

An aerial photograph of a modern city skyline, likely Shenzhen, featuring numerous skyscrapers and a large body of water in the foreground. The image is overlaid with a semi-transparent blue filter.

Qianhai's Approach to the Coordinated Development of District Cooling System and Artificial Intelligence (AI) Under the New Energy Policy Framework



Shenzhen Qianhai Energy Technology Development Co.,Ltd.

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2026-7-30

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1

Policies and Market Developments in China's District Energy Industry and AI+Energy Sector

- ☑ 1.1 The Support Policy and The Standard System
- ☑ 1.2 Overview of Chinese District Cooling Projects
- ☑ 1.3 Overview of Qianhai DCS

1.1 Three-Level Support Policy List for DCS

China has established a multi-level policy system from national top-level design to local implementation standards, covering green electricity action plans, hard targets for energy conservation and emission reduction, local technical regulations, and financial subsidies. This forms a policy guarantee pattern of "central-local linkage and progressive layers," providing solid support for the development of the district cooling industry.

01 National Level • Strategic Direction

Centered on the "14th Five-Year Comprehensive Work Plan for Energy Conservation and Emission Reduction," it clearly incorporates high-efficiency cooling actions and renewable energy substitution into the national energy development top-level direction



关于印发《绿色高效制冷行动方案》的通知
发改环资〔2019〕1054号

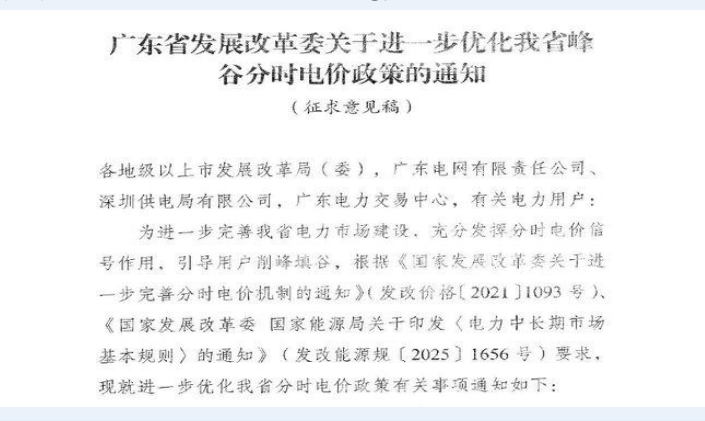
各省、自治区、直辖市及计划单列市、新疆生产建设兵团发展改革委，工业和信息化部主管部门，财政厅（局），生态环境厅（局）、住房和城乡建设厅（局）、市场监管总局（厅、委）、机关事务管理部门，各有关单位：

为贯彻落实今年《政府工作报告》、国务院《“十三五”节能减排综合工作方案》和中法《关于共同维护多边主义、完善全球治理的联合声明》等文件要求，加快生态文明建设，促进绿色消费，推动高质量发展，积极参与全球环境治理，我们研究制定了《绿色高效制冷行动方案》，现印送你们，请结合实际认真贯彻执行。

国家发展改革委
工业和信息化部

02 Provincial Level • Policy Support

Guangdong Province has issued a special action plan, clarifying economic support policies such as time-of-use electricity price discounts, reducing the operating costs of district cooling projects, and promoting the large-scale application and market popularization of technology.



广东省发展改革委关于进一步优化我省峰谷分时电价政策的通知
(征求意见稿)

各地级以上市发展改革局（委），广东电网有限责任公司、深圳供电局有限公司，广东电力交易中心，有关电力用户：

为进一步完善我省电力市场建设，充分发挥分时电价信号作用，引导用户削峰填谷，根据《国家发展改革委关于进一步完善分时电价机制的通知》（发改价格〔2021〕1093号）、《国家发展改革委 国家能源局关于印发〈电力中长期市场基本规则〉的通知》（发改能源规〔2025〕1656号）要求，现就进一步优化我省分时电价政策有关事项通知如下：

03 Municipal Level • Standard Implementation

Shenzhen has released the nation's first "Technical Specification for District Cooling Systems" (SJG 151-2024), and supports it with green and low-carbon industry subsidy policies, providing comprehensive guarantees in technical specifications, project construction and operational subsidies



深圳市工程建设地方标准 SJG
SJG 161 – 2024

区域供冷系统技术规程
Technical specification for district cooling system

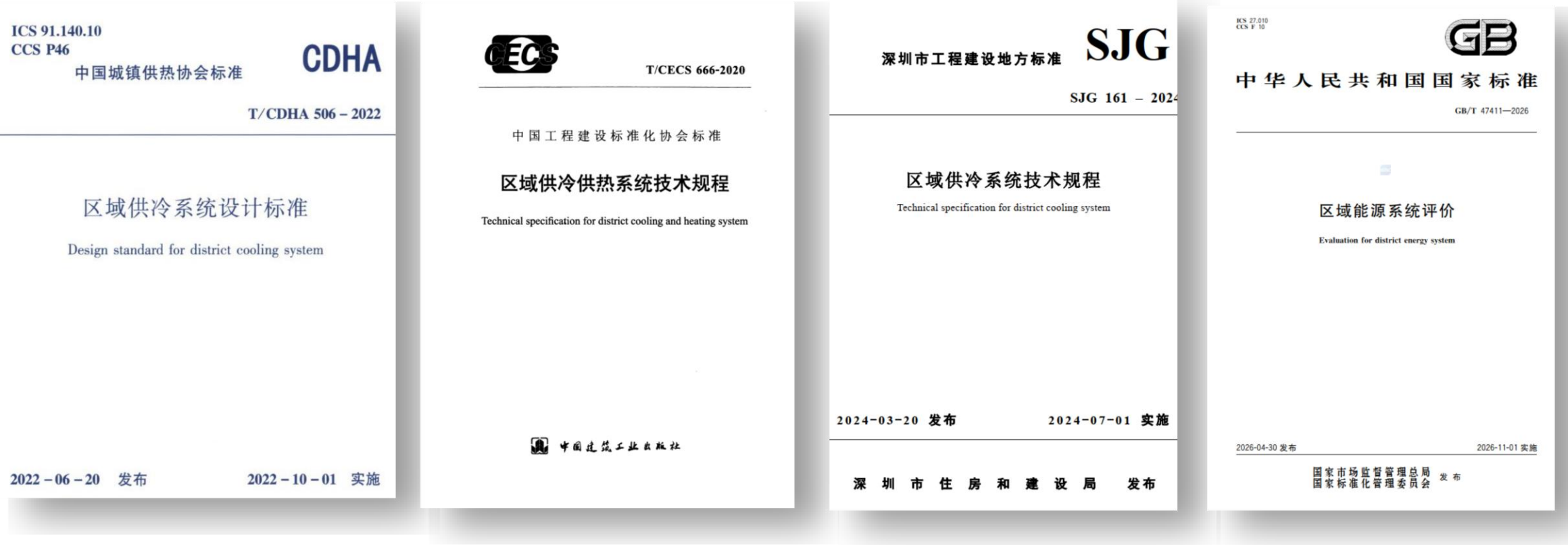
2024-03-20 发布 2024-07-01 实施

深圳市人民政府规范性文件库

深圳市人民政府办公厅关于印发深圳市促进绿色低碳产业高质量发展若干措施的通知

Summary: A three-level system of national direction-setting, provincial policy support, and local standard implementation has been formed. Shenzhen is at the forefront of the country in technical standard formulation and other fields, providing a sound policy guarantee for the large-scale development of district cooling projects

1.1 Three-Level Standard System for DCS



- ①Design Standard for District Cooling Systems
- ②Technical Specification for District Cooling and Heating Systems
- ③Technical Specification for District Cooling Systems
- ④Evaluation of District Energy Systems

Summary: China has established a three-level standard system at the national, industry, and local levels, covering design, construction, operation, maintenance, and evaluation systems.

