DISTRICT ENERGY INTERNATIONAL CONFERENCE LAC 2025

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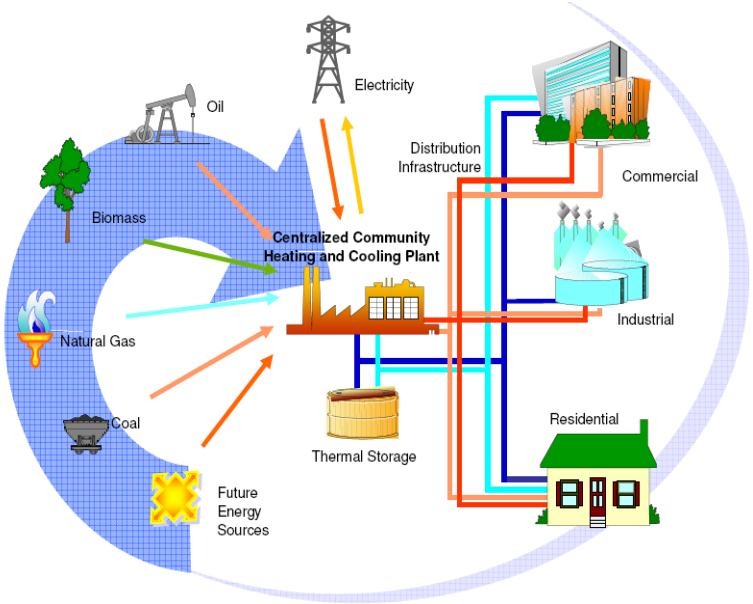
District Energy System Development in Asia: Sustainable cooling & heating solutions for fast urbanization areas

Desarrollo de sistemas de energía distrital en Asia: Soluciones sostenibles de refrigeración y calefacción para zonas de rápida urbanización

Introduction: District energy systems



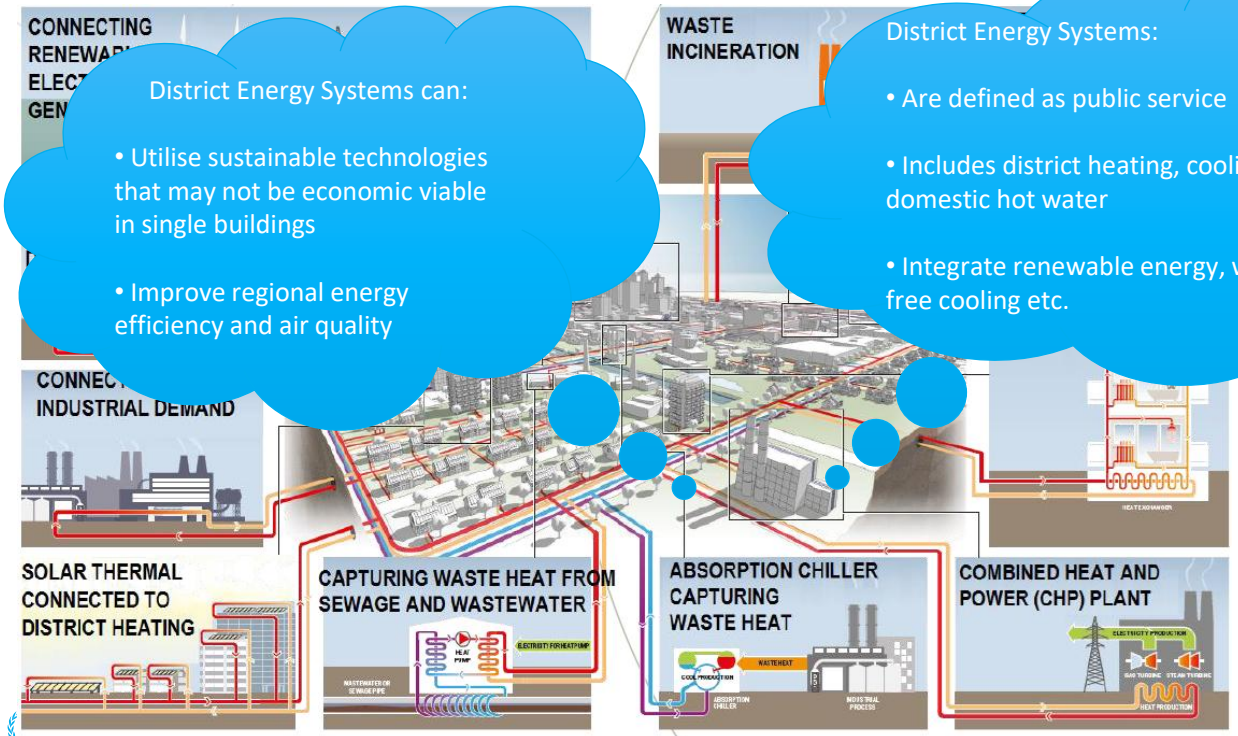
The idea of district energy is to have an efficient and often large-scale production of heating or cooling in a **centralized plant**.

Most times the heating or cooling is **co-generated** with electrical power, which yields a very high efficiency utilisation of the energy input.

The district energy system is unique in the way that it lends itself to an endless range of fuels – it is in other words a **multi-fuel energy system.**

Any energy source, renewable, present or future can be used in the District Energy system

Introduction: District energy systems



District Energy Systems can:

- Utilise sustainable technologies that may not be economic viable in single buildings
- Improve regional energy efficiency and air quality

District Energy Systems:

- Are defined as public service
- Includes district heating, cooling and domestic hot water
- Integrate renewable energy, waste heat, free cooling etc.

