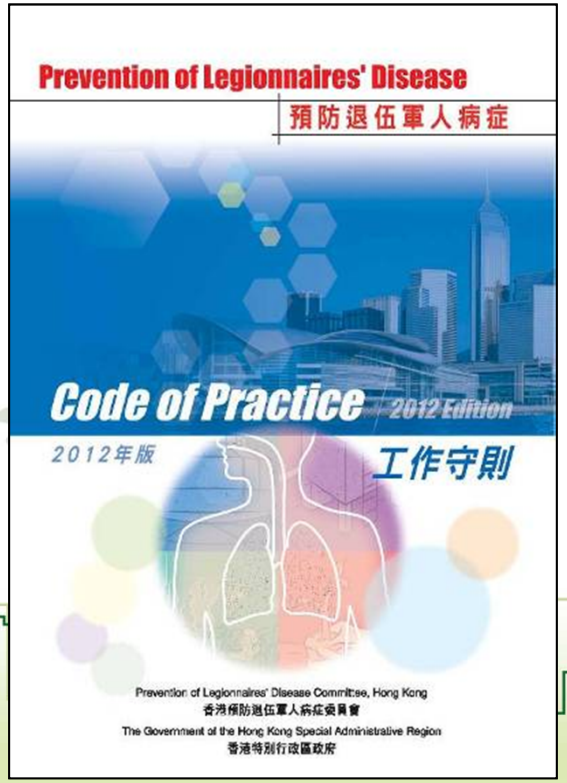
Code of Practice (CoP)

- CoP for WACS (2006)
  - *Design, Installation and Commissioning*
  - *Proper O&M Practice*
- CoP for Prevention of Legionnaires' Disease (2012)







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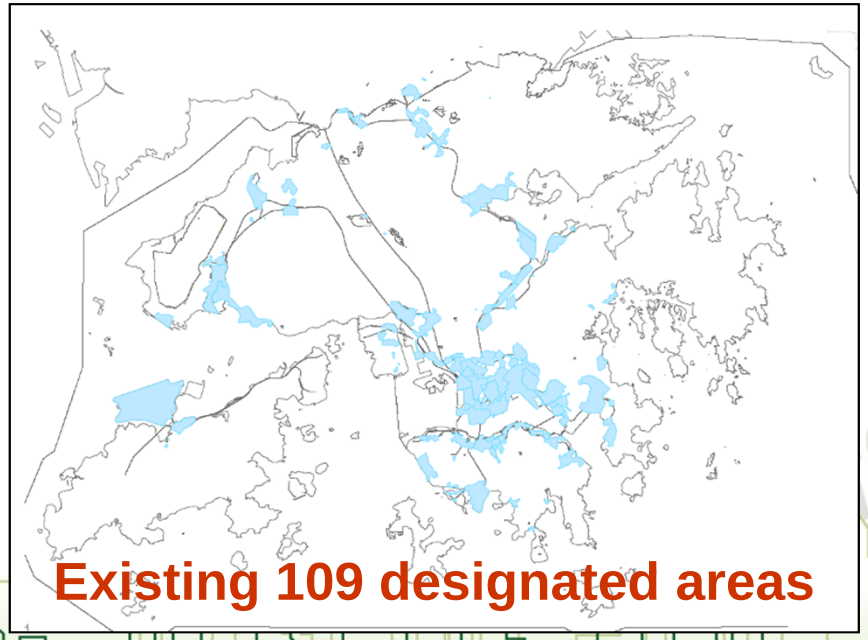
Designated Areas

- Applications from applicants outside designated areas will be considered on case-by-case basis



(http://www.emsd.gov.hk/emsd/eng/pee/psfwct_pub.shtml)

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Water Conservation in FWCT

Grey water recycling

Rainwater harvesting

Recycled rainwater/ greywater as makeup

Recycled bleed-off water as makeup

Reverse Osmosis (RO)

