Integrated Smart Energy

June, 2022

CONTENTS

PART 01

Overview of Integrated Smart Energy

1.1 Definition of Integrated Smart Energy

Based on the new generation of information technologies such as "cloud, big data, Internet of Things, mobile and intelligence(smartness) " power system, as the Center, can be closely coupled with natural gas network, heating network, industrial, transportation and building systems, for horizontal "complementation of diversity sources" of electricity, gas, heat and renewable energy, and vertical high synergy of "energy, power grid, load and storage" to form an energy service network (service) of two-way interactive concentration and distribution of production and consumption for clean, low-carbon, safe and efficient energy.

1.2 Overview of Integrated Smart Energy

Customize a comprehensive and integrated energy development strategy from "energy, power grid, load and storage":

☑ Transformation measures on the energy side:

PV curtain wall, roof PV, high efficiency centralized cooling system, etc.

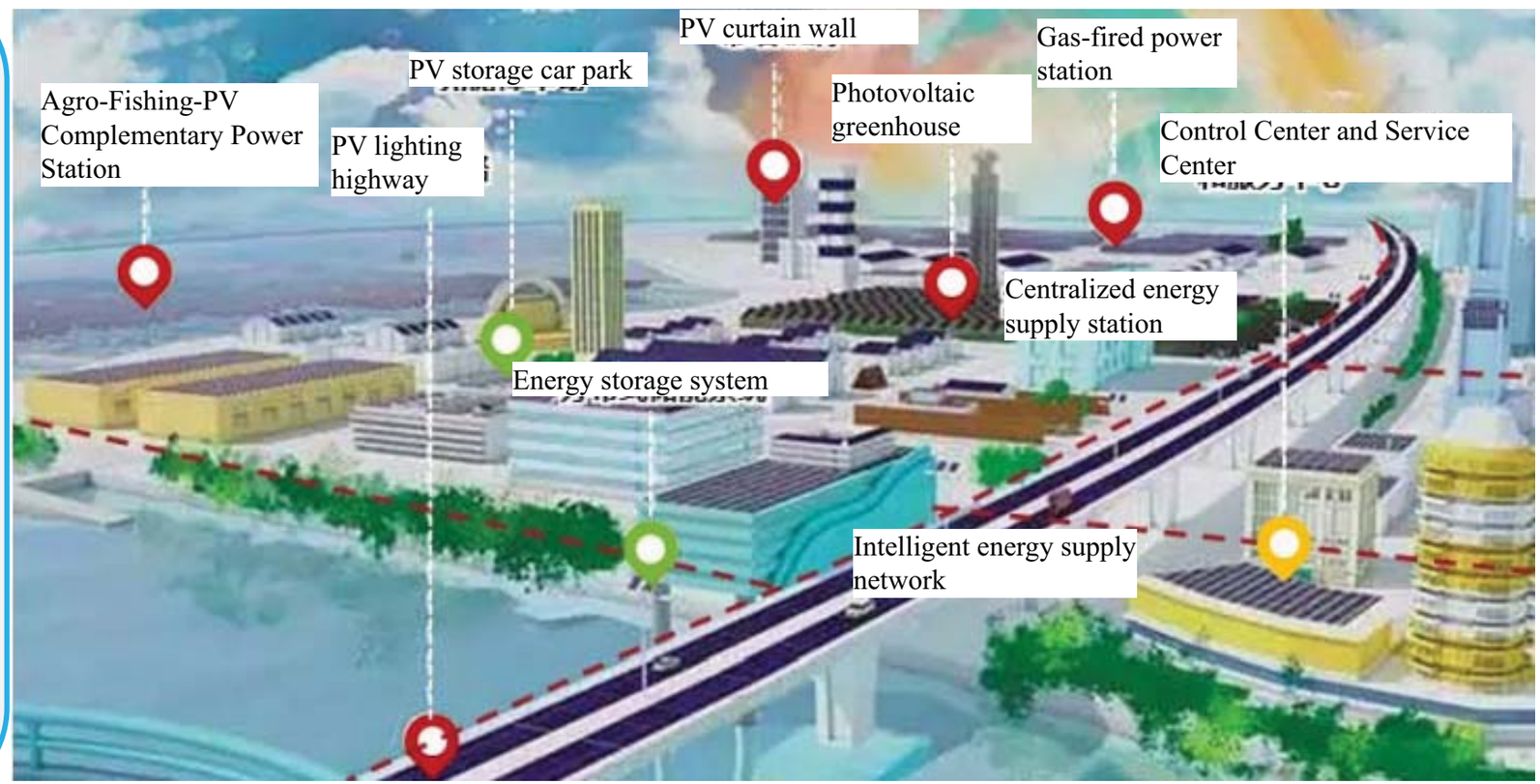
☑ Transformation measures on the energy storage side:

PV storage and charging car park, storage battery, etc.

☑ Integrated Smart Energy Control

Center and service center

☑ Intelligent energy supply network



1.3 Scope of Integrated Smart Energy Industry

- **Clean heating,** renewable energy heating, heat pump technology application, geothermal, intelligence, electrification, etc.
- A variety of energy supply services dominated by Distributed Turbine Multi-generation Natural Gas CCHP.
- **Energy storage** power side and user side peak regulation and frequency modulation project.
- **Development and Utilization of Hydrogen Energy:** Utilization of Industrial By-product Hydrogen, Renewable Energy for Hydrogen Production, Hydrogen Transportation, Hydrogen Storage and Hydrogen Filling.
- **Replace coal with electricity,** oil with electricity, gas with electricity, port shore power/transportation hub and integrated services, two-way inverter charging/discharging V2G energy service for electric vehicles, etc.
- **Comprehensive Utilization Project of Thermal Power Plant and Nuclear Power Plant:** an asset (project) providing comprehensive energy services for end-user (product). Comprehensive utilization of thermal energy in thermal power plant, nuclear energy for heating, seawater desalination, nuclear power for hydrogen production and so on.

Industrial Chain Collaboration Project: an asset (project) providing comprehensive energy service for end-user.

PART 02

Development Background of Integrated Smart Energy Industry

2.1 Low carbon, environment protection, energy conservation and emission reduction

Promote the energy consumption revolution

1. Improve the comprehensive utilization efficiency of energy through technological progress, promote the high-quality development of energy industry through technological and institutional innovation, and reduce emission of greenhouse gases and pollutants.
2. Guide and encourage the development and utilization of clean energy, new energy and renewable energy, improve energy utilization and reduce energy utilization path dependence.
3. Advocate "low-carbon and environment protection, reduce emission and curb unreasonable energy consumption", accelerate the formation of an energy-saving society, and build a good and sustainable energy consumption ecology, so that energy consumption can be controlled to a reasonable extent that population, resource and environment can bear.

2.2 Establish diversified energy supply system

Promote the Energy Supply Revolution

1. Expand supply channels and aggregate amount of all forms of energy, such as accelerating exploration and development of domestic oil and gas, coalbed methane and shale gas to provide strong support for the aggregate energy supply.
2. Through establishment of the State Piping Network Corporation, construction of natural gas production, supply, storage and marketing system has been accelerated to improve the proportion of natural gas in primary energy consumption and gradually reduce the proportion of coal.
3. It is necessary to speed up the transformation of energy production and consumption and provide new energy forms and utilization modes for green development. New energy sources such as nuclear energy, hydrogen energy and renewable energy (including hydropower, biomass energy, solar energy and wind energy) will gradually replace traditional fossil energy to achieve a low-carbon, clean, safe, economical, convenient and sustainable energy development and utilization;
4. strengthen construction of energy transmission and distribution network and reserve facilities.

2.3 Drive Industrial Upgrading

Promote the Energy Technology Revolution

1. Launch a revolution to increase production of new energy such as nuclear energy, wind energy, solar energy, hydropower, biomass energy and renewable clean energy with no carbon or less carbon, and launch a revolution to reduce conventional fossil energy such as coal and oil.
2. Technological innovation: break through the existing energy development technology, overcome the "bottleneck" problem in key technologies and make technological breakthroughs;
3. Use the new generation of information technologies such as Internet, cloud computing and big data to improve the flexibility, admission and supply capacity of energy systems, make the best use of intermittent distributed energy to build a diversified and sustainable energy supply system, fundamentally solve the problems of unsustainable energy resources and overwhelmed ecological environment for supply of green, low-carbon, safe and reliable energy.

2.4 Development of Energy on Fast Track

Promote the energy system revolution

1. Break new ground in energy management, industrial organization and market operation mechanisms, restore the attribute of energy commodities, increase competition and stimulate development.
2. Clarify the boundary between the government and the market, change the way of governmental supervision, break monopoly and further stimulate market vitality.
3. Reduce redundant construction and resource occupancy, reduce investment and operating cost, improve the allocation efficiency of oil and gas, and ensure their safe and stable supply.