1.1 The Support Policy for AI+District Energy

National and local governments have intensively introduced policies related to energy integration, forming a full-chain policy support system from top-level design, scenario implementation, funding support to industrial ecosystem construction, clarifying the strategic positioning of artificial intelligence as the core driving force for the intelligent upgrading of energy systems.

- 01 Top-Level Deployment: The National Energy Administration has listed AI and digital twins as core technologies for energy transition, establishing the strategic tone of "Digital Empowerment of Energy."
- 02 Scenario Matching: Precisely targeting core application scenarios in district energy such as industrial parks, virtual power plants, and building cluster energy optimization.
- 03 Demonstration Support: Central and local finances provide special subsidies for AI energy demonstration projects, lowering the capital threshold for technology implementation.
- 04 Ecosystem Improvement: Building a collaborative mechanism of "government-industry-university-research-application" to promote the deep integration of technology, scenarios, and capital.

Level	Policy Full Name	Document No.	Official Inquiry Link
National	国家能源局关于加快推进能源数字化智能化发展的若干意见	国能发数字〔2023〕44号	https://www.gov.cn/zhengce/zhengceku/2023-04/02/content_5749758.htm
	关于推进“人工智能+”能源高质量发展的实施意见	国能发科技〔2025〕73号	http://www.nea.gov.cn/20250912/c31a8448ceba4fba9081ee2206abc521/c.html
	关于促进人工智能与能源双向赋能的行动方案	国能发科技〔2026〕34号	http://www.nea.gov.cn/20260509/45e5721670704d4e8555d2212211db45/c.html
Local	广东省加快推进人工智能全域全时全行业高水平应用行动方案	粤办函〔2026〕50号	https://www.longmen.gov.cn/attachment/0/345/345585/5765939.pdf
	广东省培育发展未来绿色低碳产业集群行动计划	-	http://drc.gd.gov.cn/gkmlpt/content/4/4365/post_4365655.html
Industry	深圳市促进安全节能环保产业集群高质量发展的若干措施	深发改规〔2024〕3号	https://www.sz.gov.cn/zfgb/2024/1332/content/post_11306339.html
	深圳市支持虚拟电厂加快发展的若干措施	-	https://www.sz.gov.cn/cn/xxgk/zfxxgj/zcfg/content/post_11354577.html

Summary: The superposition of three positive factors—policy, scenarios, and funding—ushering in the eve of the explosion of AI empowering district energy.

1.2 Overview of Chinese District Cooling Projects

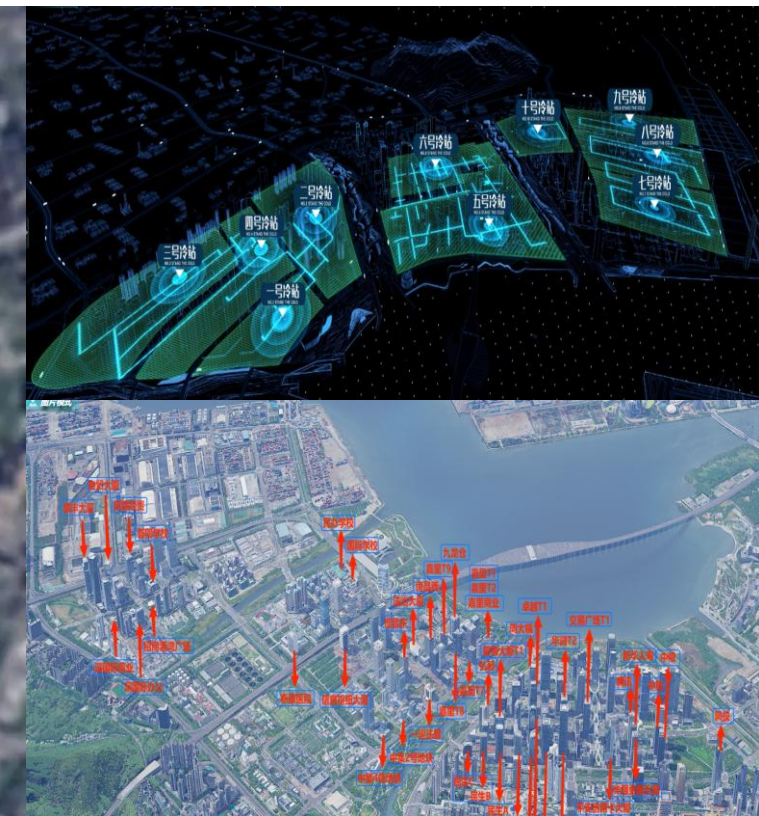
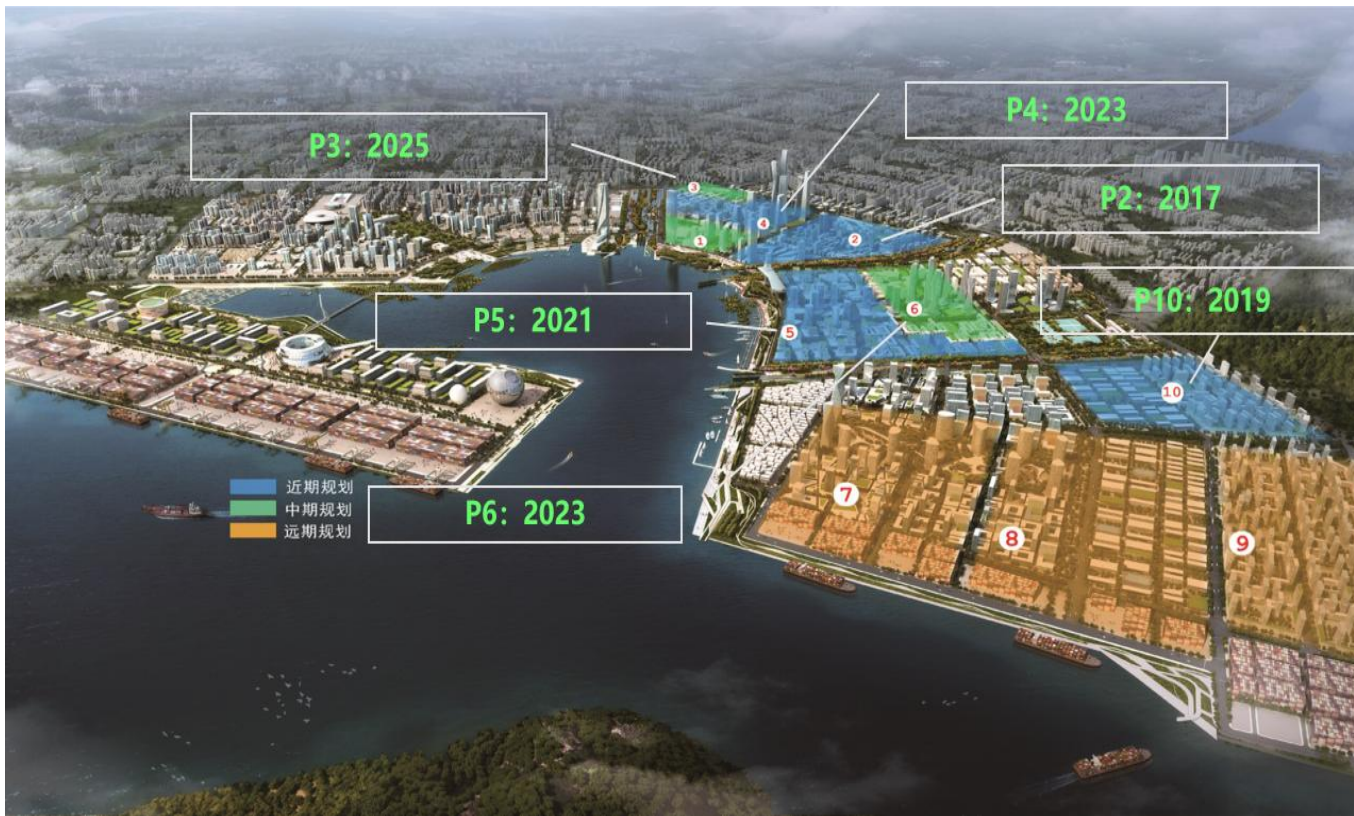
District cooling is a key infrastructure for green urban development in China. Below are profiles of ten representative projects across the country.