Control of bleed-off water

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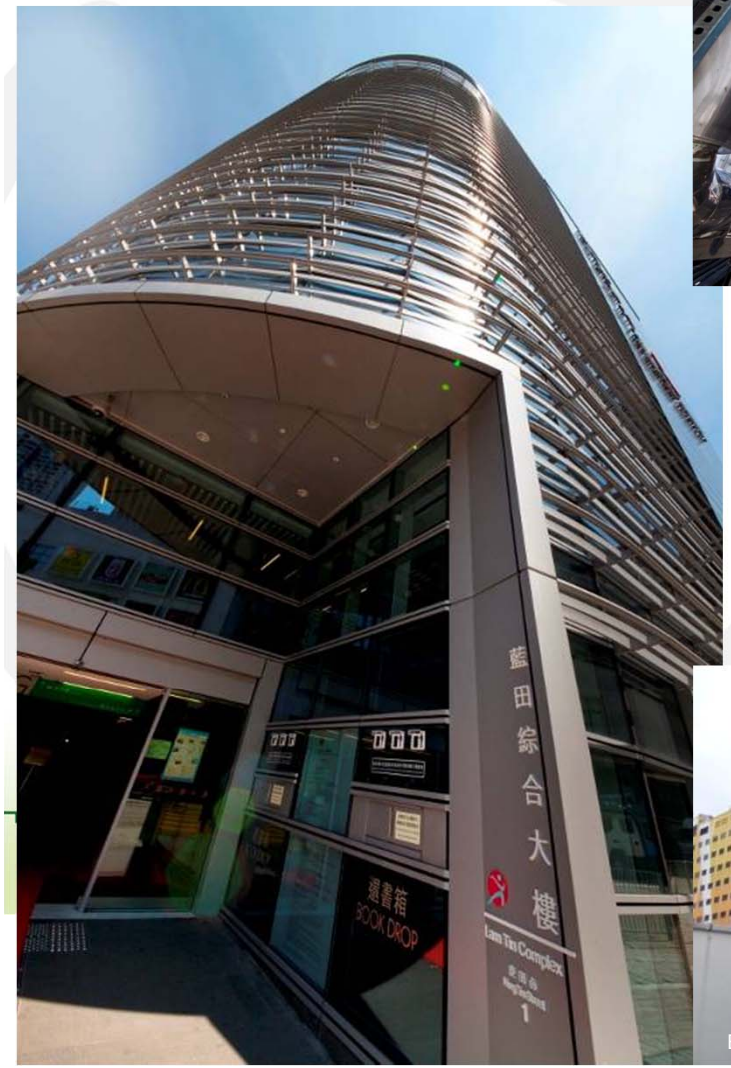
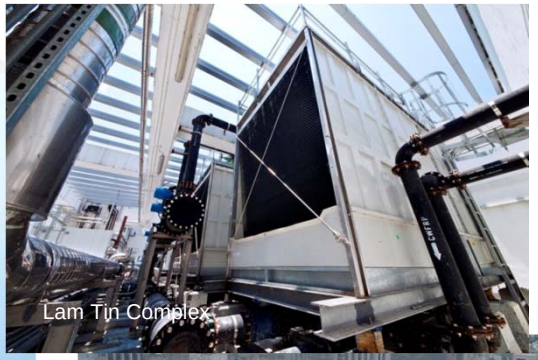
Achievements of FWCT Scheme

- Up to end March 2014
  - 109 designated areas
  - 827 applications received
  - 517 installations commissioned
  - 321M kWh energy saved per year
  - 224,000 tonnes CO_2 reduced per year

