



# Singapore District Cooling



## Agenda:

1. Introduction – Marina Bay DCS
2. Urban Heat Island Effect
3. Demand Response / Interruptible Load

# 1. Introduction: The Marina Bay District Cooling System





# Singapore District Cooling



- Singapore District Cooling supplies chilled water to iconic buildings in the Marina Bay District.
- A new urban utility like electricity and gas



- Commenced operations in 2006
- Service area > 1.7 million m<sup>2</sup>
- Plant capacity of 60,000 refrigeration ton

**Design, Build, Operate and Maintain World Largest Underground DCS**



# Our Valued Customers



Marina Bay Financial Centre



Marina Bay Sands



The Sail



Singapore Chinese Cultural Centre



Gardens By the Bay



Marina One



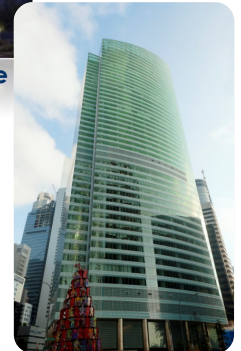
One Marina Boulevard



Asia Square



MRT Stations



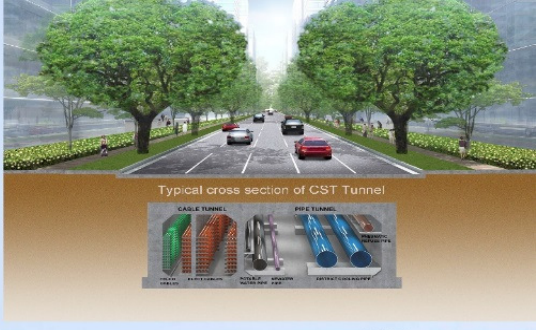
One Raffles Quay

# Heart of Our Operations





# Common Utilities Services Tunnel





# SDC District Cooling System



Unique Ice Thermal Storage System

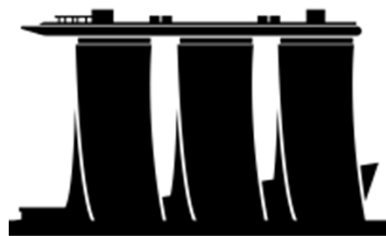


Largest Dual Evaporator Chiller

# Unique Features of District Cooling

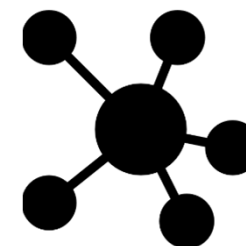


Design-to-operations  
Engineering



Fully Underground

Design to be Invisible



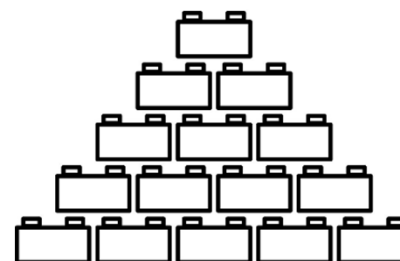
Integrated Multi-Plant Ops



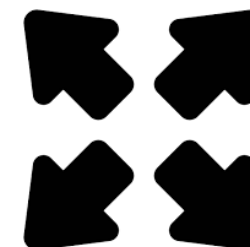
Thermal Storage Ops



Data-Driven Decisions



Modular System  
Plug & Play Design



Design for Expansion

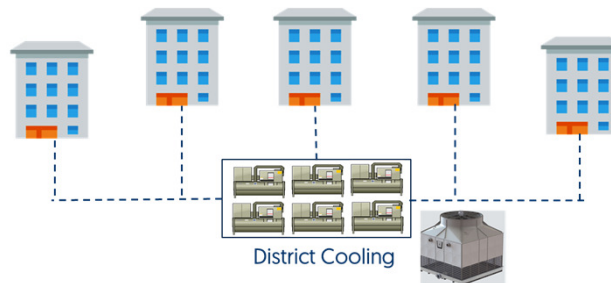
# District Cooling – An Urban Utility Service

Values provided by Singapore District Cooling:



## Energy Efficiency

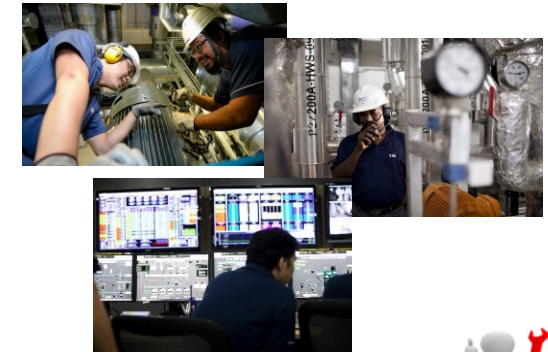
- One of the most energy efficient DC system



## Asset Efficiency



- Consolidation of assets
- Reduces upfront CAPEX
- Unlock valuable spaces



## O&M Reliability

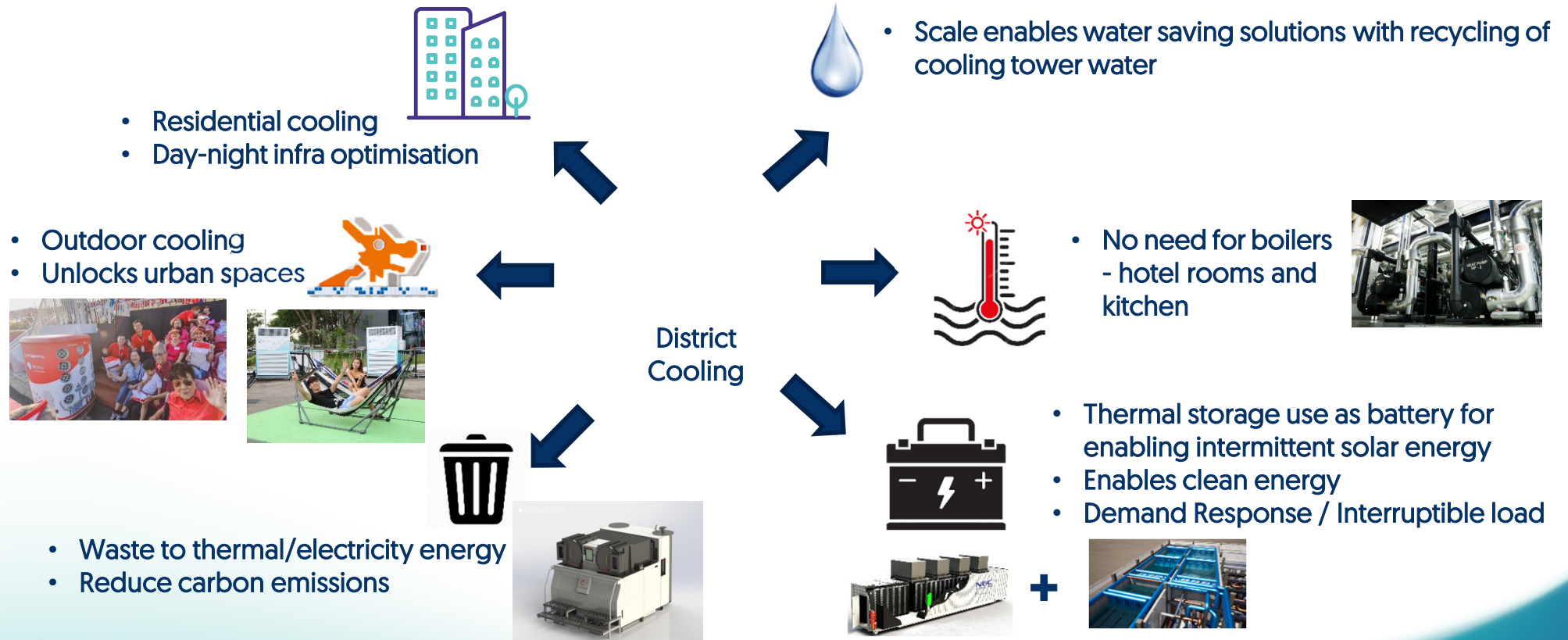


- Attention to details by professionals
- Fast response
- 24/7 monitoring

15 years track record of Quality, Reliability and Safety



# Innovative Integrated Solutions



Even greater sustainability outcomes with scale and integrated solutions

## 2. Urban Heat Island Effect (UHI): How District Cooling System Can Help Mitigate UHI

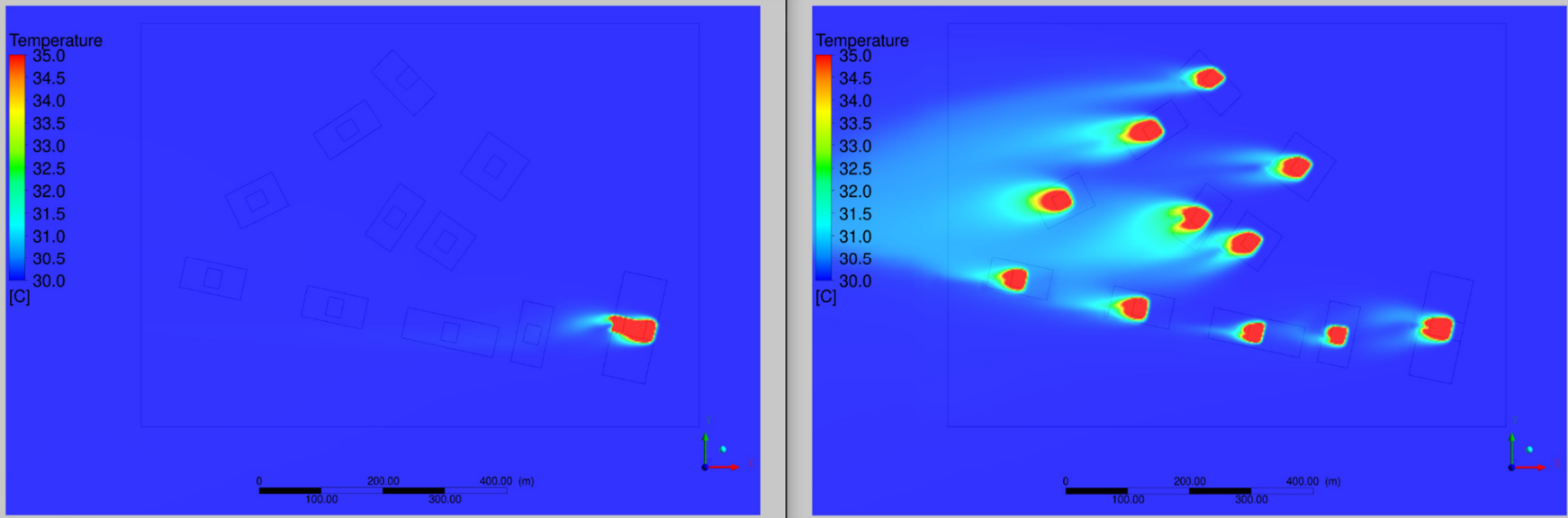
# How DCS Mitigate UHI



- i. Reducing the quantities and locations of heat emitters.
- ii. Reducing the total amount of heat energy ejected to the atmosphere for air-conditioning due to the higher efficiency of the DCS plant.
- iii. Improved heat dispersal from the DCS cooling tower.
- iv. Freeing up roof space on buildings for greenery.
- v. Reducing the effect of a stack of DX condensing units for residential buildings.



# Urban Heat Island (UHI) Effect - Commercial



Simulation of Heat Map with and without DCS

# Urban Heat Island (UHI) Effect - Residential



One giant contributor to the UHI effect: The reliance on air-conditioners. Housing blocks and office buildings effectively end up ejecting hot plumes that heat up the surroundings.

Describing the effect of a stack of air-conditioner units, Professor Gerhard Schmitt – head of a research team called “Cooling Singapore” at the Singapore-ETH Centre – said: “The bottom one is ejecting heat to the outside, but this heat is then sucked in by the next one, and the next one and the next. The higher you go, the higher the temperature that comes out.”