Project Name	City	Core Technology	Key Feature
Shenzhen Qianhai	Shenzhen	Ice Storage	World's largest scale
Hong Kong Kai Tak	Hong Kong	Seawater Cooling	Major urban development
Guangzhou University Town	Guangzhou	Multi-Energy Synergy	Longest operational history
Guangzhou Zhujiang New Town	Guangzhou	Ice Storage	First underground garden-style center
Zhuhai Hengqin	Zhuhai	Natural Gas CCHP	Smart energy island foundation
Beijing Zhongguancun	Beijing	Reclaimed Water Source Heat Pump	Renewable energy model
Wuhan Optics Valley	Wuhan	Hybrid Cooling System	Diverse technological applications
Chongqing Jiangbei	Chongqing	River Water Source Heat Pump	Largest river water system in China
Sanya Yalong Bay	Sanya	Ice Storage	First in Hainan province
Shanghai Hongqiao Airport	Shanghai	Water Storage	Critical airport infrastructure

Summary: China's first district cooling project was put into operation in 2003. Over the past two decades, the industry has developed closely intertwined with regional economic development, climatic characteristics, and local supportive policies.

1.3 Overview of Qianhai DCS



Qianhai DCS is the first case in China to incorporate district cooling system into municipal facilities. **The cooling system is planned synchronously with urban planning, with reserved space for cooling stations and pipeline routes, and linked with land leasing.** Benefiting from policy support at all levels of government, the Qianhai District Cooling System stands as one of the most successful exemplars of district energy projects in China. Commissioned in 2017, it has achieved over **3,300** days of continuous, uninterrupted cooling operation to date.

Qianhai plans to build **10** plants with a total capacity of **400,000** RT, a municipal cooling pipeline network of about **90** kilometers, and a cooling service area of about **15** million square meters, making it the largest centralized cooling system planned in the world.

To date, **6** plants have been constructed, with over **20** kilometers of municipal cooling pipelines completed. Approximately **5.82** million square meters have signed access contracts, and the cooling service area has exceeded 2.2 million square meters.

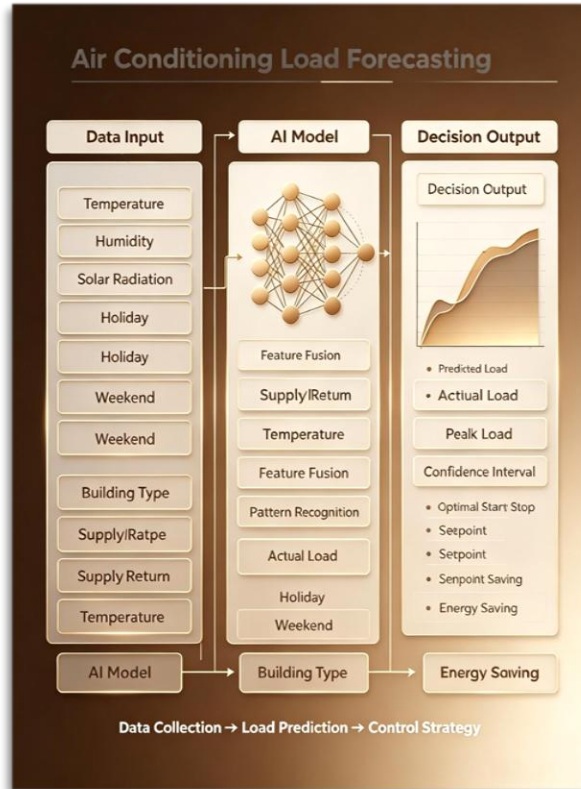


Our Understanding of Key Technologies for the Integration of District Cooling Systems and AI

2

- ☑ 2.1 AI' s View on AI & DCS Collaborative Development
- ☑ 2.2 Our Supplementary Viewpoints on AI & DCS Collaborative Development

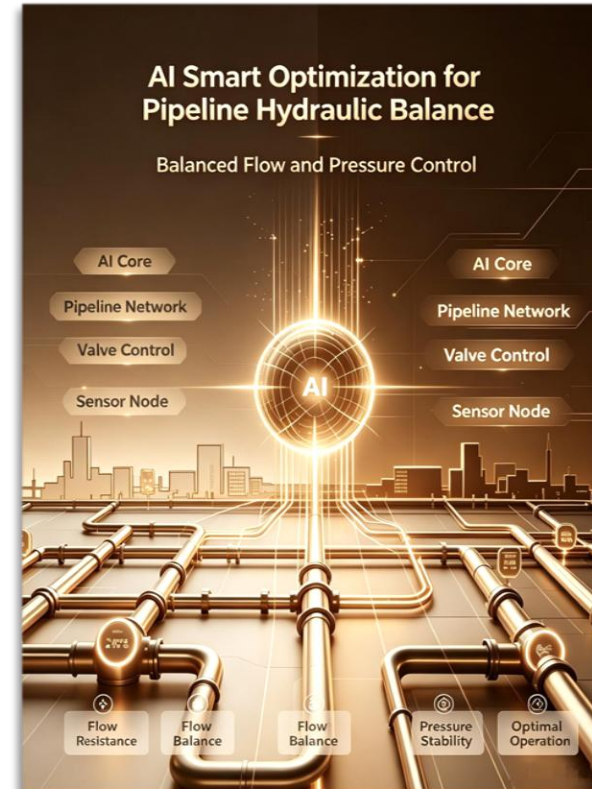
2.1 AI' s View on AI & DCS Collaborative Development