Modern district energy is considered as key to renewable and efficiency in smart cities

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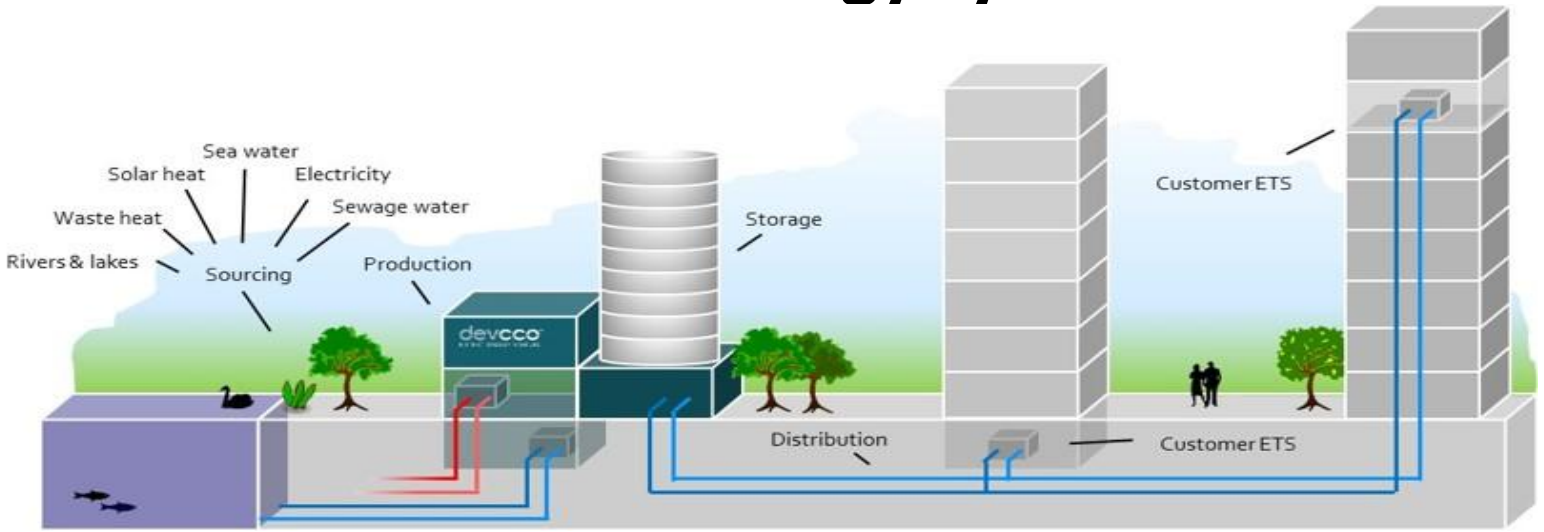
Introduction: District energy systems

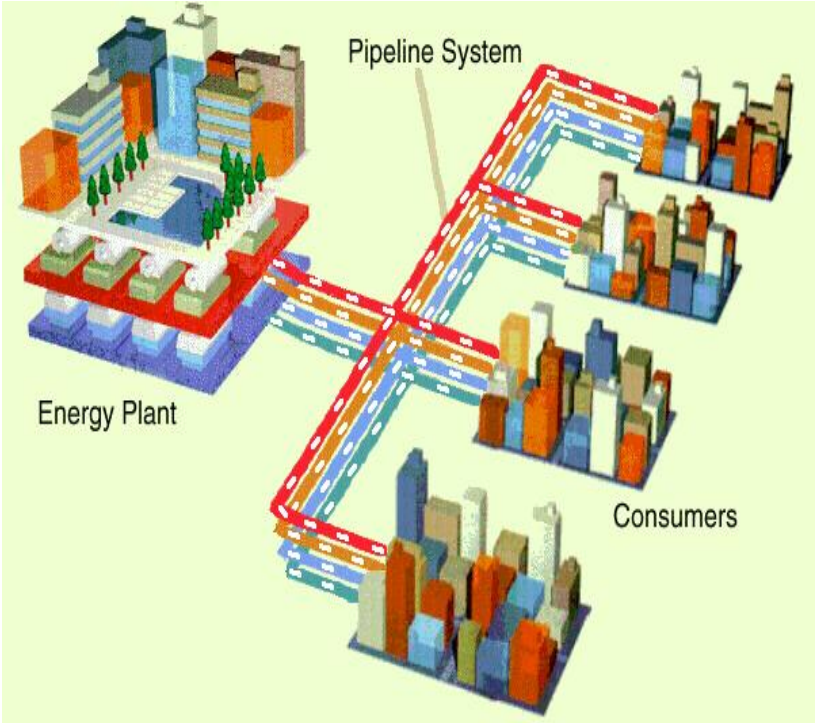


District energy aims to use **local energy sources** that otherwise would be wasted or not used, in order to offer for the local market a **competitive and high-energy-efficient alternative** to the traditional heating and/or cooling solutions.