That means the household on top could end up paying higher electricity bills for running the air-con, he noted.

Source: <https://www.channelnewsasia.com/news/cnainsider/singapore-hot-weather-urban-heat-effect-temperature-humidity-11115384>



With Centralised Cooling, no Outdoor Unit(s) are installed for each house

Heat rejected by outdoor unit accumulating around residential.

Temperatures around residential up to 30°C at 11:00pm due to split-unit air conditioning

# 3. Demand Response & Interruptible Load



# Introduction to Demand Response



## What is Demand Response?

It is a programme that enables electricity customers to voluntarily reduce or shift their electricity consumption, thereby balancing the nation's supply and demand and contributing to grid stability and resilience

## When is Demand Response Required?



Electricity **Demand High**  
in Singapore is **High**



**Adverse Weather**  
conditions impact the generation of renewable energy sources such as solar power

## Benefits of Demand Response

**FACILITATES** the integration of more renewable energy sources by helping to address supply intermittency

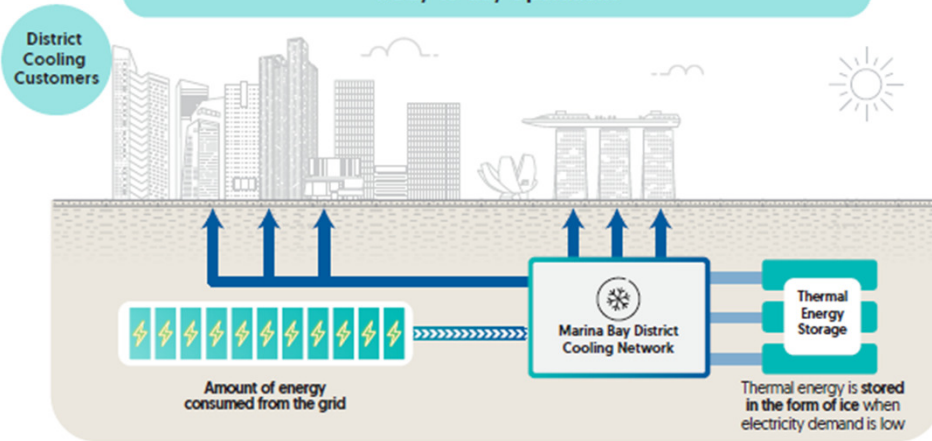
**REDUCES** peak load demand in times of peak electricity usage

**FREES UP** electricity supply which will enable the grid to be more stable and resilient, and to act as an additional resource when electricity supply conditions are tight

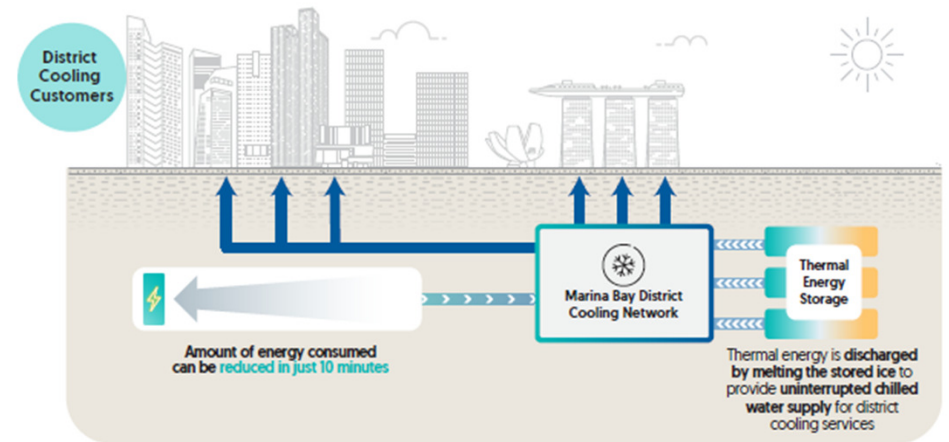
# Demand Response by a DCS



## 1. Day-to-day Operations



## 2. Activating Thermal Energy Storage to Support Demand Response





SPgroup

Empowering the Future of Energy