



The potential of District Energy in APAC 4DH International Online Forum

ll a suite an stait

Peter Lundberg, Head of Operations Asia Pacific Urban Energy Association (APUEA)

Bangkok, March 25 2021

Supported by

Presentation Overview

- **1. Energy Consumption in Cities**
- 2. The benefits of District Energy
- 3. Asia Pacific Case Studies (DCS)
 - a) Hong Kong
 - b) Thailand
 - c) Philippines
 - d) China
- 4. Existing barriers for District Energy
- 5. District Energy opportunities in APAC





APUEA – independent support to cities in APAC

Founded by the International Institute for Energy Conservation (IIEC) in 2017

Supported by Asian Development Bank, Euroheat & Power, and Danish Board of District Heating

Secretariat in Bangkok, and local representation in Beijing, New Delhi and Melbourne

Promoting the development of sustainable urban energy and disseminating trends and best practices in the urban energy sector through seminars, workshops, publications and other activities – with focus on District Energy (DE) and Multi Energy Systems (MES)

Supporting cities navigating in the cross-sectoral urban energy field, including Smart Energy City, Energy 4.0, Energy Symbiosis, and other trending concepts

ABB, Engie and Johnson Controls are Founding Members of APUEA











Energy Consumption in Cities

- Cities occupy only two percent of the world's landmass
- Cites consume over two-thirds of the world's energy
- Cites account for more than 70% of global CO₂-emissions.





Current and Future Megacities (2018 – 2030)







Sectoral Energy Consumption

Within cities, the proportion of energy use by various sectors differ by economy.

Cities in Asia Pacific region require different energy solutions depending on climate and dominant sectoral consumption:

- Hong Kong Commercial
- Bangkok Transport
- Tokyo Commercial
- Osaka Industrial

SECTORAL ENERGY CONSUMPTION







Energy Consumption in Buildings

- Buildings stands for 30% of final energy consumption in Asia Pacific
- Buildings account for a large part of GHG-emissions in cities.
- Space cooling is the fastestgrowing use of energy in buildings.
- Cooling accounted for 18.5% of total electricity use in buildings, (13% in 1990).





Trends & Developments in the Energy sector

- Trends influencing the energy sector
- Urbanization
- Digitalization
- Development trends in the energy sector
- Electrification
- De-carbonization
- De-centralization
- System integration Multi Energy Systems





Multi (Fueled) Energy Systems – A key to sustainable cities

- **District Energy** District Heating (DH) & District Cooling (DC)
- Distributed Energy Co-generation (CHP) & Tri-generation (CCHP)
- Combined Heating & Cooling (DHCS)
- Smart Grids





Multi (Fueled) Energy Systems – Benefits



Advantages over traditional energy systems:

- Adaptability to changes in fuel availability
- More effective utilization of low-value surplus energy and renewable energy
- Flexible integration of intermittent renewable energy (e.g., through energy storage and co-/tri-generation)
- Reduction in peak loads.



District Energy – District Cooling

District Cooling Systems offers:

- Reduced energy demand, DC systems are up to 50% more ۲ efficient than conventional cooling systems.
- More efficient capacity use, **DC systems use approx. 15% less** capacity than individual cooling systems.
- **Integration** of multi energy sources, such as intermittent renewable electricity, waste energy and natural cold sources
- Thermal Energy Storages (TES) enables the potential to reduce peak loads.
- A vital role to **mitigate global warming 0,5-1°C** (High Efficiency & phasing out HFC-refrigerants).
- Reduced heat urban island effect
- ۲ Long lifespan, up to 50 years
- **Huge market potential**, (Not least for CBD/TOD areas, Industries and Industry zones, Airports, Hospitals and Data Centers)

Thermal Energy Storage



Electrical Chiller







Absorption Chiller-

(Heat Driven)



Distributed Energy

Distributed Energy Systems offers:

- High Efficiency, more than to 80% of the fuel input is converted to useful energy (electricity/heat/cooling)
- **Decentralized Energy Production**, local power production = reduced stress on power grids
- Low pollution (Depending on fuel type)
- Integration of renewable energy (Depending on fuel type)
- A wide range of suitable technologies for projects with different pre-conditions
- Suitable applications include: Airports, Hospitals Central Business District Areas, Industry Zones.