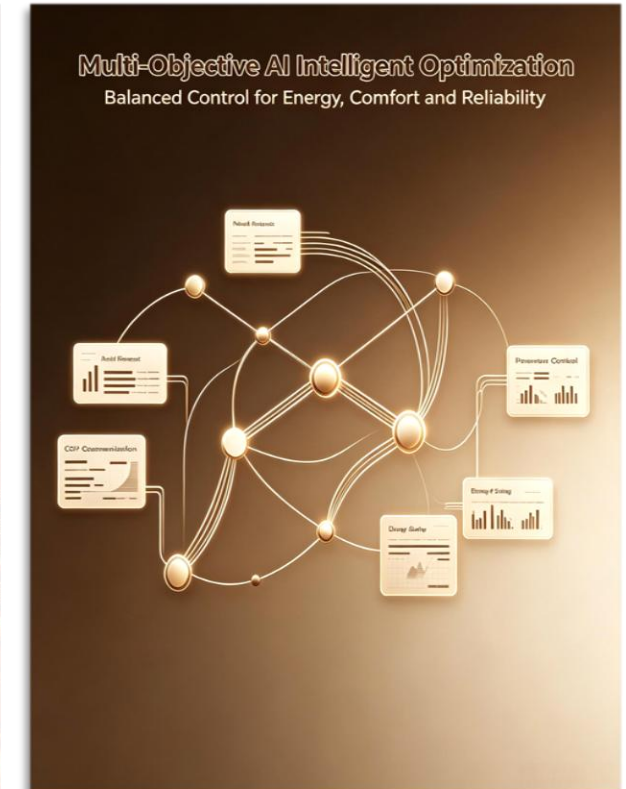
①Load Forecasting



②Chiller Group Control Optimization



③Pipeline Hydraulic Balance Optimization



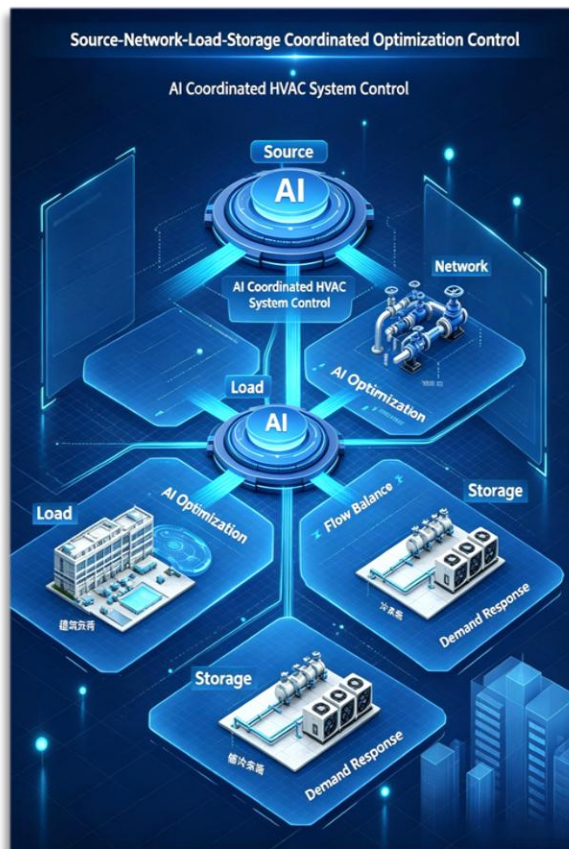
④Multi-Objective AI Optimization

Summary: From the AI perspective, AI excels at driving district cooling systems toward energy conservation, efficiency improvement and sustainable development via precise prediction, chiller group control optimization, pipeline hydraulic balance optimization and multi-objective optimization.

2.2 Our Additional Viewpoints



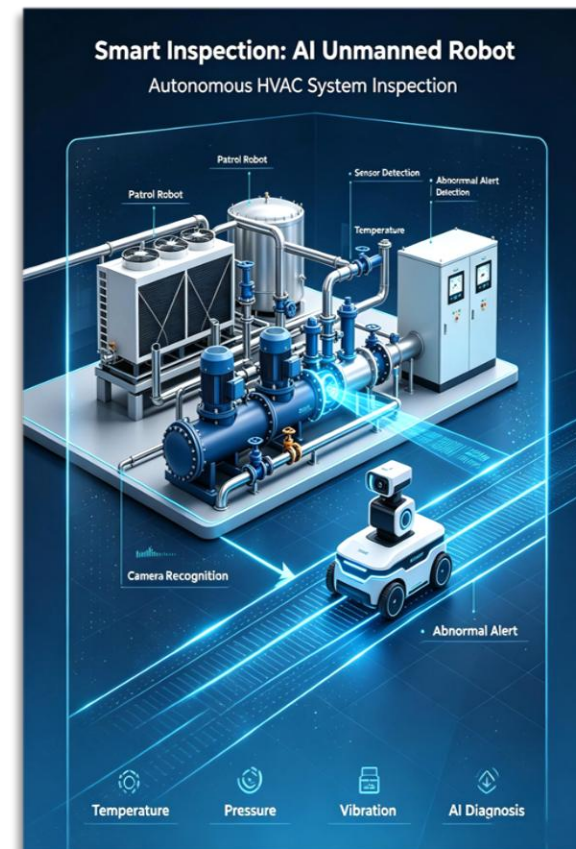
⑤ Optimal Design of Intelligent Control



⑥ Coordinated Optimal Control of "Source-Network-Load-Storage"



⑦ Optimization of Interconnected Scheduling for Multiple Cooling Stations



⑧ AI Inspection Robot & Intelligent Fault Diagnosis

The Ultimate Form = ① + ② + ③ + ④ + ⑤ + ⑥ + ⑦ + ⑧



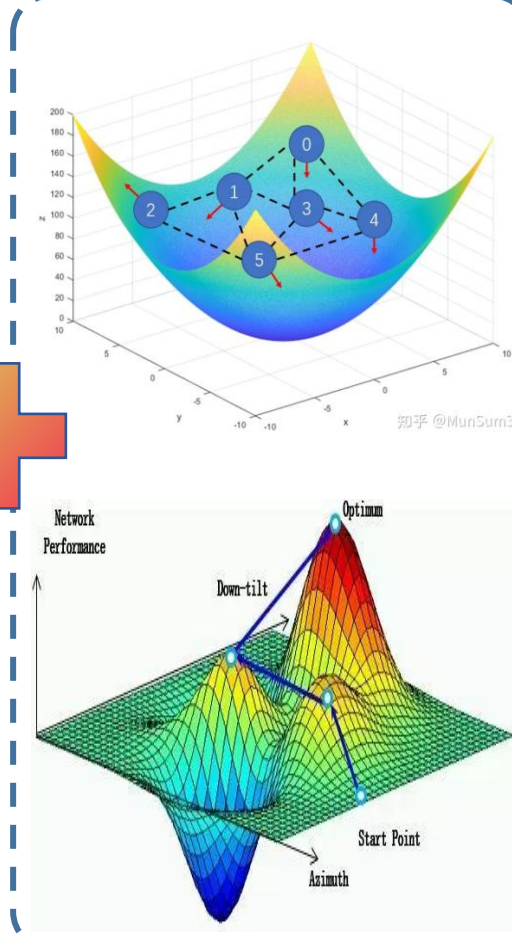
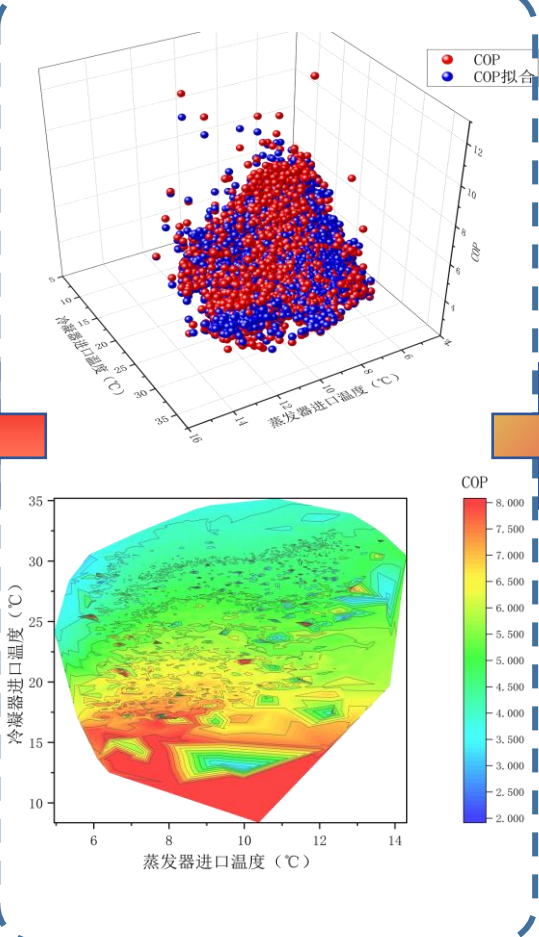
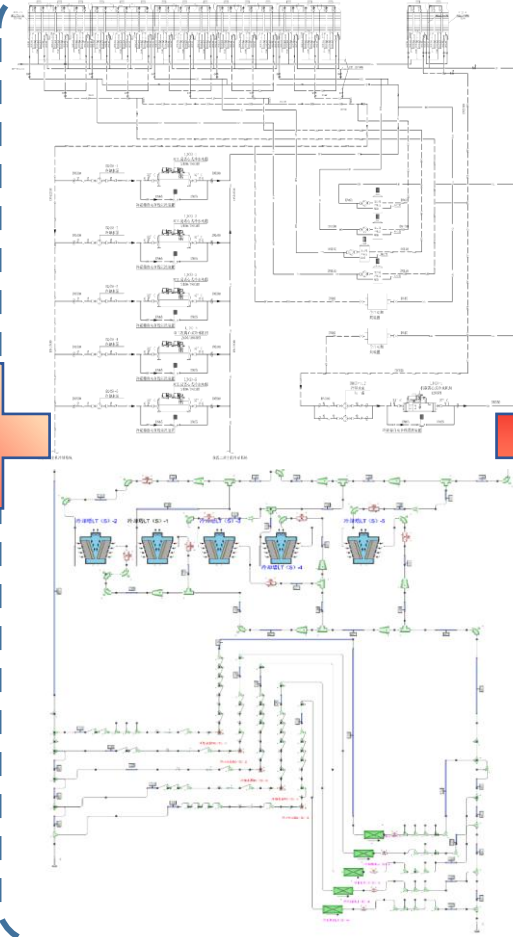
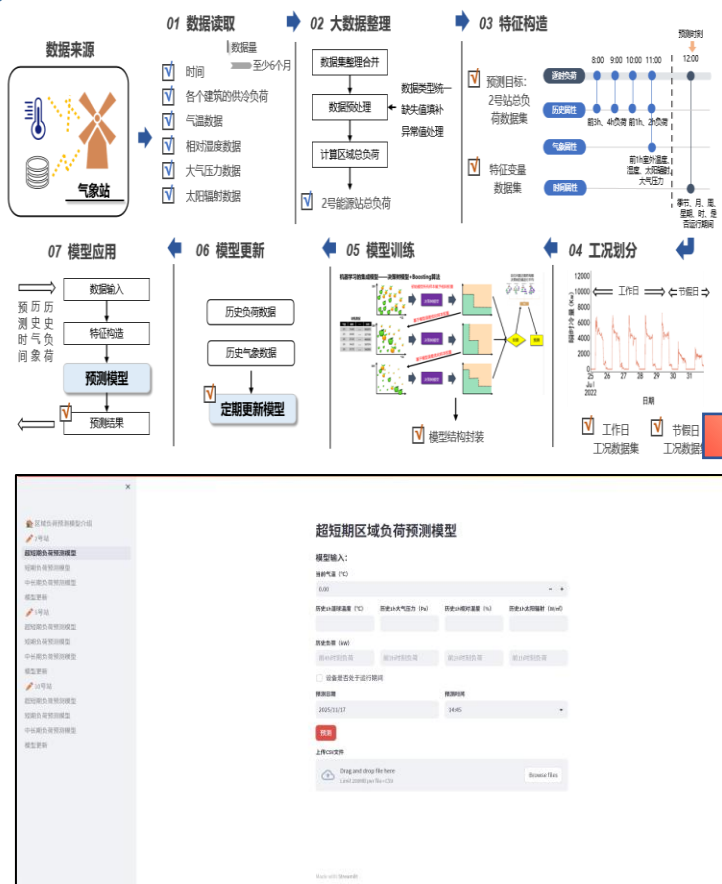
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Practices and Prospects of Collaborative Use of District Cooling Systems and AI- Case Study: Qianhai DCS