2.5 Energy Security

Strengthen international cooperation in an all-round way to achieve energy security under open conditions

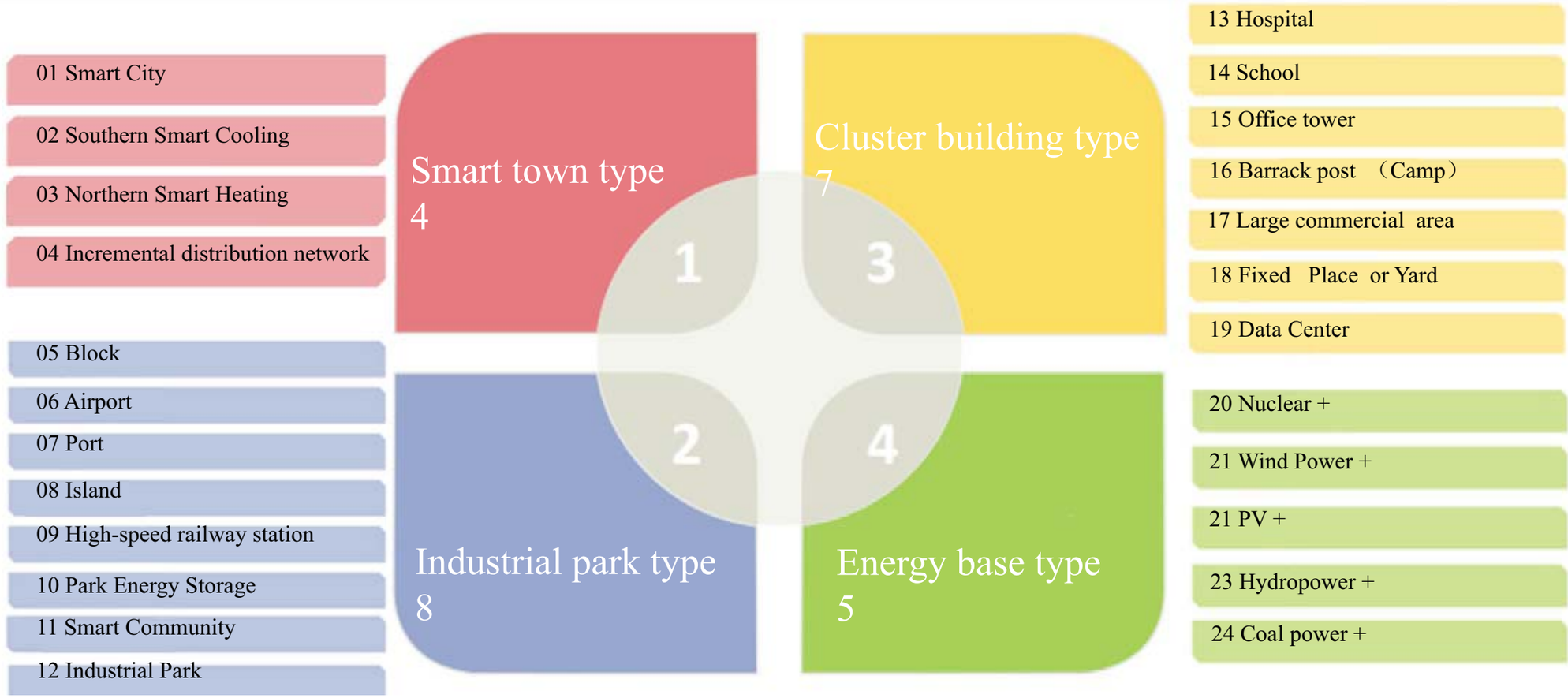
1. Ensure security supply of basic energy. China's dependence on import of oil and gas become increasingly higher and the world pattern is undergoing profound change, which is also the biggest challenge to the security of energy supply.
2. Promote upgrading of energy development technology through international cooperation, further improve energy utilization rate, promote the development and utilization of clean energy, new energy and renewable energy, and build a good and sustainable energy consumption ecology.
3. Digest and absorb global oil and gas exploration and development technologies, such as deep underwater oil and gas development technology, new energy development technology, energy reuse technology, etc., to promote the development of global energy technology.

PART 03

Typical scenarios and Cases of Integrated Smart Energy

Typical scenarios and Cases of Integrated Smart Energy

3.1 Overview



4 categories and 24 typical scenairos

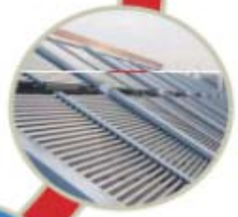
3.2 Smart Town

Facing the new and old city, According to the requirements of the construction of a **new smart city**, efforts will be made to solve the **pain points and difficult problems** such as large demand for energy, many kinds of energy, high environmental protection requirements and low comprehensive energy efficiency. Combined with smart buildings, transportation, information and other means, **an overall urban solution with energy security**, sustainable production, green environmental protection, energy conservation and high efficiency will be created.

Smart town type

01 Smart City

02 Smart Cooling



03 Intelligent cooling

04 incremental distribution network

3.2.1 Smart City

Scenario Introduction:

The customer is the local government, providing constructive comprehensive energy and industrial planning for the development of new urban areas.

It is **characterized** by the development model led by planning which will drive the project development while the project will improve the depth of planning.

3.2.2 Smart Cooling

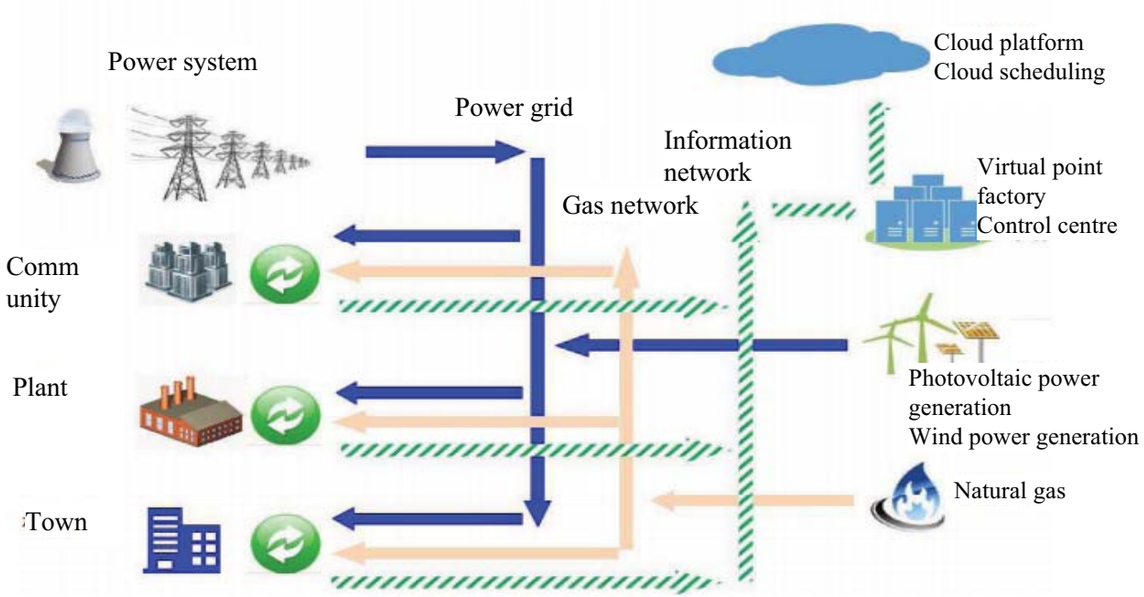
Scenario Introduction:

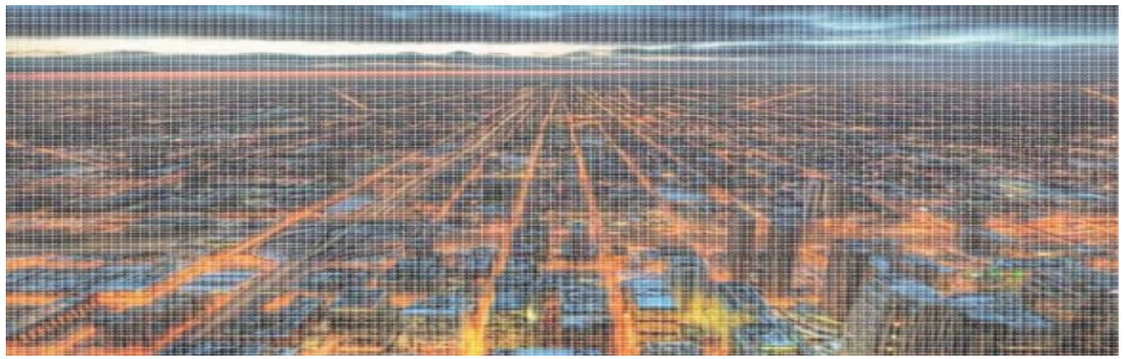
The characteristics of resources and loads can be studied by taking the cooling area as the research object, combined with the centralized cooling demand to solve problems of small scale, low energy utilization, extensive operation and management, and unfavorable marketization of decentralized cooling system. The overall solution of centralized cooling is provided with the waste heat utilization technology, gas cascade utilization technology and cold storage air conditioning technology of peak-valley difference.

