Stakeholder Coordination in District Energy Systems

The case of Combined Cooling, Heating, Power “CCHP” in Hengqin, Zhuhai (China)

Kenny Kun Yan / Vice President

Zhuhai Hengqin Energy Development Co., Ltd.

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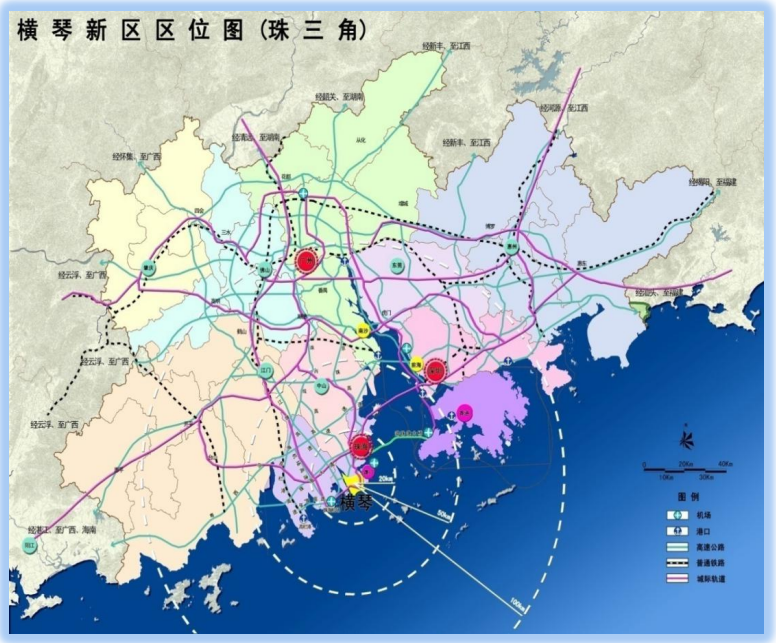
Project Background

- Situation of Hengqin before development:
  - •An uncultivated island, 106 square miles.
- Location of Hengqin Island:
  a. Coastal island in the Big Bay Area, Southern China
  b. Walk distance to Macau
  c. 34 nautical miles away from Hong Kong
  d. Connected with Hong Kong by the famous Hong Kong-Zhuhai-Macau Bridge
- Climate Conditions:
  a. Typical Subtropical Oceanic Climate
  b. Annual Average Temperature: 22.5 °C
  c. Highest at 38.5c in Aug. and lowest at 2.5 °C in Jan.



Project Background

- District Positioning:

a. Pilot free trade zone at the world level
b. International Tourism centre
c. An ecological and smart Island, complying with the National Initiative of Innovative-driven and Green Growth

- Energy Supply:

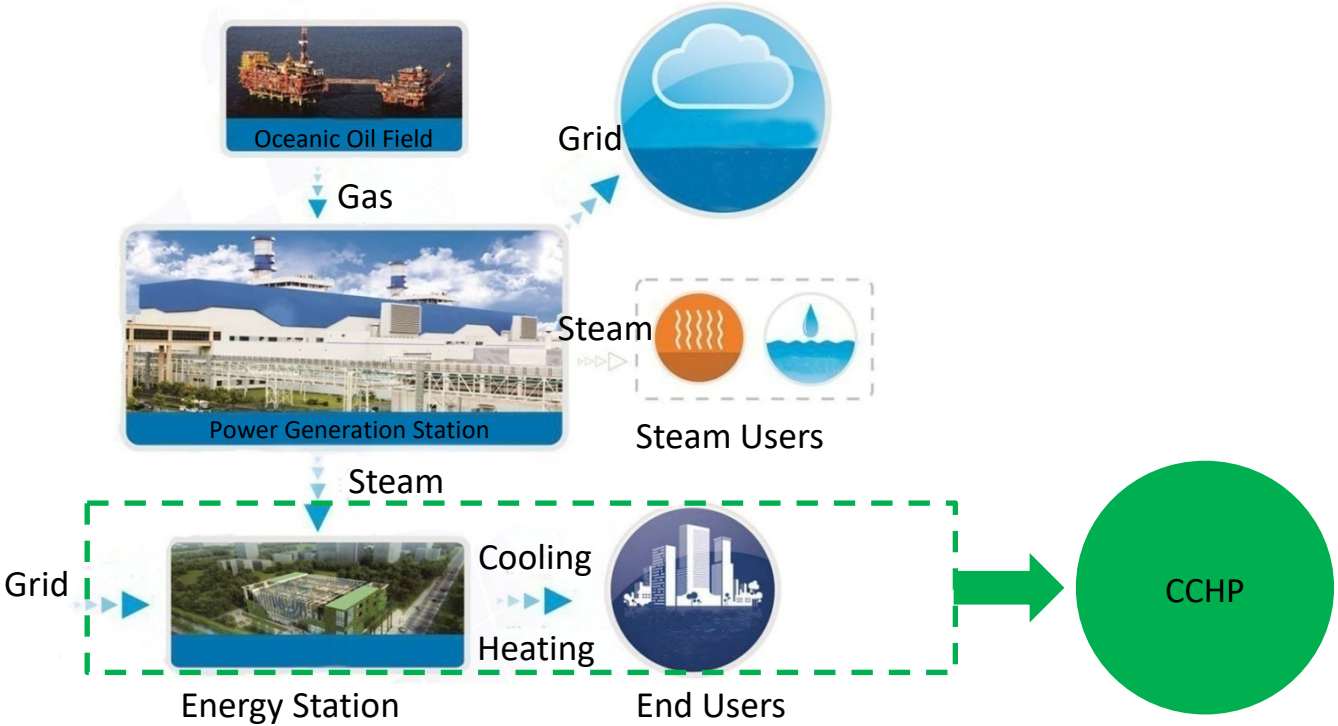
a. Demand for an additional Green Power Station
b. The capability of instantly adjusting electric peak and load for the grid of the Big Bay Area
c. Cooling/heating in need: 30 million square meters construction area, including commercial and municipal buildings

Be Positioned as A Top-level District Globally

CCHP(gas powered) Project: An inclusive decision for the Green Energy Supply

Project Description (I/II) – General aspects

- Outline of CCHP General Process Flow:



Project Description (I/II) – General aspects

- **Business Model: BOO**
  ----Build, Own and Operation

- **Executor of CCHP:**
  ZhuHai Hengqin Energy Development Co. Ltd (HQED):

  •SPIC Guangdong Electric Power Co., Ltd. (55%)
  ----National state-owned Energy Enterprise

  •Zhuhai DaHengQin Ziye Investment Co. Ltd. (45%)
  ----Local city-owned Investment Enterprise

Project Description (I/II) – General aspects

- Snapshot of CCHP:
  - 1 Gas-powered station (2*9F Generators, 390MW)
  - 10 Energy Stations(500,000 RT, Designed Cooling Capacity)
  - Steam Pipe Network (32.5 kms, designed length)
  - Cooling/Heating Water Pipe Network
  - Distributed Control System（DCS）

Project Description (I/II) – General aspects

Features of Hengqin CCHP:

- Master plan in advance
- Consistent Support by the Government
- Construction in phases and steps
- Affordability Guarantied:
  - No higher than the overall level of costs of conventional in-house cooling investment
  - No higher than the industry level

Project Description (I/II) – General aspects

Features of Hengqin CCHP:

- Cascade use of Energy
  - ➢Absorption chillers-- low-grade energy reclaimed
  - ➢Primary energy efficiency rate at 73%.
- Thermal storage
  - ➢Electricity price package(peak, normal, valley price difference at 1:4:6）
- High Efficiency Electric chillers, pumps, cooling towers etc.
- Charging Package:
  - ➢Capacity charge
  - ➢Metering Charge

- **About 30% Electric Chillers of that of Conventional In-house Cooling Capacity**
- **Phenomenal mitigation in terms of the use of HFCs**

Project Description (II/II) – Main achievements

Some Figure on the End Users:

1. Current end-users: 33 users, registered cooling load at 80,000 cooling tons;
2. Contract signed: 59 subscribers with contracts of 158,800 cooling tons.
3. Development of users: 126 users, estimated at 280,000 cooling tons, commercial and municipal buildings.