Successful Projects




Lam Tin Complex


EMSD Headquarter


International Mail Centre

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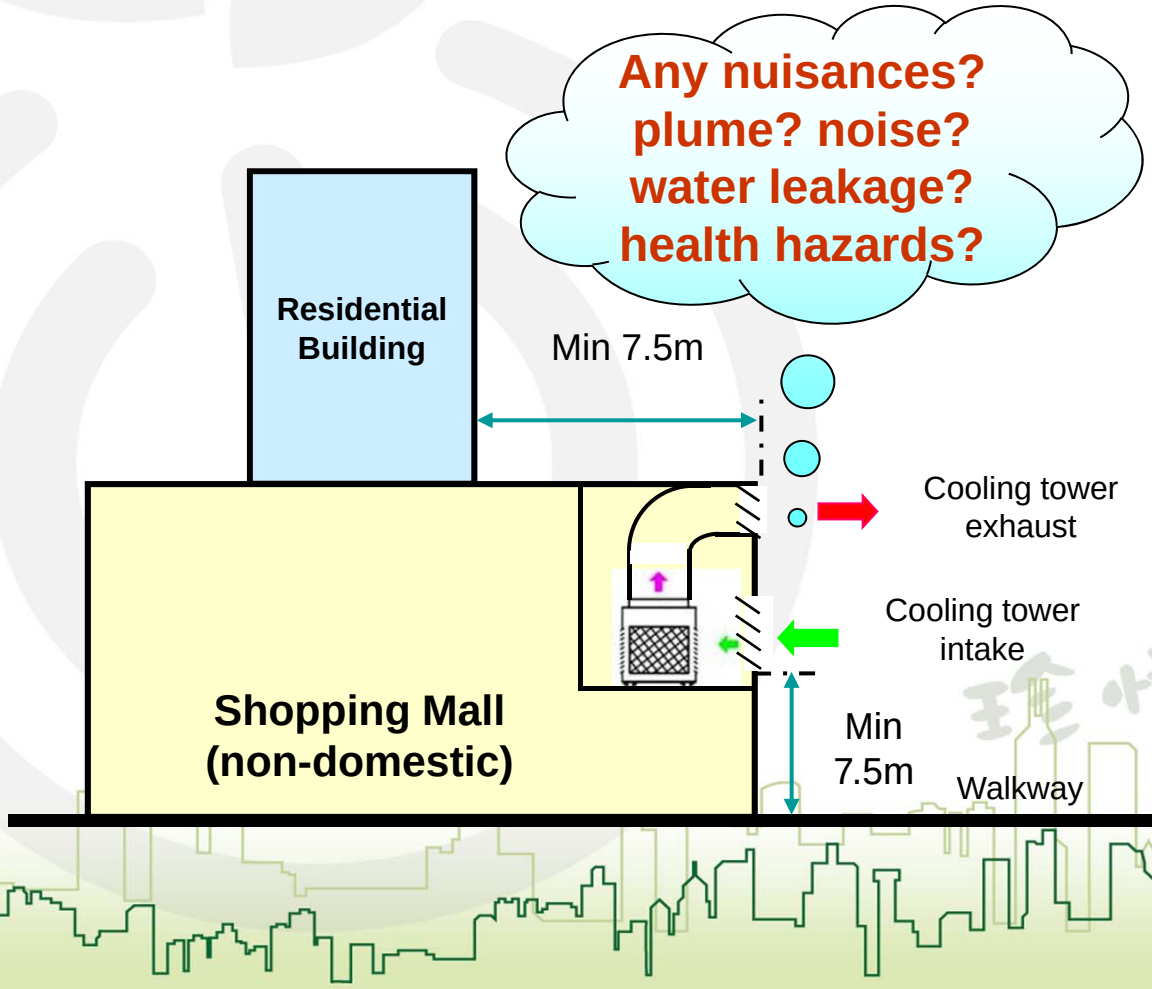
Concerns on FWCT



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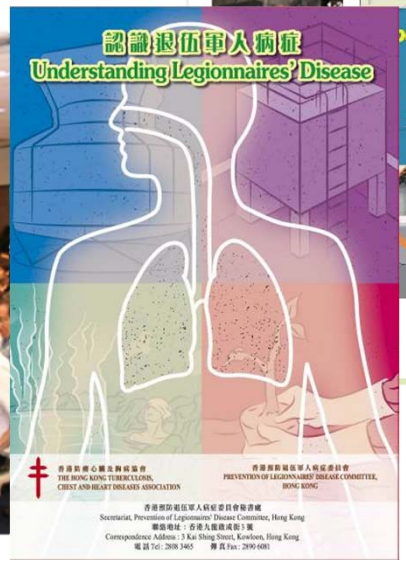
Publicity