3.2.3 Smart Heating

Scenario Introduction:

Problems such as mismatch of thermal power demand, high heat loss in each process, low proportion of clean heating and low intelligence are mainly solved by taking the heating area as the research object, combined with livelihood project and clean heating demand. Overall solutions for clean heat sources, efficient transmission and distribution networks, thermal stations and so on can be provided with the integration of electric power heating, industrial waste heating, biomass heating and the like technologies with business model.





3.2.4 Incremental distribution network

Scenario Introduction:

Problems such as how to complete the construction of incremental distribution network and ensure profitability in a legally-compliant manner by taking the incremental distribution network different from the traditional power grid as the research object, in combination with the demand of users to reduce the price of electric energy and improve the utilization rate of energy to provide legal technical solutions for power plant access and distributed grid connection, and provide business model solutions for comprehensive energy supply with network as the carrier to improve the overall profit level.

3.3 Smart Industrial Park

Facing industrial parks and high-tech parks, According to the **characteristics** of similar industrial agglomeration effect in industrial parks, aiming at the energy demand of different types of parks such as transportation, logistics, petroleum and petrochemical, and combining **the pain points and difficulties** of many types of energy consumption, poor resource sharing among enterprises, high energy consumption and high price, we will focus on **creating an overall solution of industrial parks** with hig energy reliability, cascade utilization and circular economy.

Industrial park type

Block 05

06 Airport

07 Port

08 Island

09 high-speed railway station

10 Park Energy Storage

11 Smart Communities

12 Industrial parks

3.3.1 Smart Block

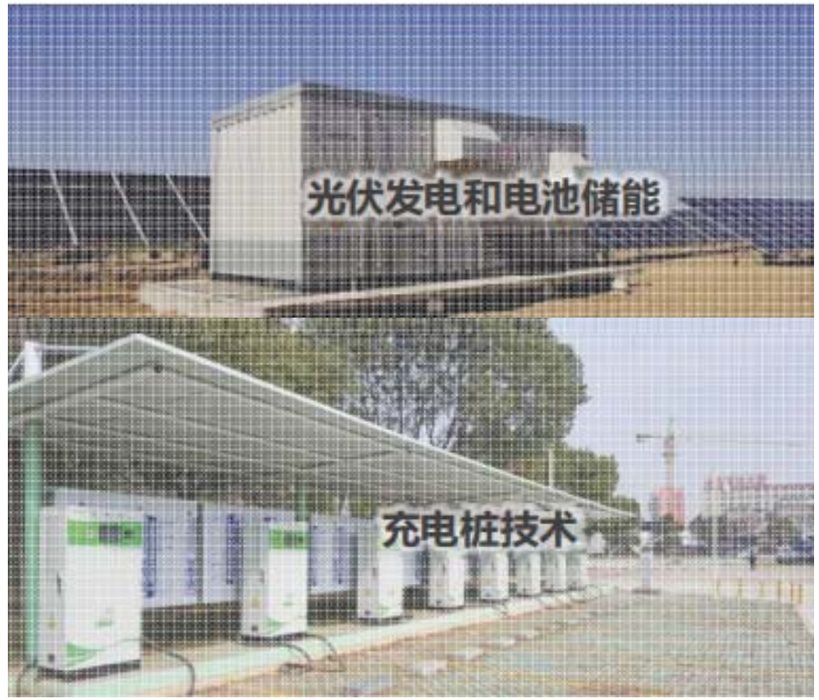
Scenario Introduction:

Problems of insufficient distribution capacity in the block, high electricity charges for users and difficult charging of electric vehicles can be solved by taking the supporting industrial and commercial users and their affiliated parking facilities in the block as the research object. And the overall solution of low-carbon energy consumption, electricity charge management for users and charging services for electric vehicles is provided in combination with distributed PV power generation, battery energy storage and EVSE(Electric Vehicle Supply Equipment) technology.

Block Case - Jimei Dahongmen DC PV Storage-Charging Integrated Power Station:

1.4-MWp PV + 12.7-MWh energy storage + 24×DC EVSEs are constructed for this Project with DC PV storage and charging power supply technology and have realized local consumption of distributed power and solved the problem of insufficient regional distribution capacity.

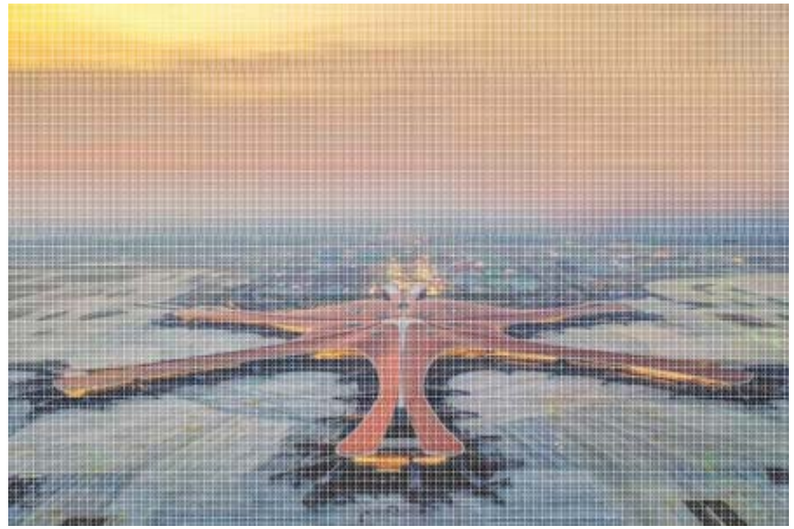
The Project has realized local absorption of distributed PV power generated and promoted the application of green power; the energy storage system can realize peak-valley price-spread arbitrage by absorbing valley power and releasing during the peak period, thus reducing the consumption cost of target commercial users in the block.



3.3.2 Airport

Scenario Introduction:

Provide "green" and "intelligent" energy supply by taking the energy supply of airport and airport economic zone as the research object to meet the diversified demand of airport energy and solve problems of high consumption of energy by airport, high consumption of energy by air conditioning equipment, low comprehensive energy efficiency and demanding environment protection, so that the airport and airport economic development zone can be provided with overall energy solutions by technical means such as building PV integration, shore power, ground vehicle oil to electricity combined cooling, heating and power supply, etc.



Airport Case - Comprehensive Energy Supply Project of Beijing Daxing International Airport

This Project has adopted roof PV and ground PV to generate power for their own use. In addition, the ground source heat pump + gas boiler + boiler waste heat recovery + ice storage can be organically combined to form a stable and reliable complex energy supply system so that ice storage is organically combined to form a stable and reliable complex energy supply system. The total utilization of renewable energy + clean energy can reach 12% and has overcome difficulties of high energy consumption in airport.

3.3.3 Port

Scenario Introduction:

Attention shall be focused to solve problems of high proportion of fossil energy such as diesel oil, serious environmental pollution and low degree of intelligence by taking water transportation hubs and port economic zones as research objects to provide an overall solution for port and logistics energy by combining technologies such as heavy truck exchange, unmanned driving, hydrogen energy and shore power with business model integration.

Port Case - Port Intelligent Charging for Heavy Truck

Intelligent charging is implemented for port vehicles and centralized planning of charging stations can realize unmanned operation in the full process of charging to meet the demand of 24-hour uninterrupted operation of vehicles by configuring auxiliary positioning of vehicles entering the station and intelligent charging equipment. The 5-minute fast charging experience and the super power of driving motor will effectively change the business model of port and highway transshipment logistics.

3.3.4 Sea Island

Scenario Introduction:

Problems such as high energy consumption cost, single guarantee mode and low energy utilization efficiency of existing islands can be solved by taking off-grid islands as research objects and multi-energy complementary solutions can be provided for islands.

Island Case - An Encampment Sea Island Micro-grid Project:

A hybrid complementary power generation system of wind - PV - diesel - storage is adopted for this project to meet the need of 72h power consumption in isolated islands and reduce the operation of diesel engines by using solar and wind energy as much as possible so that difficulties of high operation cost of diesel engines and single energy guarantee on the supply side can be overcome and a green power micro-grid can be established.

3.3.5 High-speed Railway Station

Scenario Introduction:

Efforts can be made to to meet the diversified energy demand, high energy consumption, high fluctuation of energy consumption, low comprehensive energy efficiency and demanding environment protection in high-speed railway station by taking energy supply of high-speed railway station hub and surrounding supporting businesses as the research object; air conditioning energy-saving technology, waste heat recovery technology, energy cascade utilization and the like means will be employed to provide overall energy solutions for high-speed railway station hub and surrounding supporting businesses.