Beautiful crown buttonwood Building

Hengqin International Financial Center

Hengqin Science and Technology Innovation Center

Guangdong and Macao Traditional Chinese Medicine Industrial Park

Xiangzhou Port cultural courtyard Street

Star arts creative Li Hengqin world

Zhuhai Fuying Business Resort Center

Hengqin Headquarters Building

Project Description (II/II) – Main achievements

Bright Future to Run for:

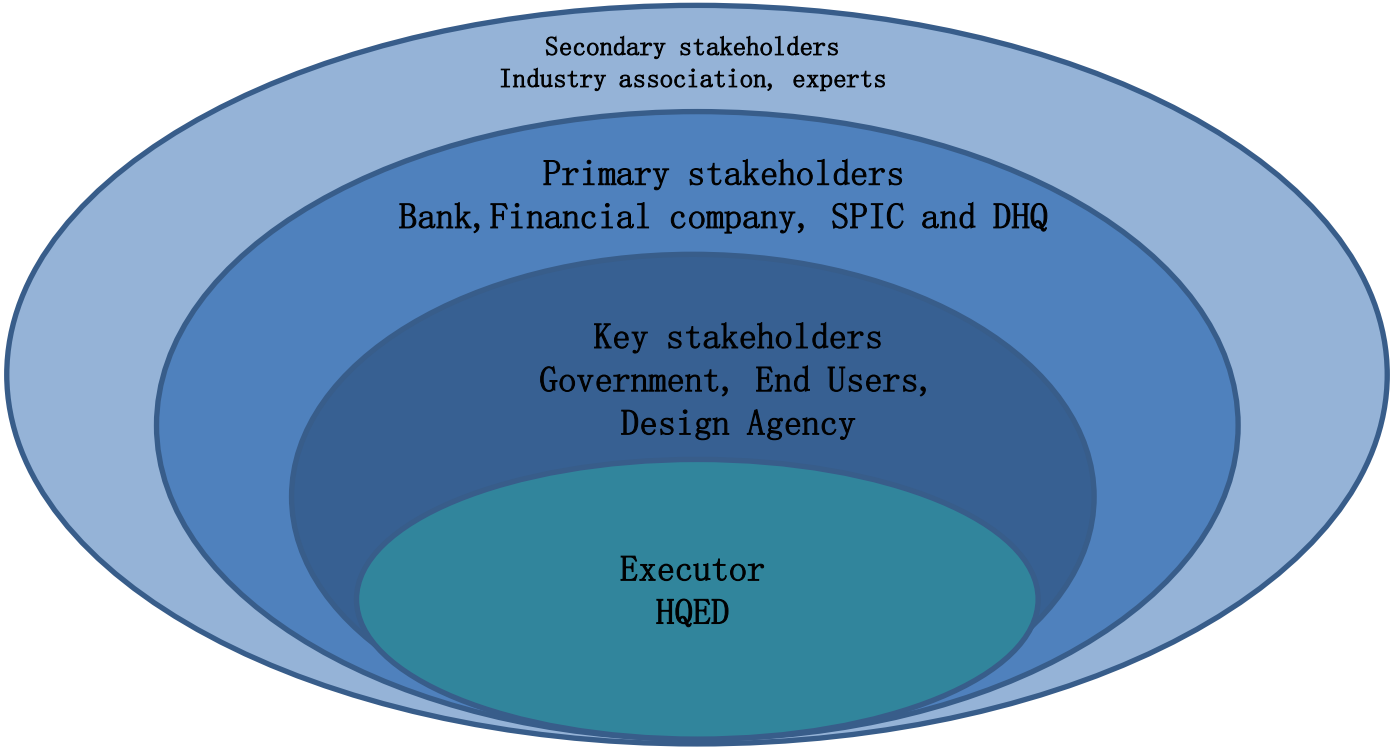
- Reduces the amount of electricity used for air-conditioning and cooling about 400 million kilowatts per year
- Reduces the use of 180,000 tons of standard coal
- Reduces CO2 emission by 480,000 tons and SO2 by 1,500 tons
- 144,000 square meters of conventional in-house cooling room were saved
- The reduced total investment in AC and refrigeration equipment for single buildings is about 2 billion yuan
- Reduced drift water loss used to replenish cooling towers by approximately 1.15 million tons per year