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DISTRICT COOLING SYSTEM IN KAI TAK DEVELOPMENT

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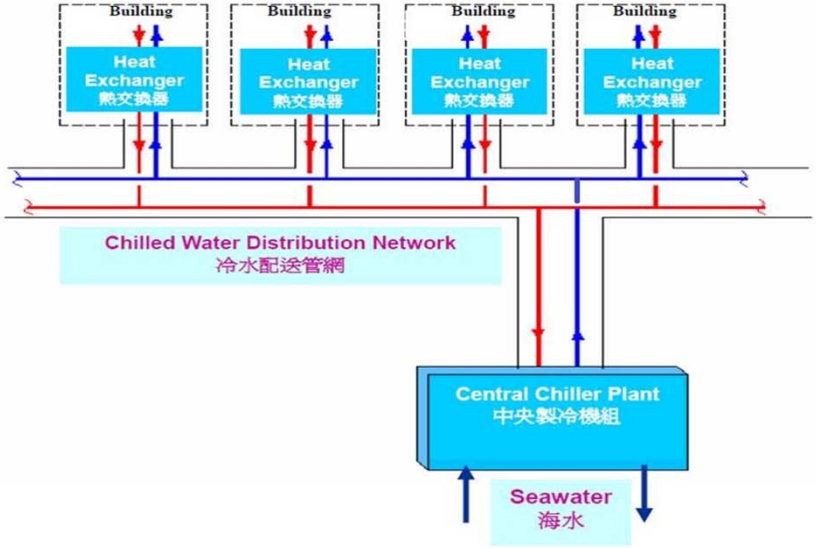
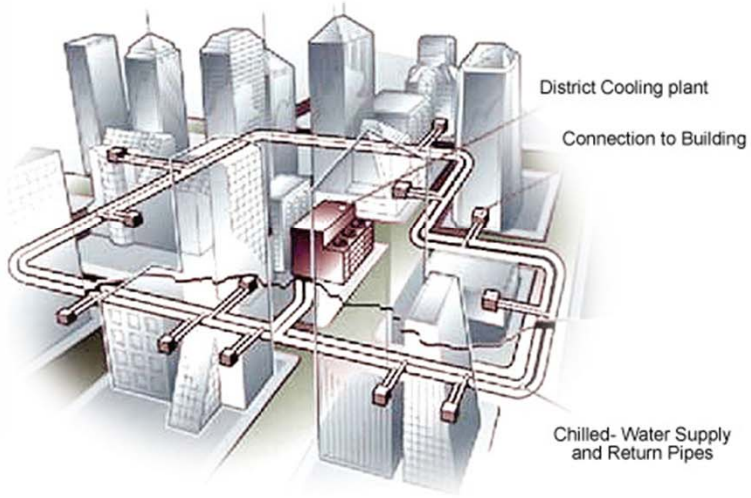
What is DCS?

- Supply chilled water to more than one building through distribution networks
- Major components include chiller plants, distribution networks and heat exchangers





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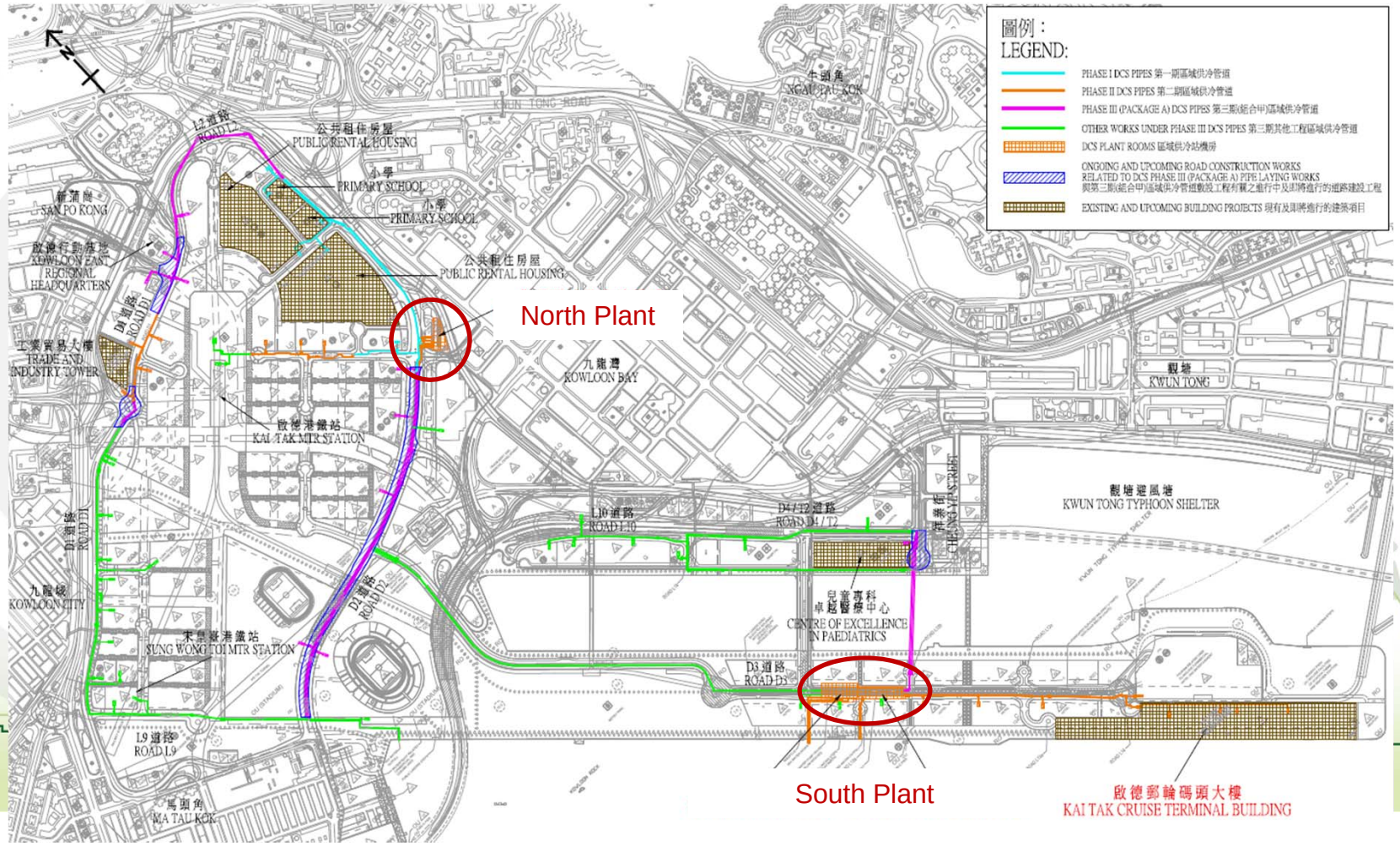
Background of the Project