Case of High-speed Railway Station - Comprehensive Energy Supply Project of Beijing South Railway Station:

The technology of natural gas CCHP + flue gas lithium bromide refrigeration unit can be adopted for this Project and roof PV can be equipped to generate power for their own use and sewage source heat pump can be equipped to achieve a comprehensive energy utilization efficiency of over 90% for cooling and heating peak-load regulation. Compared with the conventional system, the natural gas CCHP can save about 4.2 million kW · h per year. This has overcome the difficulties of high energy consumption and high demand for energy in high-speed railway stations.

3.3.6 Smart Community

Scenario Introduction:

Attention shall be focused to solve problems of water and power supply and traffic overload by taking the space carrier in confined areas as the research object to promote the large-scale application of new generation information technology, low-consumption and energy-saving equipment and intelligent equipment, guide end users to optimize the energy consumption structure, increase the proportion of non-fossil energy in end energy consumption and realize the transformation of energy structure.

Smart Community Case:

Vehicles in the smart community can realize automatic driving, and sensors, cameras and GPS navigation can enable electric vehicles to run safely and trouble-free on the route preset by the program. Establish a series of new smart communities based on "5G" Internet of Things technology, such as access control, street lamps, high-altitude monitoring, fire service and parking.

3.4 Smart Buildings

For group buildings, according to the functional **attributes of buildings**, aiming at the energy demand of different types of buildings such as hospitals and schools, and combining the **pain points and difficulties** of poor reliability, high energy consumption and high price, we focus on creating comfortable, convenient, reliable and **economical overall building solutions**

Cluster building type

13 Hospitals

14 Schools

15 Office Buildings

16 Barracks Post(camp)

17 Large businesses area

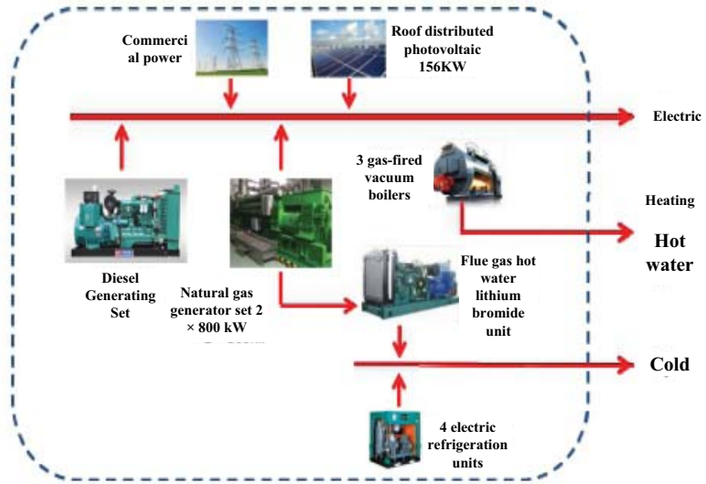
18 Fixed place

19 Data Center

3.4.1 Hospital

Energy consumption characteristic:

1. High energy density: energy consumption index of hospital building is about 1.6~2 times that of other public buildings and the highest energy consumption can reach 260 kWh/(㎡·a).
2. There are many categories of energy demanded: electricity, heat, cold, gas (steam), water, etc.
3. Safety and reliability require high rescue, surgery, ICU and other departments and equipment related to life safety; central monitoring and the like system equipment for extra and Grade I load need to ensure uninterrupted power supply.



Solution:

1. Build a distributed energy station to make full use of resources based on local conditions
   - ☑ Natural gas CCHP and roof PV
   - ☑ Water source heat pump, ground source heat pump and air source heat pump
   - ☑ Gas boiler and electric boiler chillers
   - ☑ Energy and cold storage
2. Energy-efficient transformation of system and equipment
3. Build a smart management and control system

3.4.2 School

Solution：

☑ Ground Source Heat Pump + Sewage Source Heat Pump can realize Centralized Energy Supply in Campus.

☑ The application of super energy element modular storage battery can store energy during low load at night and discharge energy during high load in the daytime to solve the problem of power supply gap.

☑ Roof distributed PV power generation can improve green power generated for their own use.

☑ PV storage and charging integrated station can create a green transportation system.

☑ Application of new technologies such as film-pressing power generation trails and smart street lamps

☑ Integrated Smart Energy Management and Service Platform

3.4.3 Office Tower

Solution：

Attention shall be focus to solve outstanding problems such as high energy consumption of office computers and air conditioning lighting by using PV curtain wall, intelligent management and control, integration of PV storage and charging, air source heat pump and the like means and to provide an overall solution for office towers with ultra-low energy consumption.

Case - Future Science City's Comprehensive Smart Energy Demonstration Project

In the first phase of the Project, 881.1kWp Roof PV +6.5kWp Ground PV + 2x1kW Breeze Wind Turbine + 150kW/300kWh Lithium Iron Phosphate Energy Storage System

In the second phase of the project, 800-m3 double water storage tank 15# building heating renovation + 50Nm3/h alkaline water electrolyzer hydrogen production + EVSE and 5G intelligent lamp pole + comprehensive intelligent energy management and control platform.

Upon completion of the Project, self-supply rate of the enterprise has reached 18% and some green buildings has been transformed and green power has been connected to the grid.

3.4.4 Large Businesses area

Solution:

Problems of large-scale commercial volume, complex functions and high energy consumption intensity can be solved by taking large-scale commercial complexes as the research object and overall solution of energy-saving commercial complex can be provided by means of EVSE, heat pump, energy storage system and intelligent management of car park.

Case - A Large Commercial Complex Project in Wuhan

Project Profile: The centralized cooling technology of high-efficiency screw chillers has been adopted for the Project and a centralized energy station has been set up, and it is divided into office and commercial areas for centralized cooling.

Operating Status: the annual operating earnings of the cooling system of this Project is better than that of general industrial and commercial buildings.

3.4.5 Fixed Place or Yard

Solution：

The problems of insufficient power distribution capacity, high demand for vehicle charging and high charging cost can be solved by taking fixed places or yards such as public transportation, logistics and sanitation as the research objects; in combination with distributed power generation, battery energy storage and EVSE technology, the overall solution of clean power consumption in fixed places and orderly charging of electric vehicles is provided under the condition of limited power distribution capacity.

Case: Zhongguancun Yanqingyuan Hydrogen Filling Station

Project Profile: The innovative demonstration project of Beijing Winter Olympics, the key special project of "Technology Winter Olympics -Hydrogen Energy Travel" of the Ministry of Science and Technology, and we participated in construction of intelligent network in the entire supply chain of production, storage, transportation and filling.

3.4.6 Data Center

Solution:

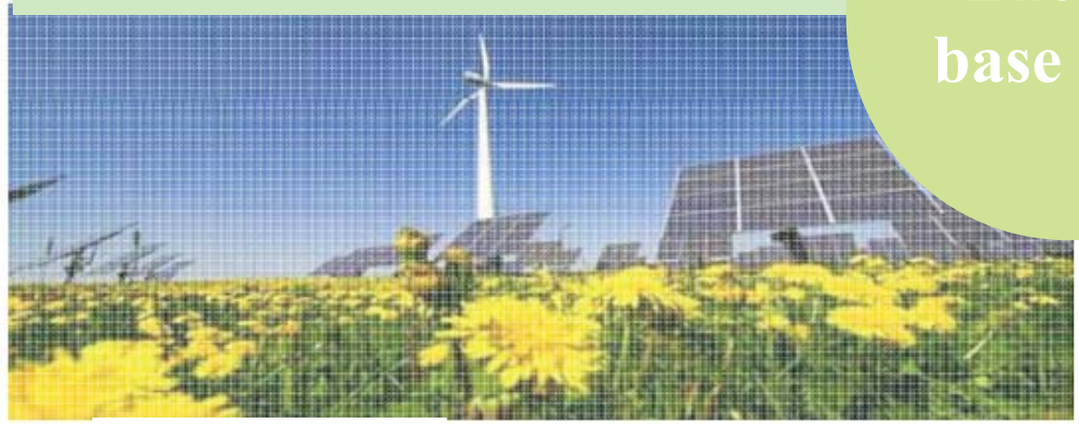
Problems of high energy consumption and small proportion of green energy in the data center can be mainly solved by taking newly-built or in-operation data center energy supply system as the research object and an overall solution based on clean energy such as natural gas and PV and taking into account natural cooling is provided in combination with the demand for electricity and cold energy in the data center.