Introduction: District cooling in cities

Definition of District Cooling:

- A system to combine heating/cooling station and end-users through pipeline network
- Belongs to **public service**, similar to electricity, water, gas etc.
- Cooling sources could include **waste heat, electrical cooling, free cooling** etc.
- **Targeted customers**: industrial/process cooling (warehouse, data centre), city complex, public buildings (hospital), commercial buildings, luxury residential buildings



District energy market in Asia

Market Overview

Market Size (2024)
$200 Billion

CAGR (2023-2029)
12.74%

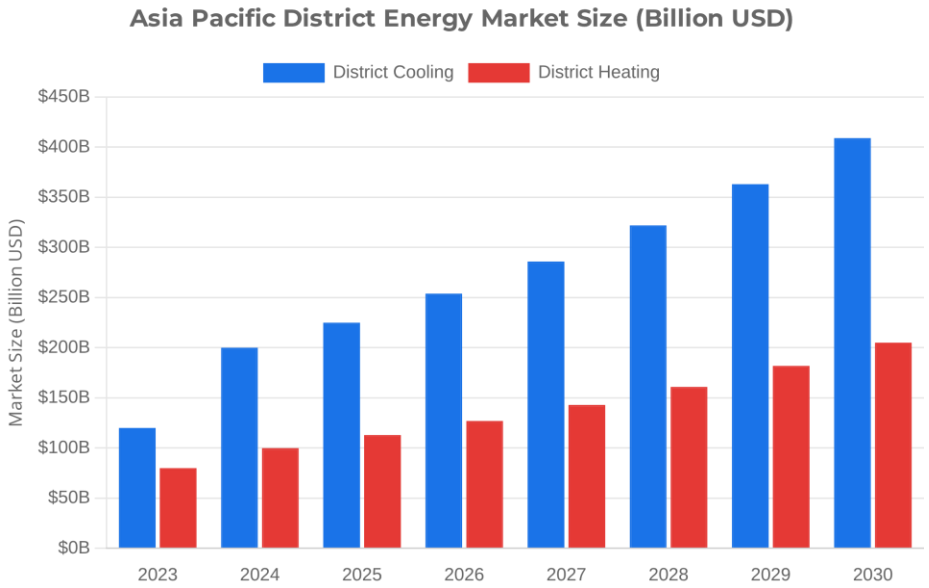
Key Market Drivers

Rapid Urbanization
Growing urban populations requiring efficient energy solutions

Climate Change Policies
Government commitments to reduce carbon emissions

Rising Cooling Demand
Increasing temperatures driving cooling requirements

Smart City Initiatives
Integration with smart urban development projects



Asia Pacific District Energy Market Growth Projection (2023-2030)

Source: Market research data compiled from industry reports

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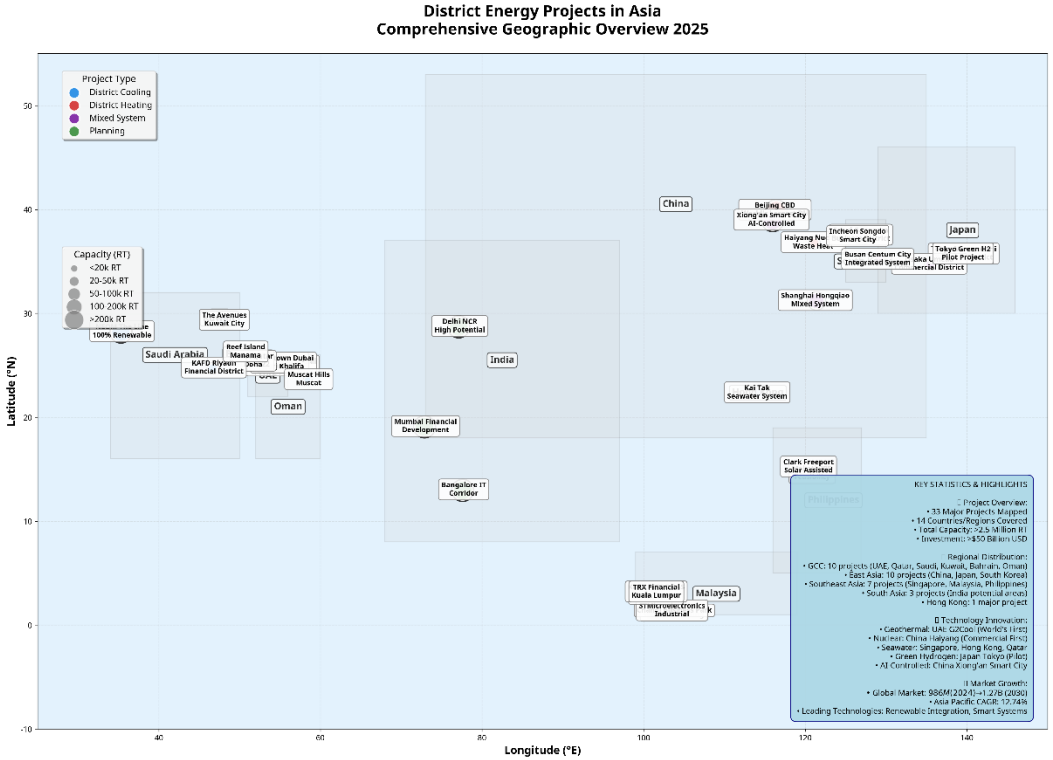
District energy market in Asia



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District energy market in Asia – District cooling

Region	Countries	Projects mapped	Development stage	Key Innovation	Market size
Middle East/GCC	UAE, Qatar, Saudi Arabia, Kuwait, Bahrain, Oman	Over 25	Mature, Expanding, New project developing	Thermal storage (chilled water), geothermal	Large scale (average 65k RT)
East Asia	China (incl. Hongkong), Japan, South Korea	Over 20	Mature, Expanding, New project developing	Smart control, large-scale thermal storage (ice), multi cooling sources	Mega scale (up to 2.5M RT in one district)
Southeast Asia	Singapore, Malaysia, the Philippines	7	Mature	Large-scal thermal storage (ice), smart control	Medium scale (aveargе 40k RT)
South Asia	India	3	Planning or expanding	Thermal storage (chilled water)	High potential (over 1M RT)

UAE: Leading District Cooling Market

Market Position

The UAE is the regional leader in district cooling, with the Middle East representing over 40% of the global district cooling market. Dubai alone accounts for 20% of the world's district cooling capacity.