- Total cooling capacity: 83,250 TR/293 MW
  - North Plant cooling capacity: 48,300 TR/170 MW
  - South Plant cooling capacity: 34,950 TR/123 MW
- Total pipe-run length: around 40 km
- Expected number of users: around 60

Implementation of the Project

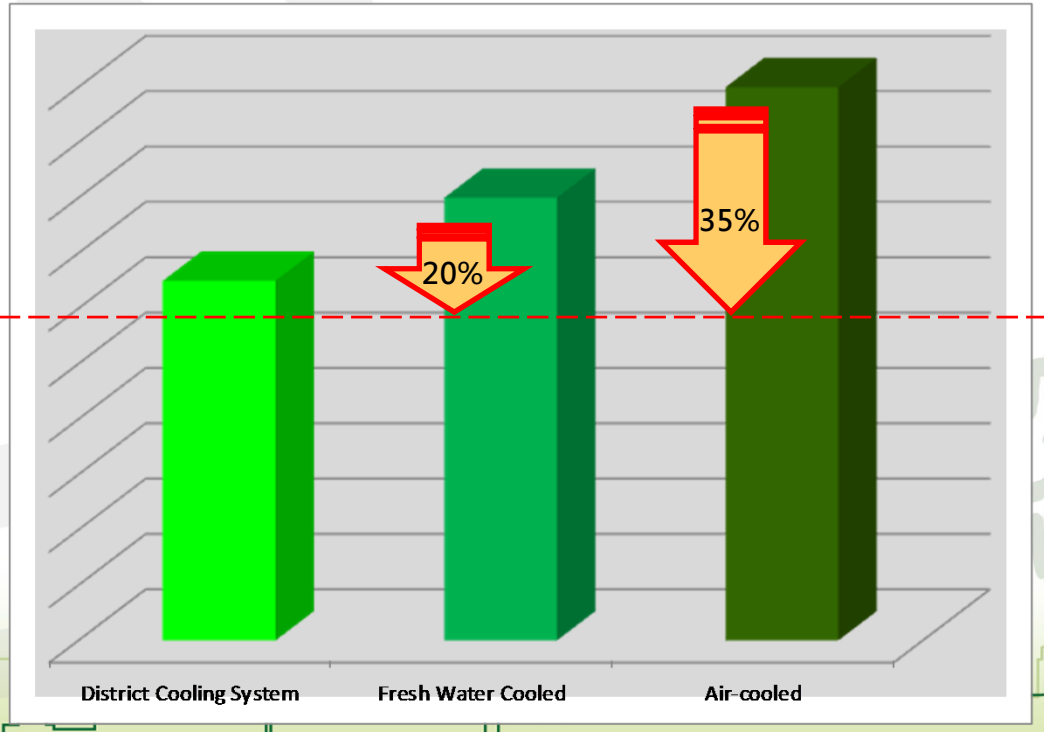


Implementation of the Project

- Phase I – pipes laying works, commenced in Feb 2011, substantially completed in Jan 2013
- Phase II – DBO contract, commenced in Mar 2011, target completion by end 2014
- Phase III (A) – commenced in July 2013, target completion by 2017
- Phase III (remaining) – to suit the actual schedule of KTD (up to around 2021)
- Operation commenced since Jan 2013 (for Kai Tak Cruise Terminal)