- ☑ 3.1 Qianhai Practice of Collaborative Development Between AI and DCS
- ☑ 3.2 The Application Outcomes of Qianhai Practice
- ☑ 3.3 Prospects for the Future Development of District Energy

3.1 Qianhai Practice of Collaborative Development Between AI and DCS

100% independently developed



① Data-driven load forecasting

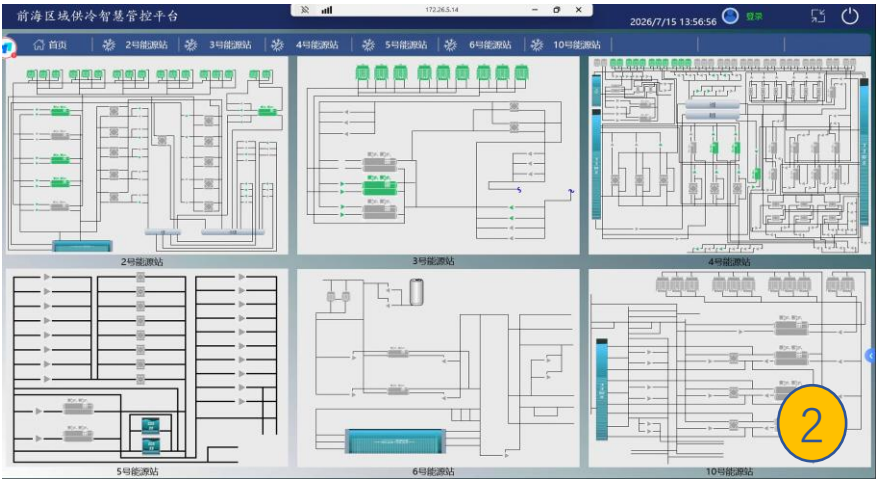
② Hydraulic Modeling Based on As-Built Conditions

③ Equipment Performance Based on Actual Test Data

④ Algorithm Based on Global Optimization

The Qianhai Practice = ① + ② + ③ + ④ + ⑤ + ⑥ + ⑦ + ⑧

3.1 Qianhai Practice of Collaborative Development Between AI and DCS



⑤ Centralized Management Platform for Multiple Chiller Plants

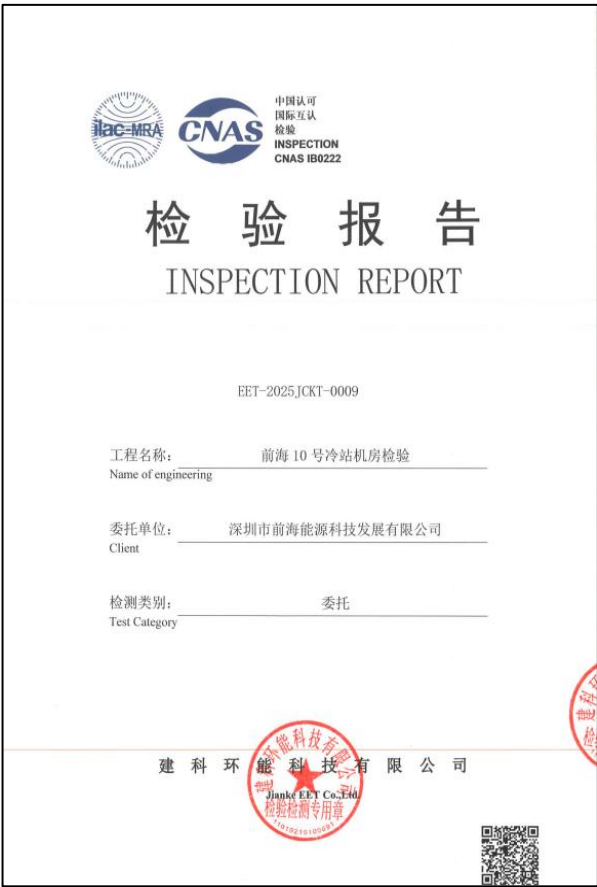
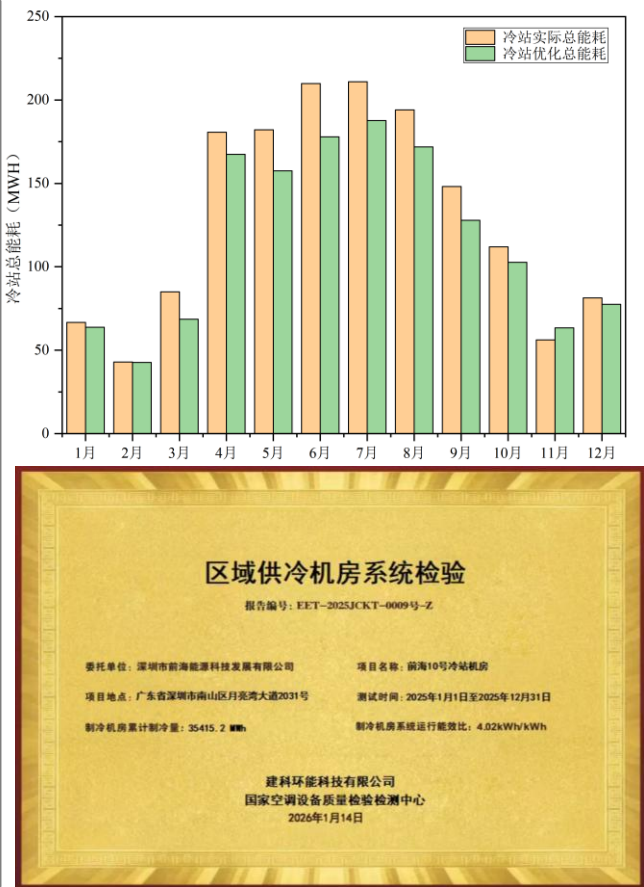
⑥ Centralized Control System for Multiple Chiller Plants