Key Players

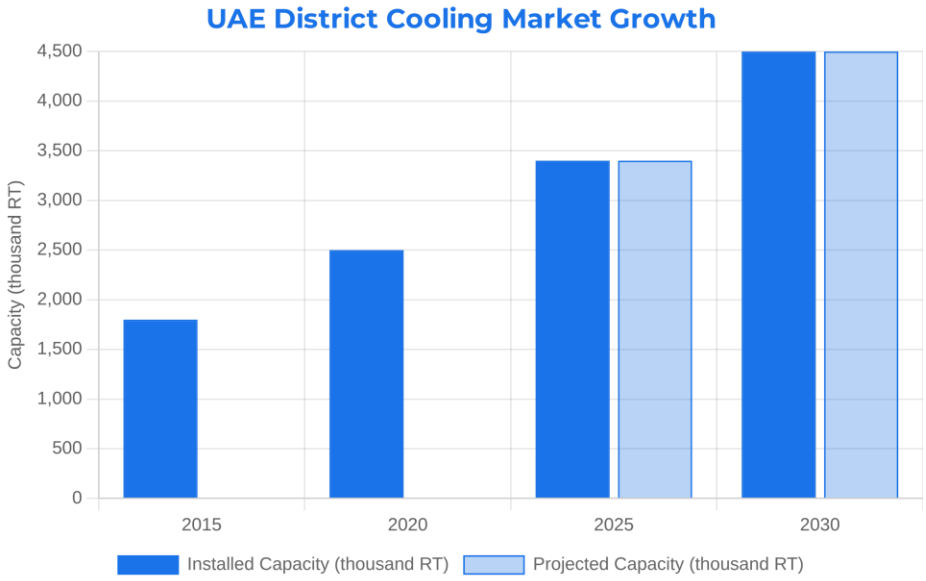
TB **Tabreed**
1.2M RT capacity

EM **Emicool**
350k RT capacity

EP **Empower**
1.4M RT capacity

Government Support

- **Regulation No. 6 (2021)**
  Mandates district cooling for new developments above certain size thresholds
- **UAE Energy Strategy 2050**
  Promotes energy efficiency and clean energy integration
- **Demand Side Management Strategy**
  Targets 30% reduction in energy consumption by 2030



UAE District Cooling Capacity Growth (2015-2030)

Source: Estimated on the basis of public available data

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Singapore: Marina Bay District Cooling Network

World's Largest Underground Network

Singapore's Marina Bay hosts the world's largest underground district cooling network, serving the financial district with reliable and efficient cooling since 2006.

The network features a 5km centralized piping system that distributes chilled water to multiple buildings, eliminating the need for individual cooling towers and chillers in each building.

Key Performance Metrics

Zero Supply Disruptions
Perfect reliability record since operations began in 2006

Expanding to 32 Buildings
Planned expansion to connect five more buildings by 2027

Environmental Impact
Reduces carbon emissions by nearly 22,000 tonnes annually

System Advantages

- 40% more energy efficient
- Lower maintenance costs
- Space optimization
- Reduced noise pollution

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Singapore: Industrial District Cooling

STMicroelectronics Project

One of Asia's largest industrial district cooling applications, providing chilled water for semiconductor manufacturing processes.

Project Highlights

Long-term Partnership

20-year cooling-as-a-service agreement between SP Group and STMicroelectronics

Precision Cooling

Maintains exact temperature requirements for semiconductor fabrication

Operational Excellence

24/7 operations with redundant systems for zero downtime

Environmental & Economic Benefits

Energy Savings

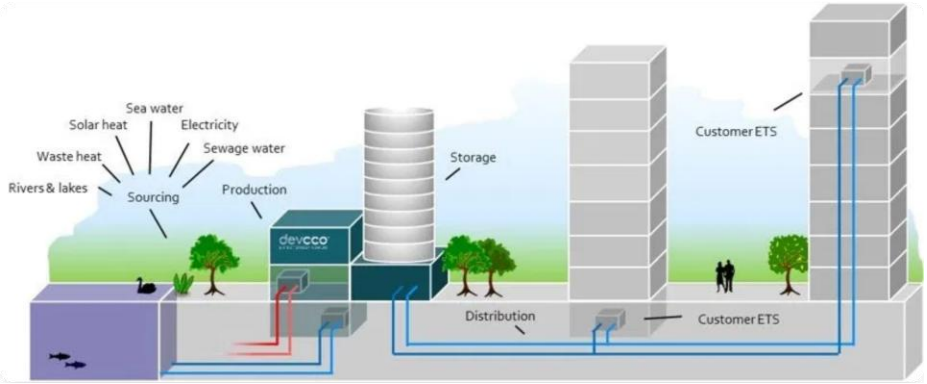
20%

cooling-related electricity

CO_2 Reduction

120,000

tonnes over 20 years



Industrial district cooling facility similar to the STMicroelectronics project

Project Specifications

36,000

Refrigeration Tonnes Capacity

$370M

Investment Over 20 Years

2018

Year Commissioned

3

Manufacturing Plants Served

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China: World's Largest District Heating Network

Massive Scale

China operates the world's largest district heating infrastructure, covering over 9 billion square meters of building area across northern regions.