Benefits of DCS

- Save energy compared with traditional A/C systems in individual buildings



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Benefits of DCS

- Annual energy saving of up to 85 million kWh or reduction of 59,500 tonnes equivalent CO_2 emission upon full development

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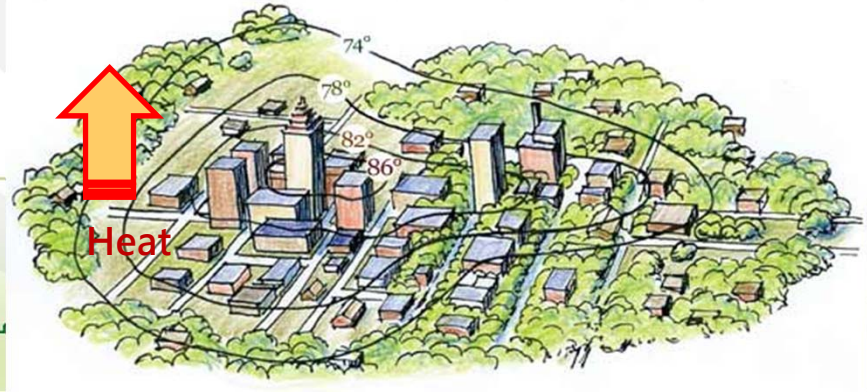
Benefits of DCS

- Noise, vibration and heat arising from individual plant could be reduced
- More adoptable than individual system to varying demand for air-conditioning
- Enhance building/architectural design/function, better planned maintenance, reduce heat island effect, etc.



Major Facilities – North Plant

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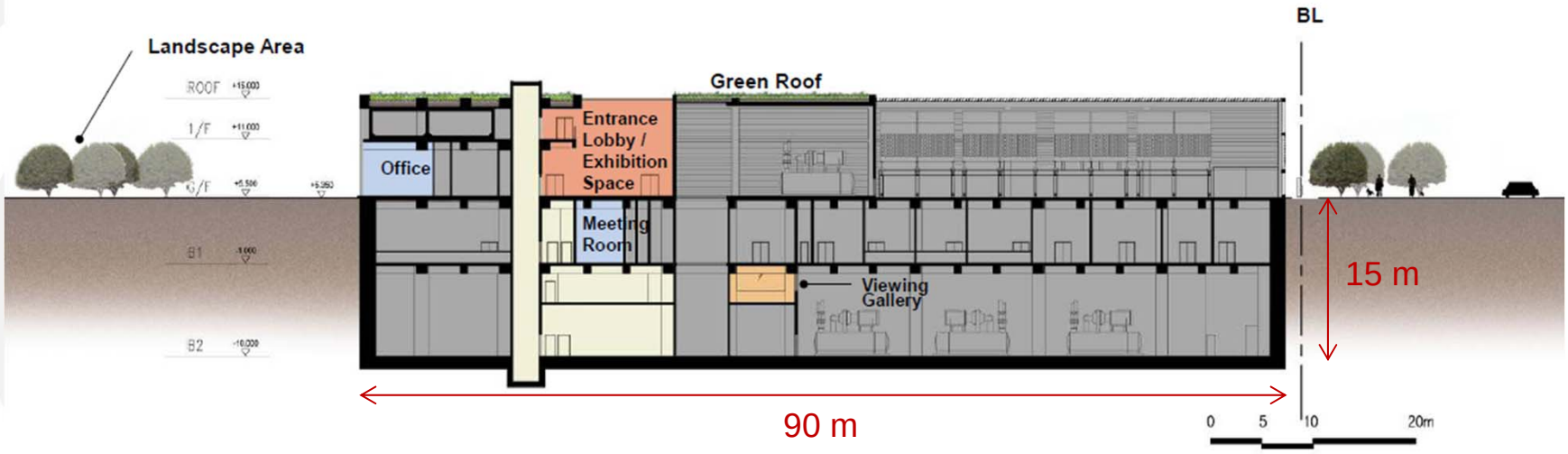
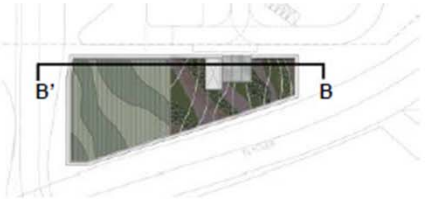