⑦ AI Inspection Robots

⑧ AI Fault Diagnosis system

The Qianhai Practice = ① + ② + ③ + ④ + ⑤ + ⑥ + ⑦ + ⑧

3.2 The Application Outcomes of Qianhai Practice



建科环能科技有限公司 Jianke EET Co., Ltd.	
报告编号 (No.): EET-2025JCKT-0009	第1页 共12页 (Page 1 of 12)
委托单位 (Client)	深圳市前海能源科技发展有限公司
地址 (ADD)	广东省深圳市南山区南山街道兴海大道 (前海自贸大厦) 31楼
工程名称 (Name of engineering)	前海10号冷站机房检验
工程地点 (Place of engineering)	广东省深圳市南山区月亮湾大道2031号
检验 (Testing)	日期 (Date) 2025-07-31~2025-12-31
	项目 (Items) 综合性能、效果检查 (制冷机房累计制冷量、制冷机房累计耗电量、制冷机房系统运行能效比)
	依据 (References) GB/T 17981-2007《空气调节系统经济运行》 EET-3327A-1《制冷机房性能现场检验方案》 《前海10号冷站机房项目现场检验方案》
	仪器 (Equipments) 电能质量分析仪 (GH-25)、温度记录仪 (GH-112-3、GH-112-4)、超声波流量计 (GH-118)
检验结论 (Conclusion)	
通过对深圳市前海能源科技发展有限公司制冷机房进行检验, 得到如下检验结论: 1) 现场仪表准确性满足《前海10号冷站机房项目现场检验方案》中的要求; 2) 2025年1月1日至2025年12月31日期间历史数据的检验结果为: 制冷机房累计制冷量为35415.2 MWh, 制冷机房累计耗电量为8802.9 MWh, 制冷机房系统运行能效比为4.02 kWh/kWh.	
批准: 审核: 主检: 检验日期: 2026-01-08	

The strategy reduced energy consumption by an average of **8.1%**, compared to the original.

Qianhai DCS meets Shenzhen's **Class 1** energy efficiency standards for chilled plants.

Qianhai Energy won WGDO's International Contribution Award for Green Design, the first recipient from China's district energy sector within 25 years.

Social benefits

深圳市气象局 (Shenzhen Meteorological Service)

三 首页 气象服务 信息公开 政务服务 互动交流 网站地图 特色服务

天气查询 天气、气象服务、气象数据、气象站查询

天气查询

要素 气温 日照量 降水雨量 湿度 气压
能见度 风速风向
0101 日照量 日照时数

时间 2025-06-18 15:40

区域 深圳 福田 罗湖 南山
龙岗 宝安 龙华 光明
盐田 坪山 大鹏 深汕

所有

气温 (单位: °C) 数据时间: 2025-06-18 15:40

区县排名

排名	区县	温度
1	龙岗区	29.3
2	盐田区	30.2
3	新罗区	29.3
4	龙岗区	30
5	福田区	30.1
6	龙岗区	30.1
7	龙岗区	31.1
8	龙岗区	28.6
9	龙岗区	28.5
10	龙岗区	31.4
11	龙岗区	29.1
12	龙岗区	31.3
13	龙岗区	30.2
14	龙岗区	29.6
15	龙岗区	28.3

气温 0 22 24 26 28 30 32 34 36 >38 °C

来源: 深圳 (2024) 数据: 来源: 深圳 (2024)

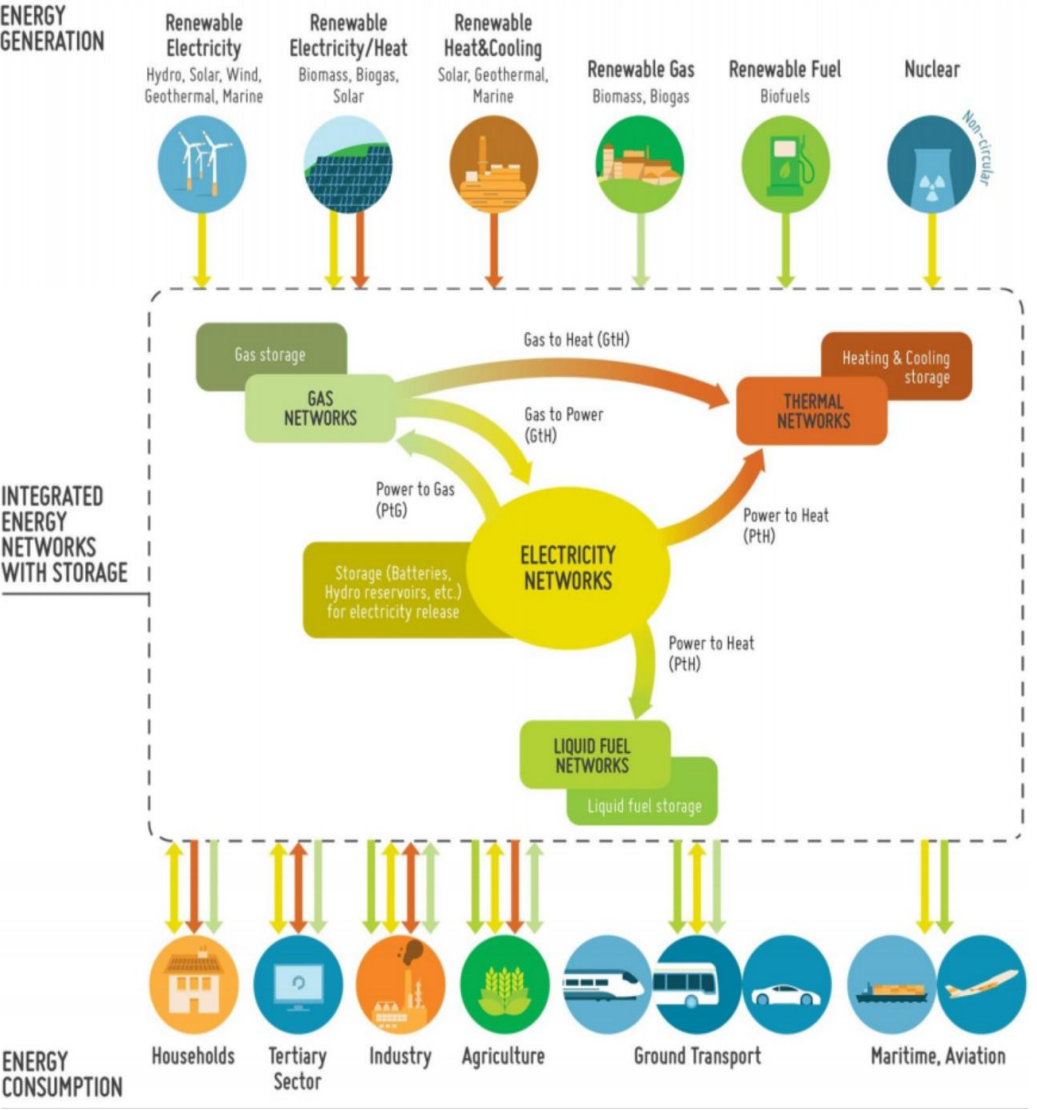
Economic benefits

Eco benefits

交易编号 NO.	
	