Market Penetration

88% Urban Coverage

District heating serves 88% of urban heating areas in northern China

Over 400 Million People

Benefiting from centralized heating systems

Energy Transition

Coal to Clean Energy

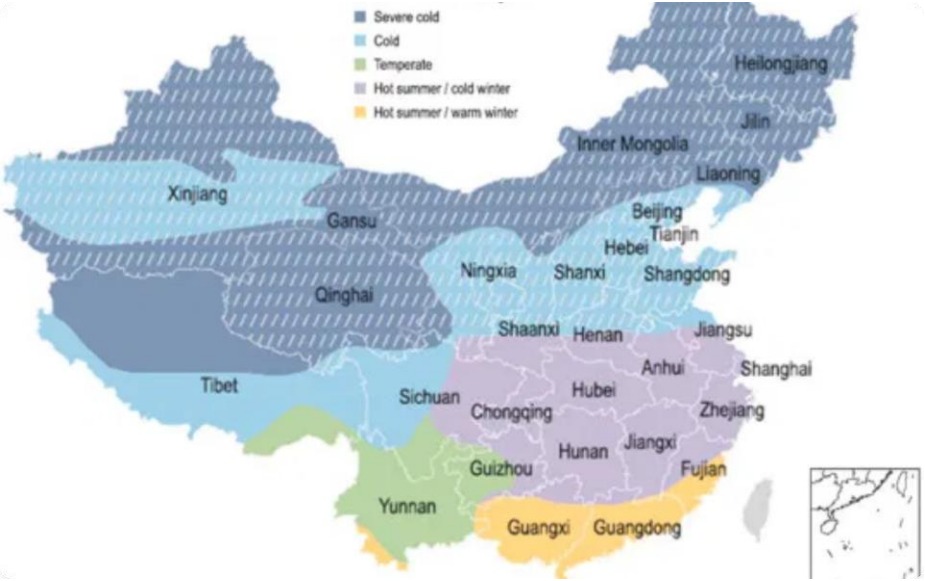
Transitioning from coal-fired boilers to renewable sources

Renewable Integration

Incorporating geothermal, biomass, and waste heat recovery

Cooling Integration

Expanding to combined heating and cooling systems in major cities



Policy Developments

- 14th Five-Year Plan (2021-2025): Prioritizes clean heating
- Clean Winter Heating Plan: 70% clean heating in northern China by 2025
- Carbon neutrality goal: Net zero emissions by 2060

China: Innovation in District Energy

Zero-Carbon Heat Source

Uses residual heat from the Haiyang Nuclear Power Plant, replacing 12 coal-fired boilers and reducing carbon emissions by 180,000 tons annually.

Shanghai's Mixed Systems

Integrated heating and cooling networks in Shanghai's Hongqiao Business District utilize waste heat recovery and seasonal thermal storage, serving over 4.3 million square meters.

Smart City Integration

Xiong'an New Area implements AI-controlled district energy systems with real-time demand response and predictive maintenance, reducing energy consumption by up to 30%.

Renewable Integration

Dezhou Solar Valley combines large-scale solar thermal collection with district heating networks, providing heating for 1.5 million square meters of building space.

China's District Energy Innovation Impact

30%
Average energy efficiency improvement

8.2M
Tons CO_2 emissions reduced annually

15+
Major innovation pilot projects

40%
Renewable energy integration target

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GBA: Cooling potential assessment

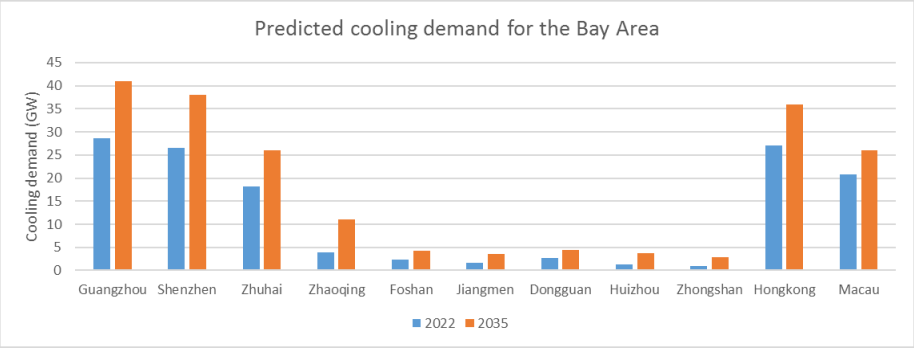
Guangdong-Hong Kong-Macao Greater Bay Area

- Include 8 cites, 2 Special Economic Zones, Hongkong, Macao
- Strong connection in transportation and economic collaboration
- Large GDP, diverse industrial structure
- Huge demand for cooling and/or heating: industrial (food storage, distribution centres, data centres, IT parks etc.) and commercial (luxurious residential and hotels, shopping malls and offices etc.)

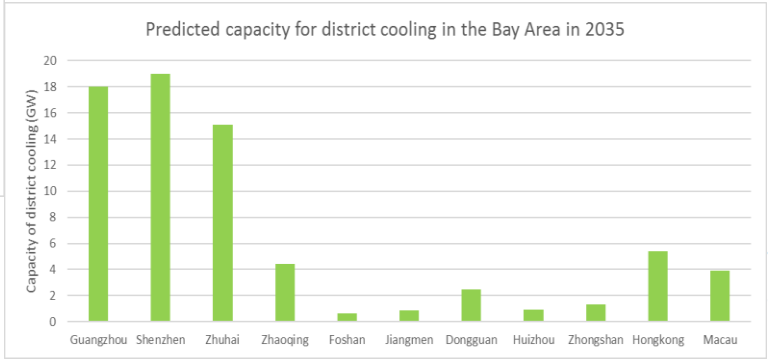
GBA: Cooling potential assessment

Guangdong-Hong Kong-Macao Greater Bay Area (56,000 sq. km)