Gas Turbine



Absorption Chiller (Heat Driven)



P 12



Integration of Electric Vehicles

Smart Grids

- Introduces communication between Producer & Consumer
- Optimized Smart Charging can reduce peaks and balance loads in the grid
- Allows for new market solutions (V2G)
- = Play a vital role to introduce EV's, by balancing the grid and enable reduction of peak loads

• District Energy

- Increased energy efficiency leads to reduced energy demand
- Reduced installed capacity
- Thermal Energy Storage can reduce peak loads and integrate more Renewable Energy
- = Increased available grid capacity, reduction of peak loads

Distributed Energy

- Decentralized Power Production,
- High Efficiency reduces energy demand
- Reduced installed capacity
- = Increased available grid capacity



Energy use for space cooling 2016-2050



Source: IEA



District Cooling A not-in-kind solution for HFC phase-down



The Kigali amendment:

- Up to 0,5 °C from HFC phase down and
- 0,5 °C due to energy efficiency improvements
- Total potential 0,5 1 degree C

District Cooling is recognized by UN to have a key role to meet both targets!

As the solution for up to 25% of the global cooling demand



District Cooling at Kai Tak Development



- DCS, the most efficient AC system suitable for the area
- First-of-its-kind DCS in Hong Kong,
- Capacity, 284 MWr (50 consumer buildings, tot. 1,73 million m²)
- 35 % more efficient than air-cooled Air Condition Systems
- Annual savings: 85 million kWh in electricity consumption, equivalent to the reduction of 59,500 tonnes of CO₂
- Consumer cost comparable to water cooled AC-systems (Cooling Towers)
- Three phases with expected completion in 2025



One Bangkok – Bangkok Thailand

One Bangkok - Thailand's Largest Fully Integrated District

- Landmark development in central Bangkok to be opened in 2023.
- Investment of THB 120 Billion (USD 3.84 Billion)
- 16.7 acres, 16 buildings, incl. offices, hotels, shopping malls, residences.
- High focus on sustainability, LEED Certification (First in Thailand)
- District Cooling (133 MW) system with high efficiency incl. thermal energy storage and utilization of recycled waste water.





District Cooling at Northgate Cyberzone, Philippines



- Northgate is a 18.7 hectares information technology park
- Fully redundant, 1,7 km cooling network
- Cooling Capacity, 42 MW (18 consumer buildings, 410,000 m²)
- 39% reduction of the annual electricity consumption
- Annual reduction of 18,400 tonnes of CO₂
- Availability of 99.8% guaranteed
- Investment cost: 26 M€
- Capex and Opex guaranteed for 20 years



Qianhai DCS, Shenzhen, China



- Consisting of 10 production plants
- 90 km distribution pipe network
- Cooling Capacity, 400,000 RT / 745 MW
- Total energy storage capacity: 4,000 MWh
- Total capital cost: 4 Billion RMB
- Total land footprint: 15 km²



Existing barriers for District Energy in APAC



- Lack of incentives and regulations to address
 - High initial cost (Front loaded investment)
 - Delayed load ramp-up and occupation ratio
 - Land access for distribution pipelines/systems
- Lack of large Cooling utilities (similar to Electric Utilities)
- Cooling policies strategies and action plans (National, local governments and SOE)
- Energy planning as a natural part of urban planning (Enable system integration to increase efficiency and environmental benefits)



The potential of District Energy in APAC



- APAC is the largest growing cooling market in the world
- DCS is recognized by i.e. APUEA, UN DES, K-CEP, and other organizations, promoting the development of sustainable urban energy
- Several countries in the region present ambitious climate targets (China, Japan, South Korea)
- Green buildings and certifications are getting more popular, introducing energy efficient solutions incl. District Cooling
- Efficient technologies and good development and implementation practices are present





7th Global District Energy Climate Awards 11-12 November 2021 in Bangkok, Thailand www.districtenergyaward.org



Thank you!

Peter Lundberg Head of Operations Asia Pacific Urban Energy Association (APUEA) plundberg@apuea.org www.apuea.org