绿色电力证书交易凭证 GREEN ELECTRICITY CERTIFICATE TRANSACTION VOUCHER	
购买方 单位(个人): 深圳市前海能源科技发展有限公司 购买绿证数量: 10000个	
10000兆瓦时	
生产方 项目名称: 广东省陆河抽水蓄能电站项目 项目编号: PPC23-00000000000000000000 项目类型: 太阳能发电 项目所在地: 广东省揭阳市普宁市流沙镇 电量生产日期: 2024年07月 交易平台: 广州电力交易中心	
 扫码查验真伪	有效期 [2024]第[]号 绿色电力证书

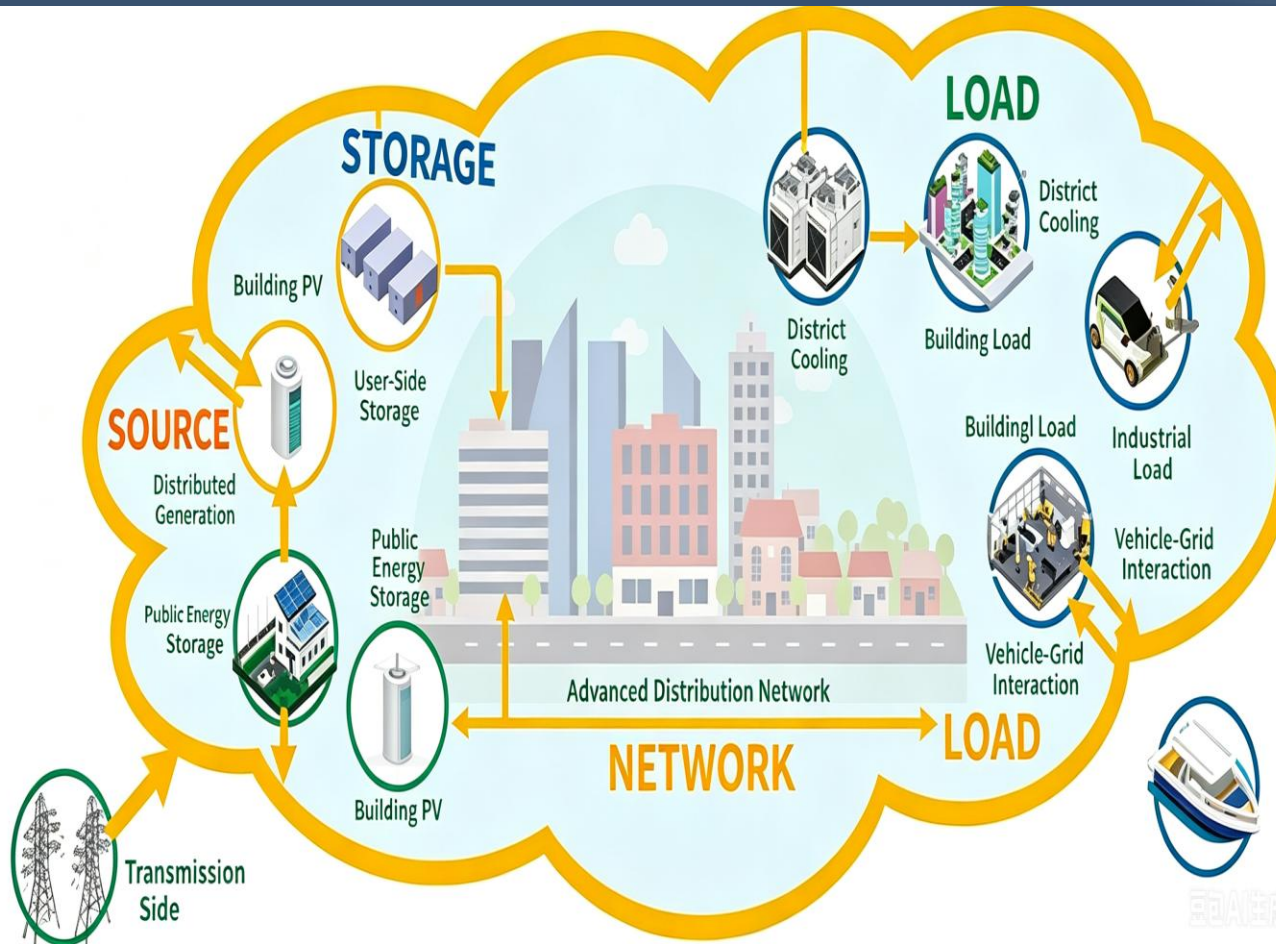
深 圳 市 住 房 和 建 设 局 联合发布
深圳市前海深港现代服务业合作区管理局

3.3 Prospects for the Future Development of District Energy (European Union)



Summary: A low-carbon, secure, reliable, resilient, accessible, cost-efficient, and market-based integrated energy system.

3.3 Prospects for the Future Development of District Energy (QianHai)



Source-Network-Load-Storage Integration: Optimize resources of power sources, distribution networks, loads and energy storage to achieve high integration, deep coordination and intelligent control of all segments.

Multi-energy Complementation: Power-centric complementary utilization of multi-grade energies: wind, PV, hydrogen, natural gas, sewage waste heat and cold energy.

3.3 Prospects for the Future Development of District Energy (QianHai)



Carbon Reduction



Multi-functional, complementary integration demonstration

Electricity, Wind Energy, Solar Energy, Energy Storage, Gas, Cooling Systems, Wastewater Treatment

Local renewable energy sources
Power Generation Share

≥ 8%

Reducing carbon emissions annually
Minimum:

52,000 tons

Building Integration
Proportion of photovoltaic installations

100%

mass transit
Clean Energy Ratio

100%

Efficiency Enhancement



Municipal Complex

Energy supply available nearby; highly efficient and intensive utilization.

Regional cooling system + Water-source heat pump

- The regional cooling system is more energy-efficient than installing separate central air conditioning systems in each individual building.
- The water-source heat pump utilizes wastewater from water purification plants to reduce both electricity consumption and cooling water usage in refrigeration systems.

Quality Upgrade



High-quality power supply leadership zone

Average power outage duration per customer

≤ 5 minutes

High-Level Charging Service Demonstration Zone

Full coverage of supercharging

Parking lot charging station utilization rate

≥ 40%

High-quality regional cooling services

- All eligible commercial office buildings and other public structures are included in the regional cooling coverage area.

Smartification



Precise energy detection throughout the entire system

intelligent management

Centralized management across the entire system, achieving intelligent integration of "source, grid, load, and storage".