Case: Energy Station Project of a Data Center in Beijing

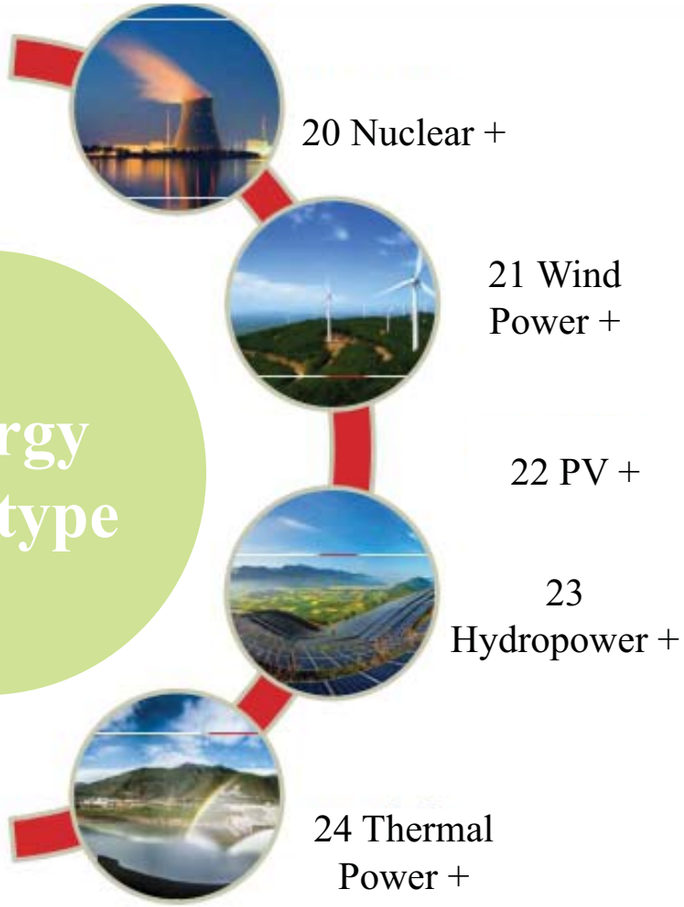
Based on the original configuration, the Project is provided with an additional set of internal combustion engine-lithium bromide energy supply system, which can utilize the peak-valley price spread in Beijing and adopt the internal combustion engine-lithium bromide energy function in the daytime; commercial power is used for energy supply in the nighttime; in addition, natural cooling is adopted when the temperature is low in winter. This Scheme has reduced PUE (Power Usage Effectiveness) and energy consumption cost of customers.

3.5 Energy Base

Relying on large-scale energy bases, Combined with regional load characteristics and peak shaving and frequency modulation requirements of power grid, Efforts should be made to solve **the painful and difficult problems** such as low utilization hours of units, low utilization efficiency of energy sources, unbalanced space and unbalanced time, and to create an overall **solution of energy base with multi-energy** complementarity, peak clipping and valley filling, circular economy and other diversified development functions by combining energy storage, hydrogen energy, heat storage and heat supply.



Energy base type



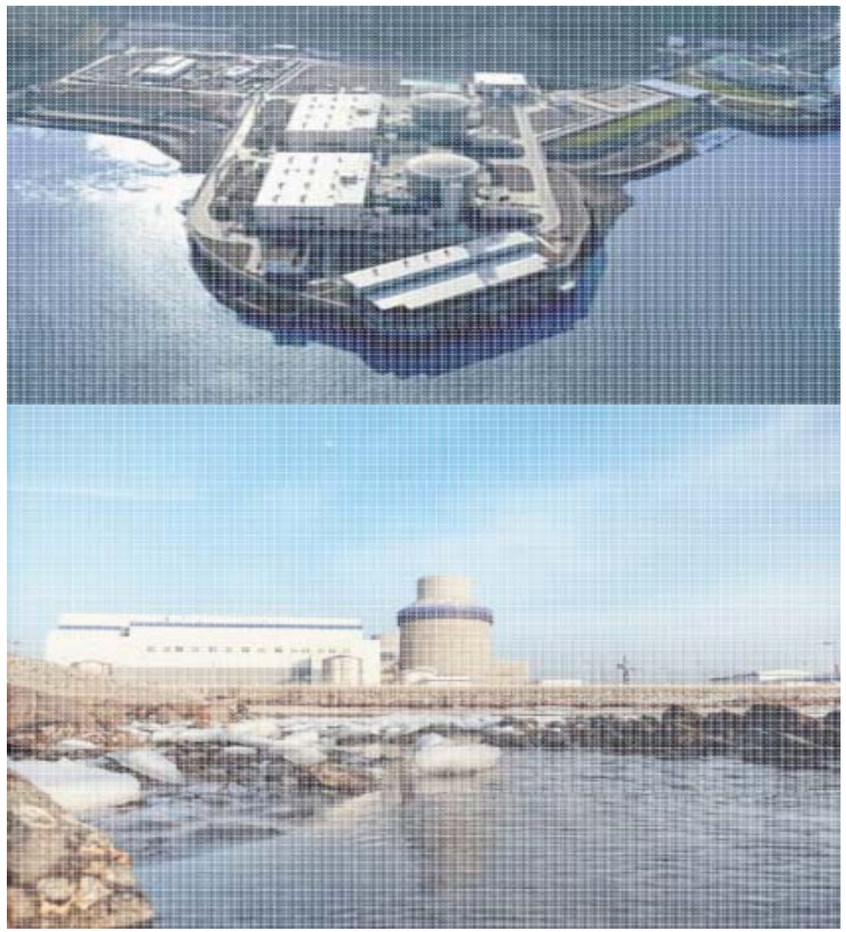
3.5.1 Nuclear Energy +

Case Study

The first phase of Shandong Haiyang Nuclear Power Station has undergone steam extraction transformation to realize 700,000 square meters of heat supply; the circulating thermal efficiency of the unit has been increased to 37.2%; when the heat supply area has been expanded to 4.5 million square meters, the efficiency has been increased to 39.9%; for the present, the planned heating area of **the second phase** is estimated to be 3,000 square meters and the efficiency can be increased to 48%. The electricity involved in peak shaving can be available for heat supply, hydrogen production, seawater desalination, etc., increase the comprehensive utilization efficiency of nuclear power units, and adopt water-heat simultaneous transmission technology for seawater desalination and winter heating at the same time.

Solution:

☑ Nuclear energy + heating
☑ Nuclear energy + seawater desalination
☑ Nuclear energy + heat supply + seawater desalination + simultaneous transfer of water and heat
☑ Nuclear energy + comprehensive utilization of peripheral renewable energy for power generation, hydrogen production and energy storage to form a diversified energy network to meet the need of electricity, heat, cold, water, hydrogen and storage.



3.5.2 PV +

Application Scenario

Focus on solving problems of ecological restoration, high PV curtailment rate and difficulty in transmission by taking large PV bases as the research object and develop overall solutions to water, wind, solar storage and multi-energy complementation, PV + ecological management, PV + ecological agriculture and animal husbandry, and PV + industry.

Case Study

Qinghai Gonghe Graziery-PV Demonstration Base: the mode of growing forage grass to plant pasture in PV power stations for "dual use of one grass" adopted not only restored ecology, but also played a role in preventing wind and stabilizing sand, and became more conducive to improving the environment and grazing-PV complementary climate; promoted the efficient use of land resources, improved soil erosion and increased water conservation. The green barrier formed by vegetation improved the surrounding environment of PV power stations, reduced the damage caused by sandstorm to them, and finally achieved the goal of PV industry for driving ecological construction.

3.5.3 Wind Power +

Application Scenario

Problems of high power fluctuation, high wind curtailment rate and difficulty in transmission can be solved by taking large-scale wind power bases as the research object and the overall solutions of wind power consumption nearby and peak load shaving are provided by means of clean heating of wind power, energy storage of wind power, hydrogen production of wind power and wind-power and thermal power complementation.

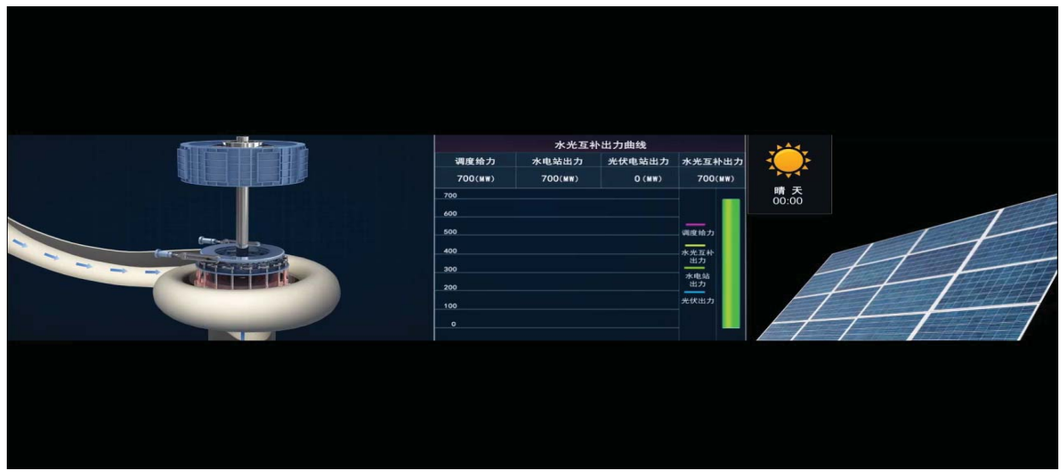
Case Study

The 98.8MW wind farm of a wind power project in Dalian is equipped with a large-capacity all-vanadium redox flow battery energy storage system (10MW/40WMh) to the proportion of 10%, improved the acceptance capacity of wind power grid connection, adjusted the power supply structure of the grid, improved the peak shaving demand, participated in dispatching frequency modulation, and improved the power supply reliability and safe and economic operation capability of the grid.