- According to the development planning towards 2035, authorized by the Central Government, the total cooling demand in the region will reach 196GW. The district cooling capacity will reach 72GW, compared to 12GW in 2017.
  - Group some of the district cooling projects in the city cluster and apply for financial support for revolving-seed funding/city climate fund
  - Potential support from local municipalities (land, long-term concession and/or partial investment to the revolving fund)
  - District cooling projects can be developed, constructed and operated by the same company with experiences in the region-DBOT/DBOO model



All the data in the figure are calculated based on the development planning of the Bay Area, authorized in 2019



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District Heating REIT of Jinan City Energy Group (2025)

- **First REIT** on **district heating** as municipal public service infrastructure in China
- Moblized **900m RMB (125m USD)** as REIT issued through Shanghai Stock Exchange in Feb. 2025
- Knowledge sharing through **Sino-Danish Clean & Sustainable District Heating Virtual Knowledge Center** with the city-own utility since 2021
- UNEP Disrict Energy in Cities Initiative, UNEP CCC and Danish Energy Agency supported **Jinan city (pilot city of GEF-6)** for long-term district heating planning, technical & financial assessment of potential sustainable district heating retrofitting projects as well as heat-pump-based district heating & cooling new projects since 2018
- UNEP CCC supported Jinan city for detailed sustainable technologies implementation plan & **financial investment pipeline/IPS** since 2021

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India: Emerging District Cooling Market

Massive Growth Potential

India's cooling demand is projected to double between 2017-2027, creating a significant opportunity for district cooling systems to address energy efficiency challenges.

Key Market Indicators

40% Reduction

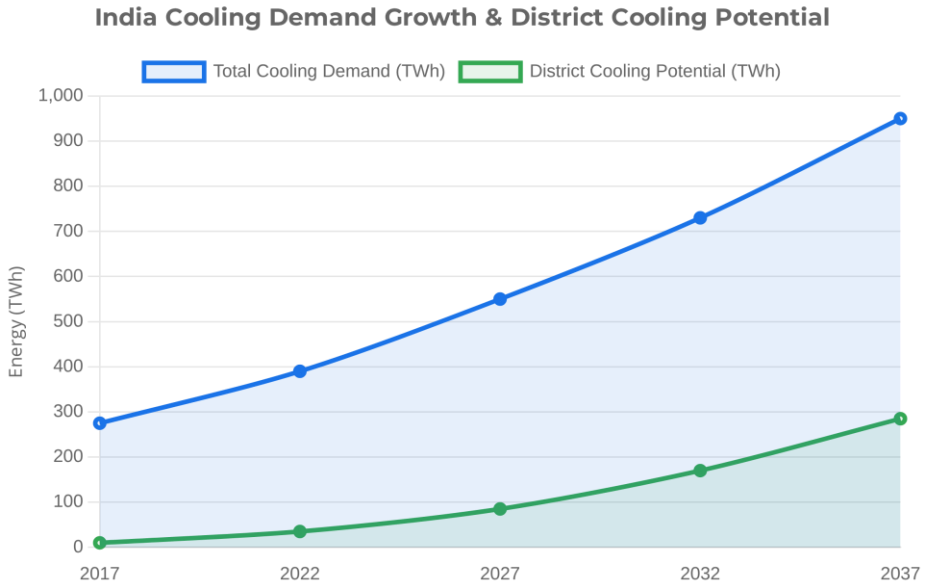
Potential power consumption reduction compared to conventional cooling

Urban Development

Rapid urbanization creating ideal conditions for district cooling

Climate Conditions

High cooling degree days across major urban centers



India's Cooling Demand Growth and District Cooling Potential (2017-2037)

Source: UNEP District Energy in Cities Initiative, India Cooling Action Plan

Policy Initiatives

India Cooling Action Plan (ICAP)

First-of-its-kind comprehensive cooling policy

National Smart Cities Mission

Incorporating district cooling in urban planning

UNEP District Energy in Cities Initiative

Technical assistance for pilot projects in Rajkot and Thane

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India: Key Development Areas

Strategic Urban Centers

India's rapid urbanization and increasing cooling demand has created significant opportunities for district cooling development in key metropolitan areas.

Priority Development Zones

Delhi NCR

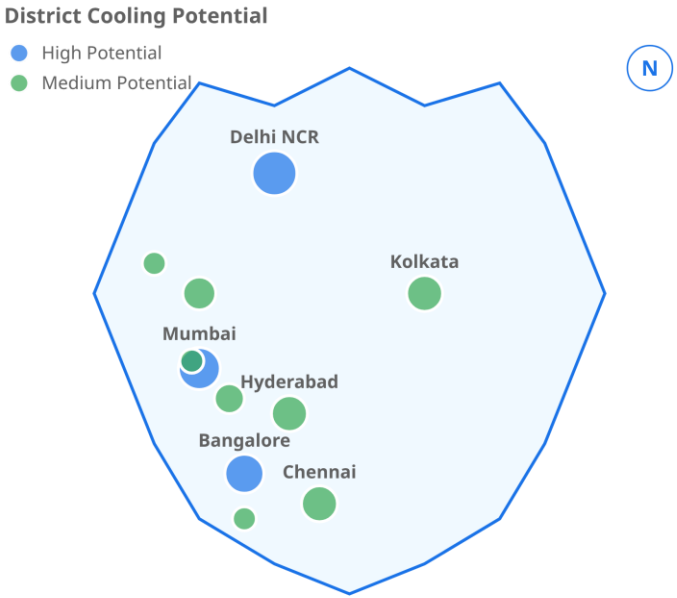
New government complexes and commercial developments in the National Capital Region, with potential for 500,000 TR capacity across planned smart city projects.

Mumbai Financial District

Bandra Kurla Complex and surrounding financial zones, with feasibility studies showing potential for 300,000 TR district cooling implementation.