Plant Room Area

Internal Circulation



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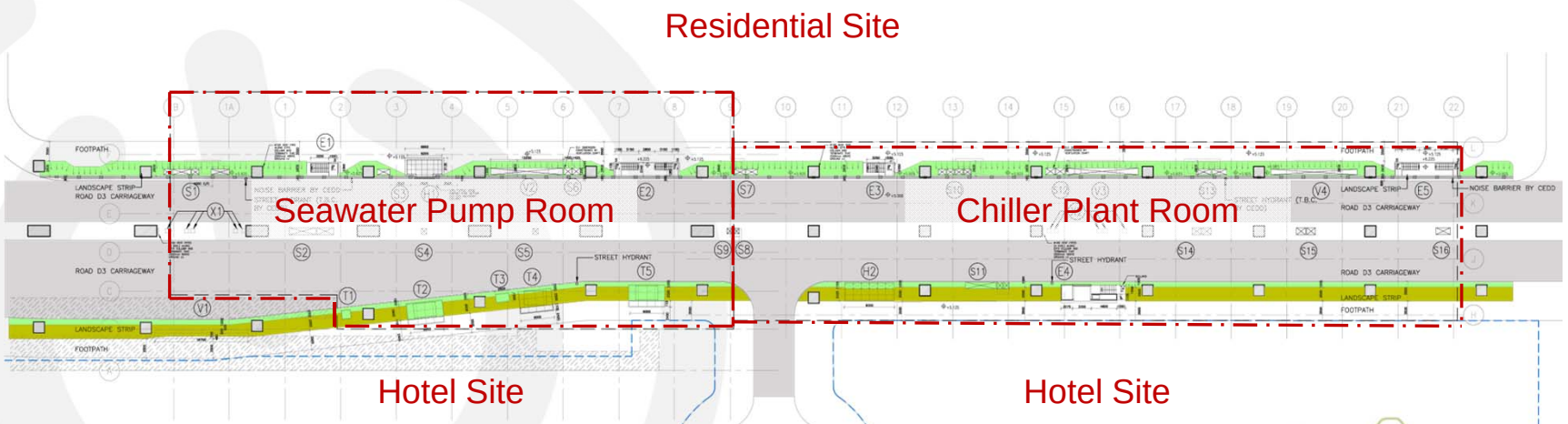
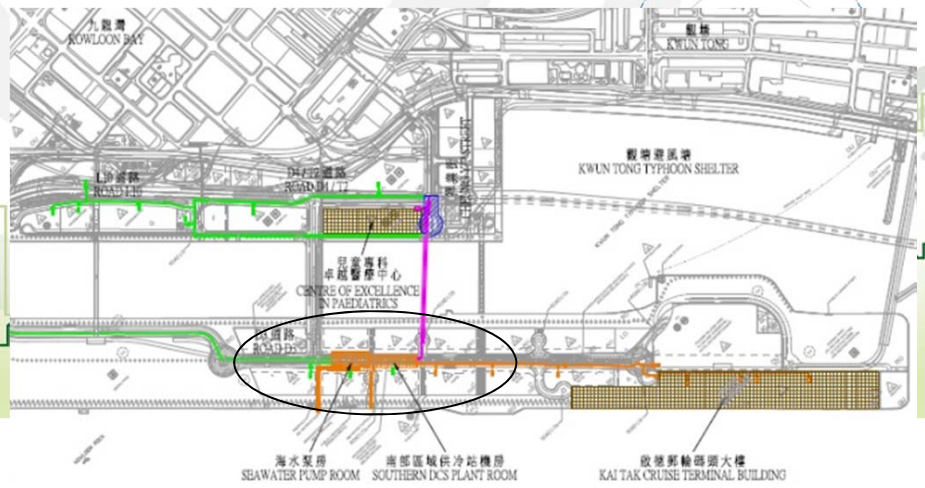
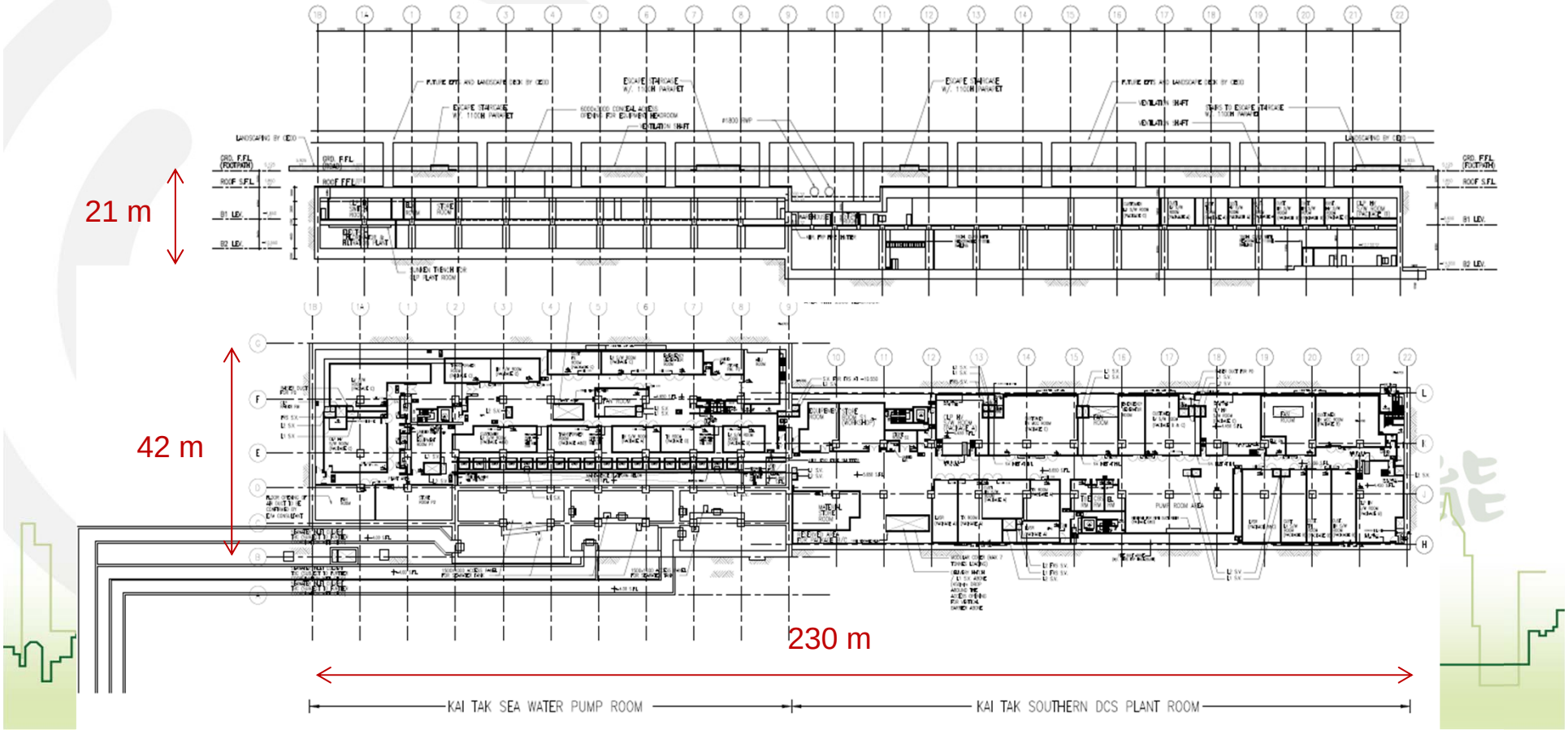
Major Facilities – South Plant





Major Facilities – South Plant



Major Facilities – Customer Substation

- Normally, one sub-station per building to house two heat exchangers

Current Status – North Plant

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Current Status – North Plant

Current Status – South Plant

Current Status – South Plant

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Concluding Remarks

- Water, as a valuable resource in the Earth, plays an important role in air-conditioning installation
- With the adoption of WACS, more than 20% of energy could be saved
- As KTD is a new district development with large demand of air-conditioning, the opportunity was taken to implement the most energy efficient air-conditioning system, i.e. DCS