3.5.4 Hydropower +

Application Scenario

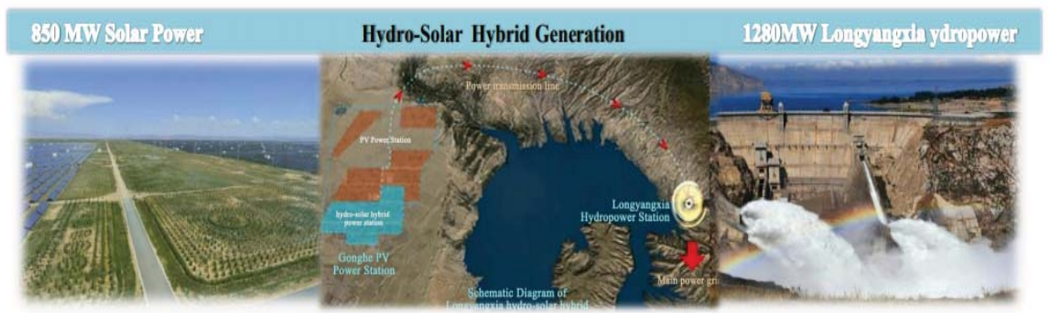
Problems of surplus water in wet seasons, insufficient power transmission in dry seasons and low utilization of transmission lines can be solved mainly by taking large hydropower bases as the research object and then the hydropower can be absorbed in a wider range by means of hydropower-PV complementation, pumped water for storage and hydrogen energy storage.



Case Study

Qinghai Gonghe hydropower-PV Complementary Project: Longyangxia 1.28GW Hydropower Project + 850MW PV Project. Through hydropower-PV complementary coordinated control technology, stochastic, fluctuating and intermittent PV power generation is converted into stable virtual hydropower and transmitted to the grid.

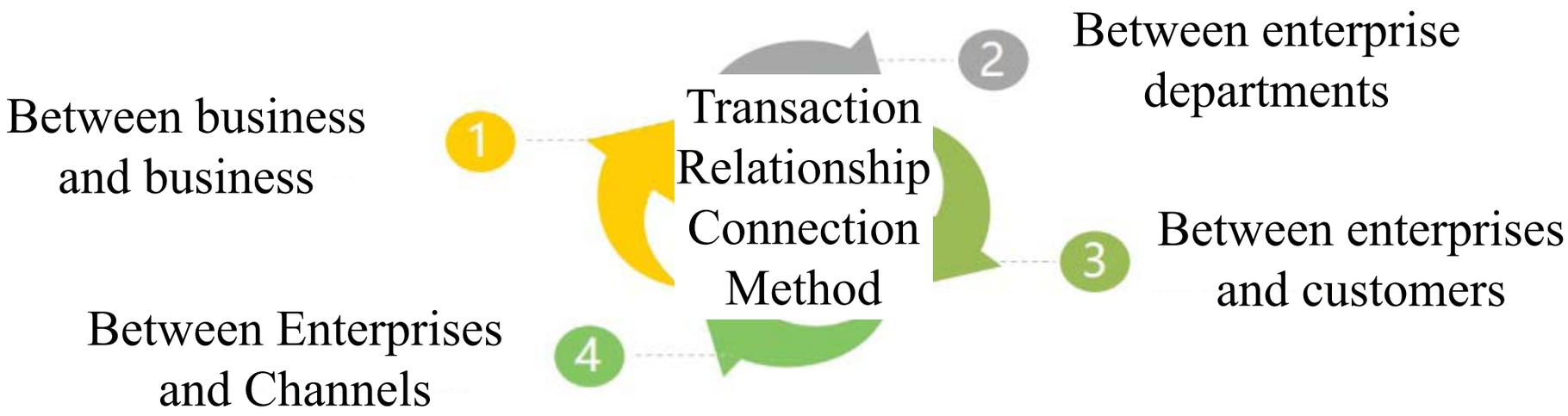
- ☑ Save rotating reserve capacity;
- ☑ Water can enhance peak shaving and frequency modulation capability.
- ☑ Improve transmission capacity
- ☑ Improve the power quality of the grid.



PART 04

Integrated Smart Energy Business Model

4.1 Overview



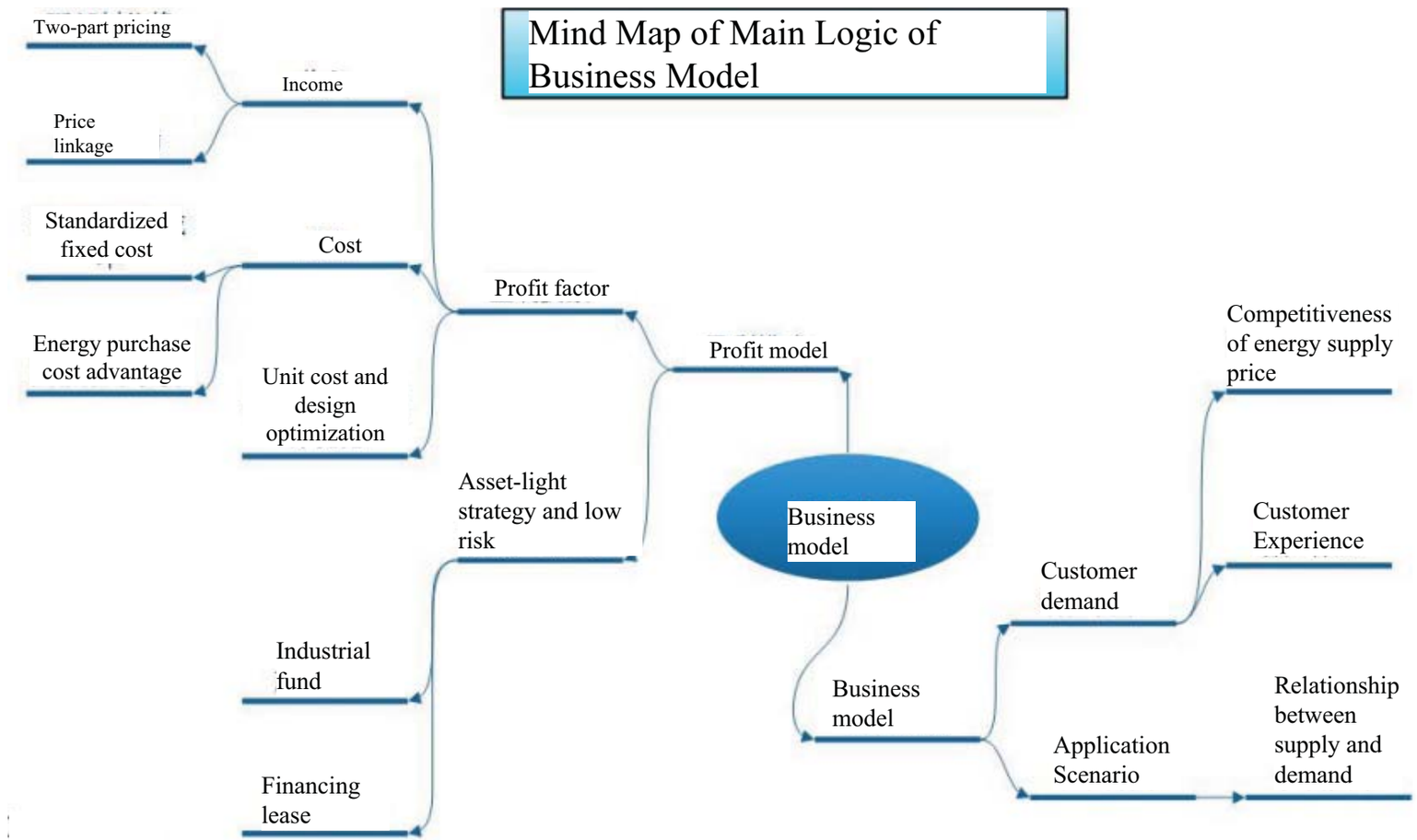
The business model is a complete and efficient system integration scheme with unique core competitiveness and sustainable profitability formed by the Enterprise in order to maximize value, integrate internal and external elements, and meet customer needs and realize customer value through optimal realization forms.