Large Urban Area Energy Aggregation Demonstration Project

Industrial and commercial buildings possess the following characteristics:

electrified wire netting
Proportion of friendly and interactive interfaces

100%

Car Network
Interaction Ratio

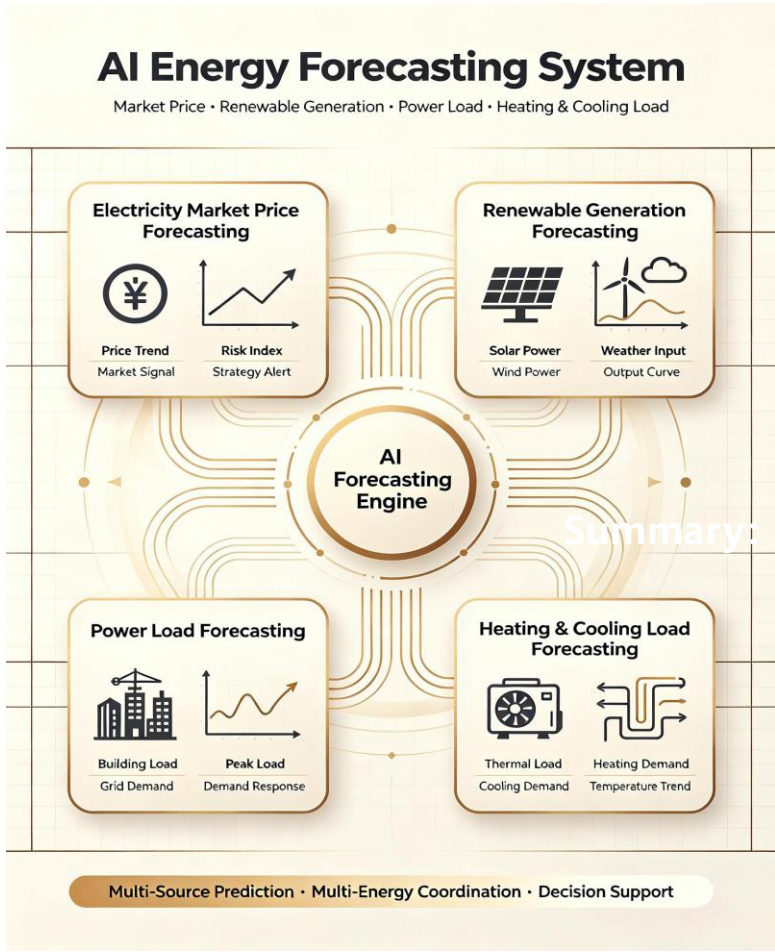
100%

Flexible adjustment capability

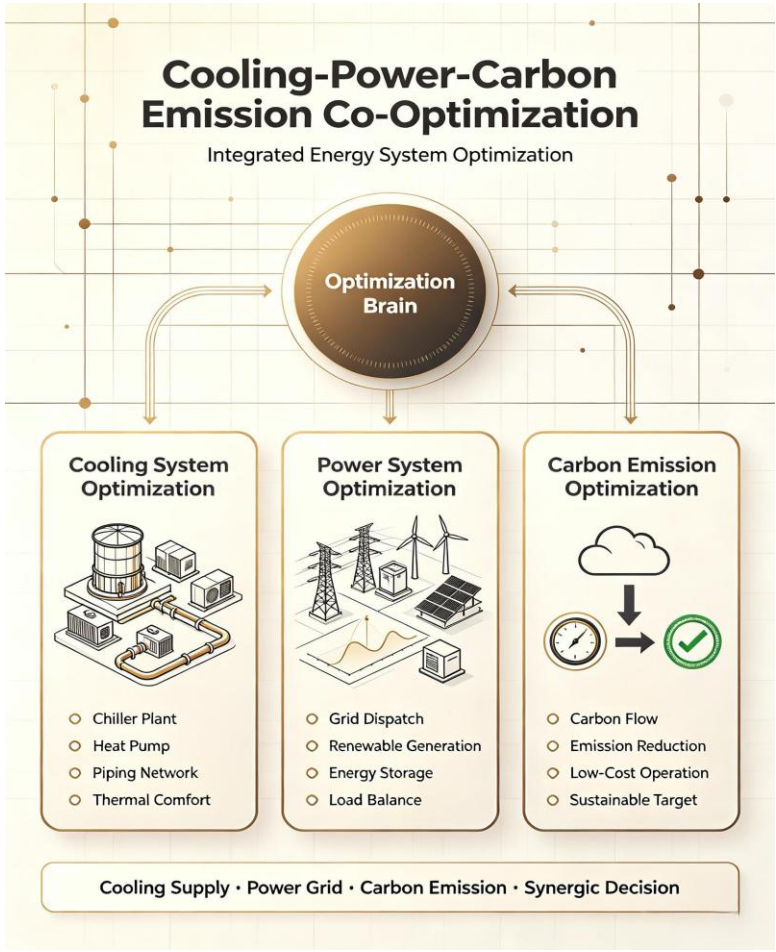
≥ 10% of maximum load

Core Objective: Achieve 100% local consumption and efficient utilization of renewable energy, and comprehensively enhance the resilience, security level and flexible regulation capability of the system.

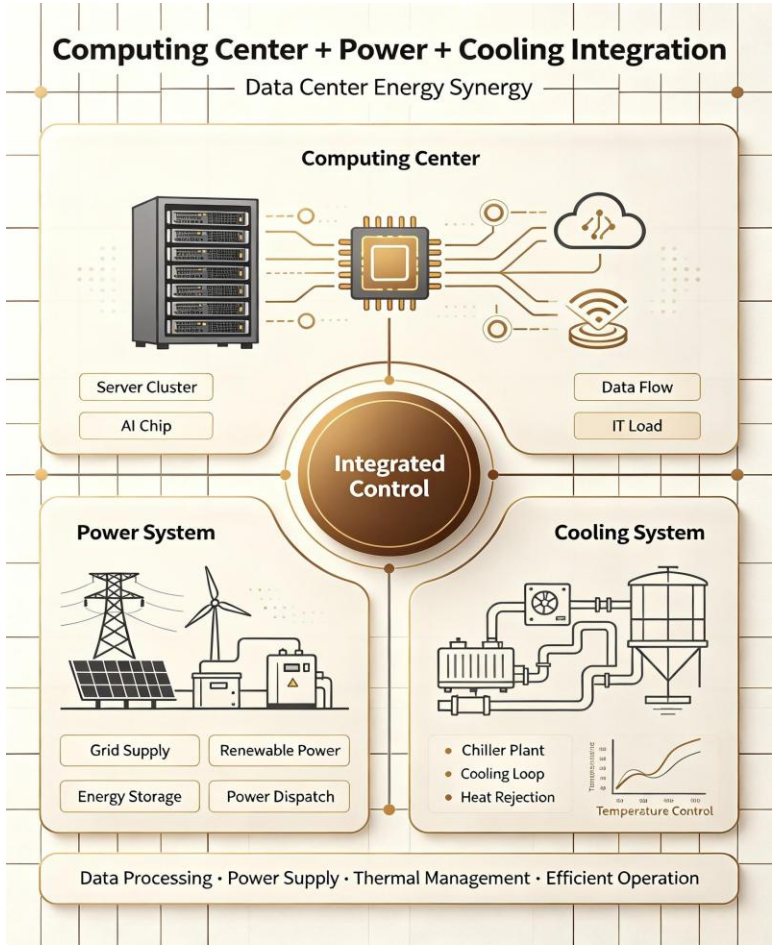
3.3 Prospects for the Future Development of District Energy (QianHai)



① Coupling of Four Types of Trend Forecasts



② Balance of Three Types of Value Optimization



③ Linkage of Three Types of Application Scenarios

Summary: Our outlook for the future development of district energy lies in Source-Network-Load-Storage Integration and the application of the 4+3+3 framework.

Thank You

■ 近期规划
■ 中期规划
■ 远期规划

前海能源
QIANHAI ENERGY