Chennai

Technology parks and campuses in new developing townships in the city, where cooling demands for data centers and office complexes create ideal conditions for district cooling.



Key Indian cities with district cooling potential and planned projects

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Technology Integration Trends

Modern District Energy Systems

District energy systems are evolving through integration of advanced technologies that enhance efficiency, sustainability, and operational performance.

Key Technology Trends

Smart Technologies

IoT sensors, AI-driven optimization, and predictive maintenance systems reduce operational costs by up to 25% while improving system reliability.

Renewable Energy Integration

Solar thermal, geothermal, biomass, and waste heat recovery systems are increasingly integrated to reduce carbon footprint and operational costs.

Water Management Innovations

Closed-loop systems, water recycling technologies, and advanced filtration reduce water consumption by up to 30% in cooling operations.

Energy Storage Solutions

Thermal energy storage, phase change materials, and advanced battery systems enable load shifting and peak demand management.

Integration Benefits

- 15-40% energy efficiency improvement
- 30-50% carbon emissions reduction
- 20-35% operational cost savings
- Enhanced system resilience

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Environmental and Economic Benefits

Key Benefits of District Energy

Environmental Impact

District energy systems reduce carbon emissions by 30-50% compared to conventional systems through improved efficiency and renewable energy integration.

Energy Efficiency

Centralized production achieves 15-35% higher energy efficiency through economies of scale, load diversity, and advanced technologies.

Economic Advantages

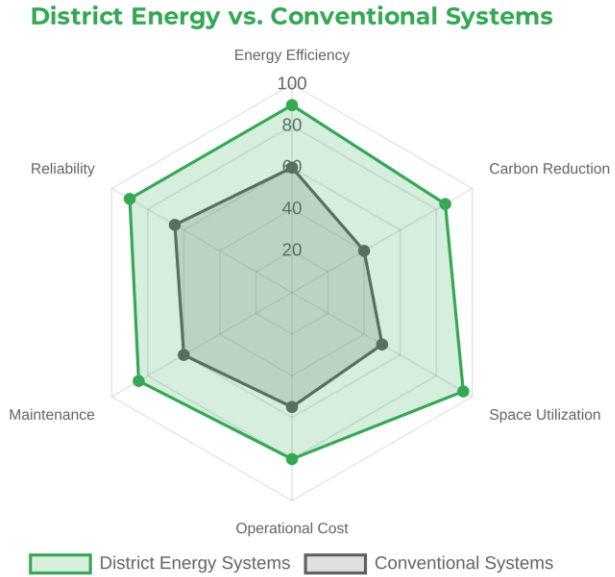
Lower lifecycle costs through reduced capital expenditure, operational expenses, and maintenance requirements for building owners.

Urban Space Utilization

Eliminates the need for individual cooling towers and equipment rooms, freeing up 5-10% more usable space in buildings.

Additional Benefits

- Reduced noise pollution in urban environments
- Improved reliability and resilience during extreme weather
- Flexibility to integrate multiple energy sources
- Extended equipment lifespan through professional operation



Comparative benefits of district energy vs. conventional systems

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Challenges and Opportunities

Key Challenges

Despite the numerous benefits, district energy development in Asia faces several significant challenges that must be addressed to unlock its full potential.

High Upfront Capital Costs

Initial investment requirements for infrastructure development can be prohibitive, requiring innovative financing mechanisms and public-private partnerships.

Regulatory Frameworks

Many Asian countries lack comprehensive policies and regulations specifically designed to support district energy development and operation.

Integration with Existing Infrastructure

Retrofitting district energy systems into established urban areas presents technical and logistical challenges.

New Business Models

Energy-as-a-service and other innovative business approaches are needed to overcome traditional barriers to adoption, e.g. DBOT, PPP, EPC and REIT.

Strategic Approach

Successful district energy implementation requires a holistic approach that addresses technical, financial, regulatory, and social dimensions simultaneously. Stakeholder engagement and knowledge sharing across the region are essential for overcoming barriers.

SWOT Analysis: District Energy in Asia

STRENGTHS

- Proven technology with successful implementations
- Significant energy efficiency improvements
- Reduced carbon emissions and environmental impact
- Lower lifecycle costs for building owners
- Economies of scale in operation and maintenance

WEAKNESSES

- High initial capital investment requirements
- Long payback periods (10-15 years)
- Complex stakeholder coordination needed
- Technical expertise gaps in some regions
- Limited awareness among potential customers

OPPORTUNITIES

- Rapid urbanization creating new development areas
- Growing policy support for sustainable solutions
- Integration with renewable energy sources
- Smart city initiatives and digital transformation
- New financing mechanisms and business models

THREATS

- Competing technologies and conventional systems
- Fluctuating energy prices affecting economics
- Regulatory uncertainty in developing markets
- Climate change impacts on cooling/heating demand
- Infrastructure development challenges