To put it simply, the business model is the way for the Enterprise to make money.

4.1.1 Enterprise Case

Decisively sold or closed 20% of traditional energy business in 2016	ENGIE judged ahead of time, preempted the layout, supplemented by advanced digital technology, and seized the opportunity of industry development.
Invested heavily in acquisition of French energy giant, Alstom, in 2015	GE strengthened its core business, increased its market share and consolidated its monopoly advantage through mergers and acquisitions.
Deployed GE's complete Predix software system in 2016	Exelon uses data to tap the potential of assets and improve the profitability of assets.
Decisively sold or closed 20% of traditional energy business in 2016	With the help of the advantages of core business in the market, it will drive the extension of the business chain and broaden the profit-making channels.
Provided comprehensive service solutions through industrial funds	Start from overcome financing difficulties of customers with financial thinking, industrial funds have effectively alleviated the capital chain problem in the development and operation of wind farm.
Ensure investment in core competitiveness and reduce operating cost	Huawei has fulfilled the purpose of business model innovation, tapping her own potential, enhancing her own strength and improving competitive advantage.

4.2 Business Model Analysis - 4.2.1 Main Logic



4.2.2 Overall Analysis

Strength

1. Complete industrial chain structure
2. Strong team of professional and technical personnel
3. A group of representative projects and corresponding experiences
4. A number of intelligent management results of clean energy supply ports

Weakness

1. The capability to serve C-end customers is insufficient.
2. The projects are scattered and lack of leading business models.
3. The internal forces are scattered and no uniformed joint force has been formed.
4. Lack of institutional mechanisms to motivate staff

Opportunities

1. Large domestic market space
2. National and local government-supported industries
3. There are breakthrough competitive opportunities in the early stage of development
4. Separation of transmission and distribution pricing in power system reform,
to give power generation enterprises the opportunity to enter the C-end market

Threats

1. Industry barriers are not high
2. Customer's willingness to accept should be constantly guided.
3. It is difficult to make profit during the customer cultivation period.
4. Contradiction between asset-heavy industry and asset-light industry

4.2.3 Special Investigation

Company	Project Name	Project Features	Current Status
Shanghai Electric Power	Qiantan	Gas turbine CCHP	Commissioned in July 2019
	Hongqiao Fund Town	DC microgrid	Debugging phase
	Pingtan	Electric cooling/heating	Operation of temporary energy station
	Yuanhong Investment Zone	Smart Microgrid for Cooling and Heating	Not started
Fujian Company	Gutian	Electric cooling heat + energy storage	Not started
	Xiamen Third Hospital	Centralized cooling, photovoltaic power generation	Not started
	Hengqin Thermoelectric	Gas turbine cogeneration	It was put into production in November 2014
Guangdong Company	Hengqin Energy	Refrigeration with electric and thermal energy sources	On May 3, 2016, the station was put into operation
	Zhongxin Pharmaceutical Building	Water storage heating	It was officially put into production on November 1, 2019
Tianjin Company	Beijing-Tianjin Industrial Park	Gas boiler + conventional water chiller + ice storage	It was completed and put into production on November 5, 2019
	Waterproof and Heat Insulation Roof Photovoltaic in Dagang Oilfield	Roof Photovoltaic + Roof Waterproof	Grid-connected power generation on July 31, 2018

4.2.4 Project Features

1. Application Scenario

From the perspective of Chinese market application scenarios, customers are located in economically developed regions, Beijing-Tianjin-Hebei, Yangtze River Delta, Greater Bay Area and Sichuan-Chongqing Economic Zone;

☑ Customer's demand of cooling and heating can be met and the cost for use of energy in plateau is high.

2. Functional Mode

☑ The Project is characterized by customized service and non-standard service.

☑ Clean energy supply with centralized cooling and heating as the main direction.

3. Technical Route

"Taking electricity as the core to improve energy conversion efficiency" is the leading technical route of comprehensive energy supply;

Choose the technical route according to local resource endowment;

☑ Energy storage is an effective means to utilize low-cost electric energy.

4. Revenue Model

Franchise has been obtained for the pre-project planning to bind the customer base and reduce the subsequent investment risk;

☑ For the present, there are various forms of obtaining franchise: cooperation with regional developers and cooperation with the government, suitable for large-scale projects and signing contracts with the Park for energy management

5. Management Model

☑ Due to lack of a unified structure, a brand effect cannot be formed.

☑ The existing intelligent management system focused on optimization of operation side and lacked of customer service.

6. Ownership Mode

Select partners according to local policy environment;

The joint venture between the developer and the local government makes the binding effect more stable so that the project can obtain stable franchise;

4.2.5 Comparison of Project Indicators

Purchase price of each item

	Qiantan Project	Pingtan Project	Hengqin Energy	Beijing-Tianjin Industrial Park
Gas price (yuan/Nm 3)	2.79	-	-	2.63 (2019) 3.17 (2020)
Purchased water price (Yuan/m3)	4.72	4.4	3.83	10
Outsourcing electricity price (yuan/WK. h)	0.66	0.58	Peak 1.03 Flat 0.63 Valley 0.18	Peak 92 Flat 0.36 Valley 0.63
Basic capacity fee for purchased electricity (Yuan/kVA)	42	36	23	-

Comparison between 2019 Value and Feasibility Study Value of the Project

Item	Unit	Qiantan Project			Pingtan Project		
		Value in 2019	Feasibility Study	Practical feasibility study	Value in 2019	Feasibility Study	Practical/feasibility study
Income	RMB Ten-thousand	3450.44	12025	28.7%	702.93	7319.29	9.6%
Cost	RMB Ten-thousand	2284.79	9342	24.5%	626.41	5385.89	11.6%
Total Profit	RMB Ten-thousand	378.62	2683	14.1%	27	1109.45	2.4%
Return on Equity	%	0.81	22.36	3.6%	0.66	12.46	5.3%

Comparison of evaluation indicators of each project

	Qiantan Project	Pingtan Project	Hengqin Energy	Beijing-Tianjin Industrial Park
Unit Cost (Yuan/kW)	3126	2801	4814	770
Unit Employer (person/MW)	0.1	1.44	0.1	0.15
Depreciation Method	Initial investment period workload method, reaching post-production straight line method	Straight-line method	Straight-line method	Straight-line method
Period of depreciation (years)	20	15	20	20
Residual value (%)	5	5	3	3

1. Analysis

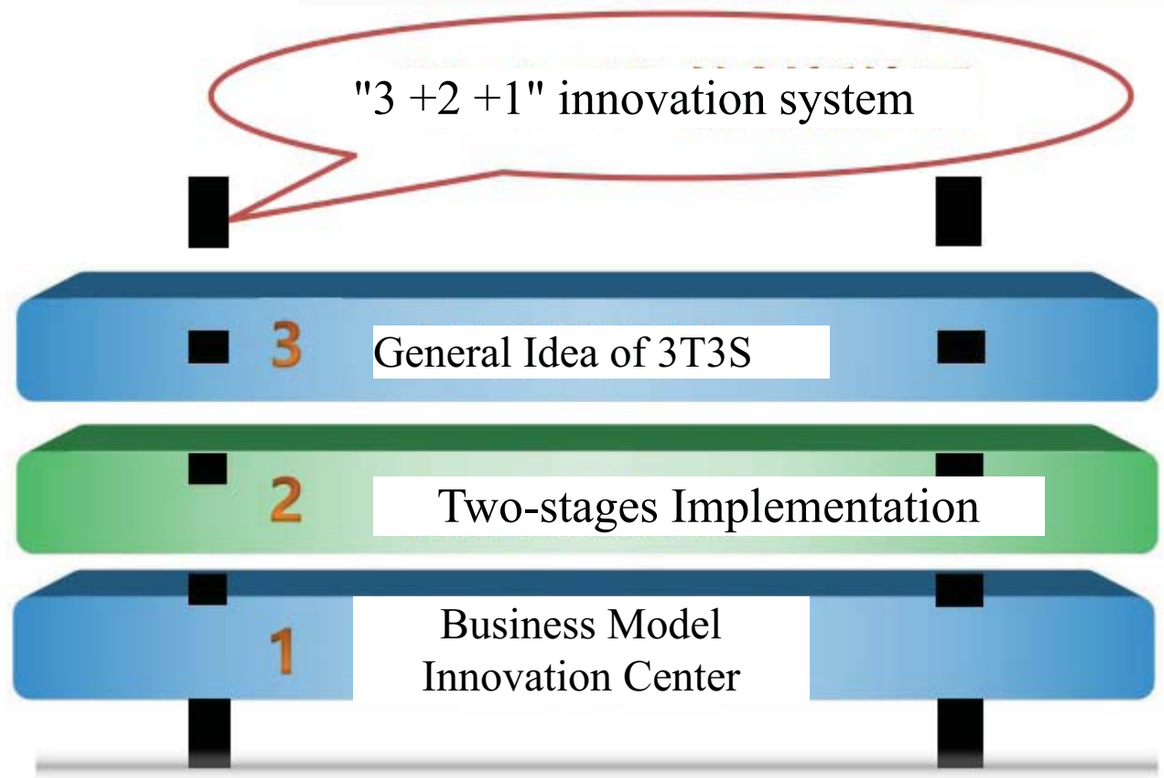
☑ **There is a big difference between the actual operation and the feasibility expectation, and the customer's energy consumption is less than expected; different technical routes cause great differences in unit cost;**