That's 26.23 million adult trees planted in urban areas

----Calculated as co218.3kg/year absorbed by an adult tree)

Stakeholders Coordination

Map of Stakeholders



Stakeholders Coordination

The Roles of Key Stakeholders:

- **Hengqin Energy Development Co. Ltd (HQED)**
  --CCHP Executor
  - Coordination with other Stakeholders;
  - Construction: full responsibility of project construction
    Project Plan and process management, Quality control, Budget Control, Construction Field management, Equipment Purchasing etc.
  - Operation: marketing, financing, pricing, mantainance, after-sales and extension services etc.
  - Compile and refine User Handbook, Technical Guidelines.

Stakeholder Coordination

The Roles of Key Stakeholders:

Hengqin Government:

- Policies: District master plan, regulatory detailed plan, Cooling/Heating Act, Green policies;
- Construction: supervision, review, and coordination;
- Operation: supervision and evaluation on HQED operation and cooling fees, financial support, acceptance of user complaints, market review and coordination.


珠海市横琴新区管理委员会文件

关于印发横琴新区区域供冷供热管理办法的通知

Stakeholders Coordination

The Roles of Key Stakeholders:

Design agency

----Architectural Design And Research Institute Co., LTD., Southern China University of Science and Technology

- Overall scheme designer of the project to ensure the scientific and advanced nature of the project design.
- Consultant to review, update and introduce industry's innovative technologies to help HQED upgrade the CCHP project level.

Market End-users

- Communication at early stage on cooling/heating system design
- Compliance to the Agreement (Heat exchange system runs properly)
- Information feedback
- Improvement suggestions

Key challenges & Lessons Learned

It is difficult to achieve the expected rate of return in the market cultivation period.

If necessary, construct tempo or mobile energy station to meet the small market demand in the early stage.

Construction of permanent station in stages and steps, with small mobile station in early stages, are beneficial for the financial performance.

For the pipe network project, it is difficult to coordinate with other projects in cross-construction.

If possible, incorporate the pipe network paving project, or pre-pave casing tube across main streets with the municipal road projects.

The lack of heat users leads to the negatively impact on the financial performance.

Recommendations

- Consensus in Project Functions and Features:
  - Clean & green (social benefits)
  - Smart (operation cost)
  - High efficiency (operation cost)
  - Security (critical feature of distributed energy project)
    a. Resilience
    b. Redundance
    c. Stable
  - Reasonable IRR (investor)
  - Affordable (end users)

For the key stakeholders:

Consensus implies investment, commitment, belief, and compromise;

Consensus matters in terms of increasing construction and operation efficency, reducing divercified costs, both tangible and intangible;

Consensus ensures the project's smoothness and feasibility.

Recommendations

Others:

- Strong support from local government
  - master plan, supervise, coordination, financial support, green policies, etc.
- Expertise in design, construct, operation, services etc.
- Expectation on return (social vs economic benefits)
- Green Financing (such as bond, fund) Carbon exchange program

THANK YOU !