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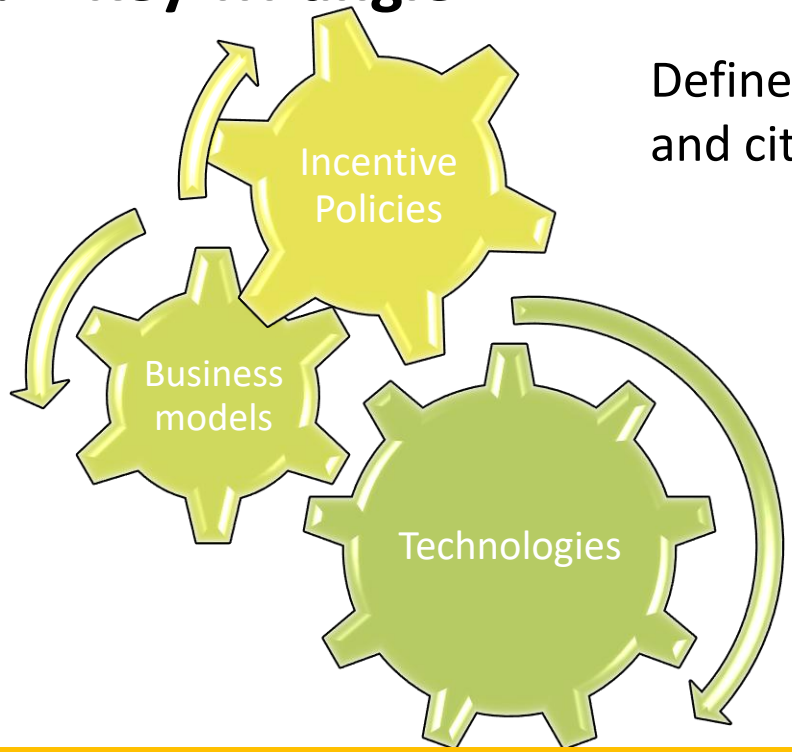
How to develop and implement district energy projects in Asian cities? – Key Tri-angle



Define the roles of municipalities and cities

Suitable business models to enable the investment environment

Cost-effective technologies to integrate multiple sectors for higher systemic efficiency

Combining suitable incentive policies, business models and cost-effective technologies can accelerate the implementation of carbon neutral communities and scale up after demonstration.

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Future Outlook for District Energy in Asia

Projected Growth Areas

District energy in Asia is projected to grow at a Compound Annual Growth Rate (CAGR) of 12.74% through 2035, with cooling applications leading the expansion in Southeast Asia and South Asia.

Emerging Technologies

Fifth-Generation Networks

Low-temperature networks enabling simultaneous heating and cooling with decentralized energy sharing

Small Modular Reactors

Nuclear-powered district energy systems for zero-carbon heating and cooling

AI-Optimized Operations

Machine learning algorithms for demand prediction and system optimization

Investment Landscape

$120B

Projected investment in district energy infrastructure by 2035

45%

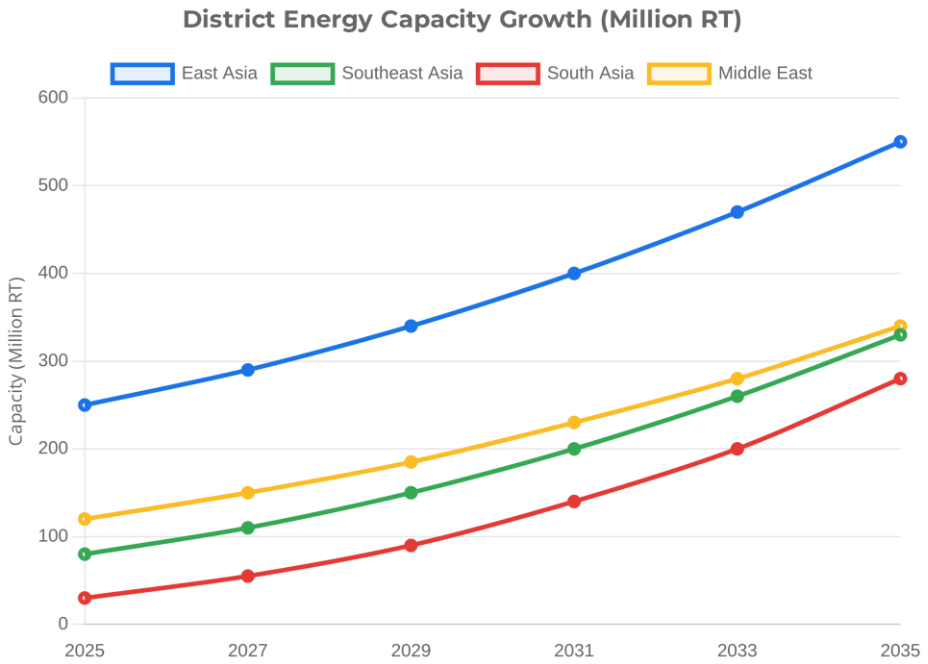
Expected market share of renewable-powered systems

60+

Major cities with district energy expansion plans

30%

Projected reduction in cooling-related emissions



Projected District Energy Capacity Growth by Region (2025-2035)

Source: Estimated on the basis of existing data sources

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Thank you very much!

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Malaysia: Putrajaya District Cooling

Gas District Cooling (Putrajaya) Operations

Malaysia's Putrajaya administrative center features one of Southeast Asia's most extensive district cooling networks, operated by Gas District Cooling (Putrajaya) Sdn Bhd.

Cooling Infrastructure

8 Co-generation/District Cooling Plants
Strategically located across Putrajaya's development zones

Combined Capacity
Over 100,000 refrigeration tonnes (RT) serving government and commercial buildings

Core Island Plant 4
Malaysia's first remotely charged district cooling facility

System Benefits

Energy Efficiency
35% Higher
than conventional systems

CO_2 Reduction
40,000 tons
annually

Operational Since
1999
pioneering in Southeast Asia

Space Savings
10-15%
building space reclaimed

District Cooling Plant in Putrajaya, Malaysia
Source: Straits Consulting Engineers

Technology Integration

The Putrajaya district cooling system integrates gas turbine co-generation with thermal energy storage, allowing for load shifting during peak demand periods and optimizing energy efficiency throughout the day.

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Please write your questions for the speakers in the link:

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