☑ **Depreciation: the workload depreciation method is taken for Qiantan Project, and the straight-line depreciation method is taken for other three projects; their depreciation periods are 15 years and 20 years, which has brought great flexibility to profit calculation; the traditional idea of feasibility of any power generation project is not fully suitable for this kind of market.**

☑ **It is necessary to establish a comprehensive smart energy investment evaluation system to standardize main indicators such as unit cost, depreciation method, depreciation period, number of people employed, operation and maintenance cost, etc.**

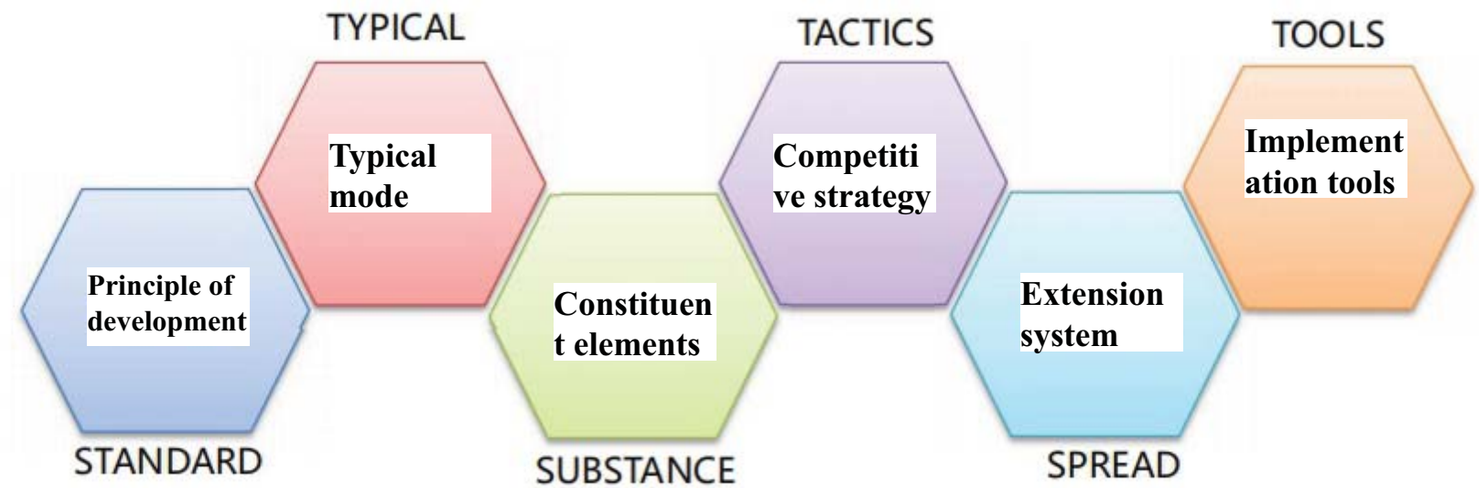
4.3 Business Model Innovation System

4.3.1 Framework



4.3.1.1 General Idea

General Idea for Innovation of Comprehensive Smart Energy Business Model (3T3S)



Turn the concept of business model into a concrete guide to action.

4.3.1.2 Three Typical Business Models

Cluster buildings

Commercial complex, headquarter base, office tower, hotel, hospital, school, community, etc.

Industrial park type

Industrial parks such as hospital, data center and logistics, or high-tech parks such as airports, high-speed rail hubs, higher education parks and science parks.

Smart town type

Being geared to construction of new urban districts, expansion and transformation of old cities, and construction of new smart cities

The typical model is characterized by reference, replicability and generalizability.

4.3.1.3 Competition Strategy

Build core competitiveness

Reduce construction cost through supply chain cooperation, design optimization and economic evaluation; reduce operation cost by optimization scheduling and intelligent management, and establish a cost control system,

Create cost leading superiority

Launch brand marketing through clean energy supply and intelligent management, marketing through market research and pricing strategy, and establish a marketing system,

and create marketing leading superiority,

Cost leading strategy

Marketing leading strategy

4.3.1.4 Four tools

3 Books +1 Model

Business Recommendation

For external use, introduce the Group's capabilities and characteristics to the government, customers, etc., and find market opportunities

Business Plan

for both internal and external use, play a market-oriented role, serve as an important basis for investment decision internally and a powerful tool for project financing externally.

Business Model Proposal

For internal use, guide project development and implementation of industrial unit and improve profitability.

Finance Model of Project Economic Evaluation

Forwardly used to identify the project boundary condition and verify project winning by estimation; reversally based on the rate of return, and backstepping of design optimization and cost control

4.3.1.5 Collaborative promotion system

Flexible Utilization
The 3 books can be adjusted to meet the need of customers. The system should be used flexibly and integrated to achieve greater value.

Interlocking:
Business Recommendation is used to obtain project, Business Model Proposal to guide project development, Business Plan to guide project implementation, and Finance Model used to calculate project estimate.

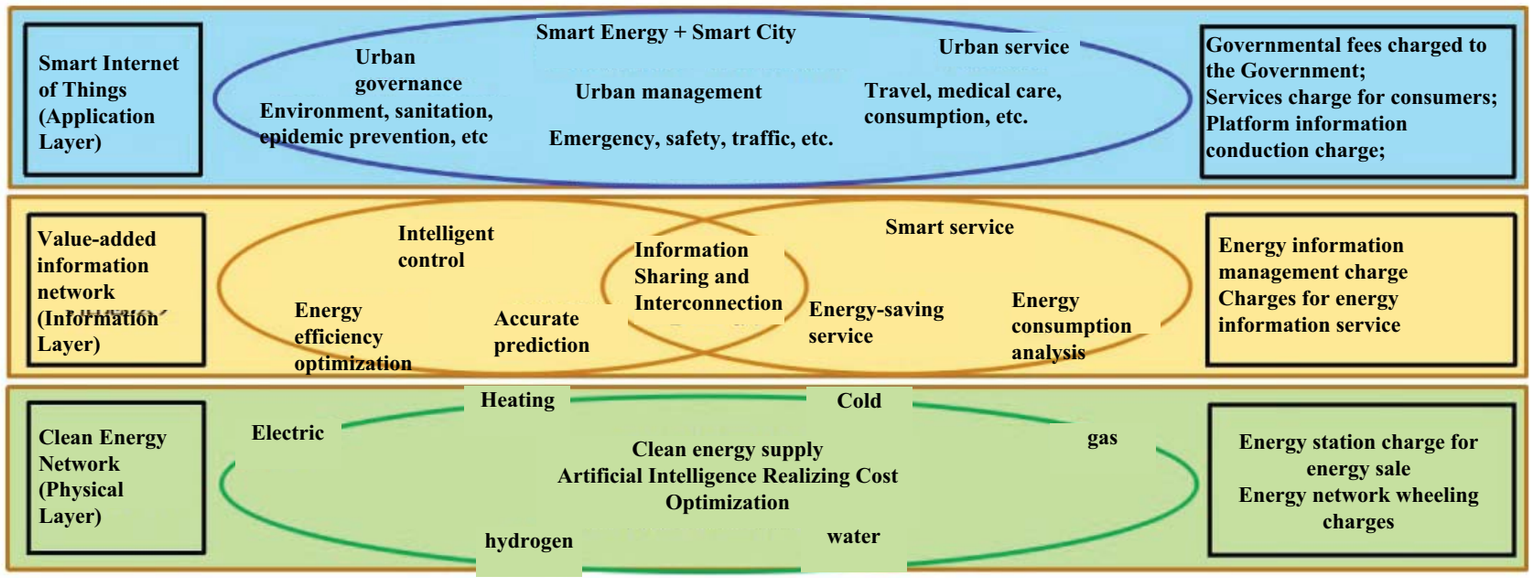
Attributed to value:
The ultimate goal of the System is to guide the Project to make profit and return to the essence of the business model.

4.3.2 Phased implementation

Integrated Smart Energy Business Model

4.3.3 Innovation Center

Center positioning



Thank you for your guidance and support!