

## Research on Integrated Energy Service Mode of Park-level Energy Internet

Jiangbo Wang<sup>1, a</sup>, Dawei Song<sup>1, b</sup>, Hongkun Bai<sup>1, c</sup> and Qian He<sup>2, d</sup>

<sup>1</sup>State Grid Henan Electric Power Company Economic and Technological Research Institute, Zhengzhou 450052, China

<sup>2</sup>North China Electric Power University, Changping District, Beijing 102206, China

<sup>a</sup>409227228@qq.com, <sup>b</sup>51077632@qq.com, <sup>c</sup>1420254015@qq.com, <sup>d</sup>heqian031506@163.com

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**Abstract.** Energy Internet is the product of deep integration of energy and information, is an important fulcrum to promote the energy revolution. In existing traditional market transactions, independent power generation model of various energy results waste of energy resources, and low efficiency of the industry's production, transmission and utilization. This paper, from the perspective of energy Internet operators, has studied the integrated energy service mode of park-level energy Internet from the five energy service business. It aims to improve the intelligent level of the distribution network, reduce the operation and maintenance cost, form the effective competition business pattern, promote to optimize the allocation of energy resources and improve the park's economic vitality.

### Introduction

In July 2015, the State Council issued "Guiding Opinions on Actively Promoting the Internet + Action" and made "Internet + Wisdom Energy" as one of the key areas of action. In the context of energy Internet, the traditional energy industry (power companies, gas companies, etc.) or the energy industry chain upstream and downstream enterprises (equipment manufacturing enterprises, public service enterprises, energy service companies, etc.) will be based on their own resource base and advantages, expand their business scope, and turn to an integrated energy service provider.

Comprehensive energy service mainly includes three aspects: one is comprehensive energy, covering various energy such as electricity, gas, cold and heat; The second is the whole industry chain of energy, covering energy production, transmission, storage and consumption. The third is the whole life cycle of services, covering planning, investment, construction, operation and other services. Micro grid operators as the only provider of cold, heat and electricity, they provide users with integrated energy supply, demand side management, energy saving and other energy services, and strive to build the comprehensive energy service providers.

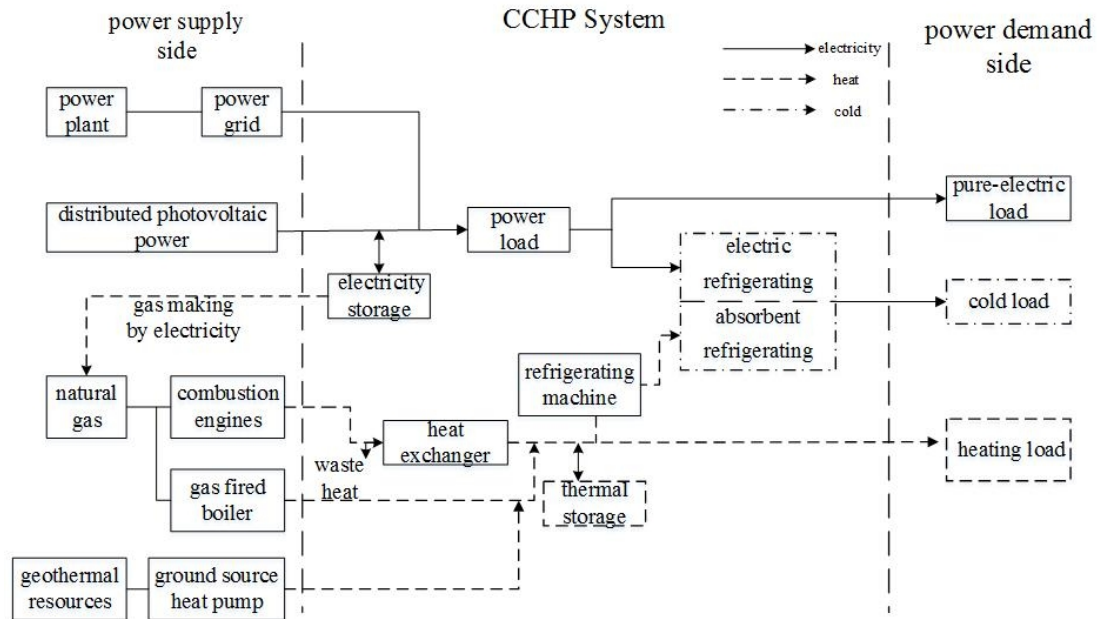
Therefore, the energy Internet as the focus of future work in the field of energy, the design of its business model is of great significance to enhance the efficiency of comprehensive utilization of energy, optimize the power market resource allocation, the successful implementation of the energy Internet pilot project, studying the energy Internet integrated energy services model is imperative.

### Park Integrated Energy Supply Service Mode

Park integrated energy service providers offer cooling, heating, power supply and other public services to the hotel, science and technology park, office buildings, commercial buildings and other specific users. Considering the electricity reliability of different users, a certain reliability protection fee is charged for users with high reliability, some of the cost will be used to improve the micro-grid and emergency energy equipment in the area, at the same time, some expenses are compensated to users with low reliability, thereby enhancing the reliability of key users, offsetting the construction and maintenance cost of micro-grid and emergency energy equipment, and providing economic compensation for some lost users.

**Cold and Heat Power Three-Link Supply Mode.** The cold and heat power three-link supply system is an integrated production and energy system based on the utilization of energy cascade. It is distributed near the client side. First, the primary energy is used to drive the engine power supply, and the waste heat is recovered by various waste heat utilization equipment, and ultimately achieve higher energy efficiency, lower energy costs, higher energy security and better environmental performance and other multi-functional goals.

The system can be used for one-stop solution including electricity, cold, heating, hot water, steam, natural gas and other energy needs, it can reduce energy transactions, directly provide refrigeration, heating and power supply services to the users, realize the comprehensive utilization of various energy sources in the region. The schematic diagram of cold and hot electric triad is shown in Fig. 1.



**Fig 1.** Schematic diagram of cold and hot electric triad

**Distributed Photovoltaic Mode.** According to the current PV policy, the ground power station adopts the "full Internet" mode, distributed photovoltaic power generation includes two modes: "spontaneous self-use + redundant Internet" or "full Internet".

- self-use part of the price of micro-grid = micro-grid user price + national subsidies micro-grid + local subsidies
- redundant Internet part of the electricity price micro-grid = local desulfurization coal price + national subsidies micro-grid + local subsidies

The price of full Internet model for the country is divided into three types of electricity price, the price of photovoltaic benchmarking were 0.65 yuan / kWh, 0.75 yuan / kWh, 0.85 yuan / kWh.

In general, "spontaneous self-use + redundant Internet" has an advantage of economy, and local consumption avoids a higher loss of power transmission process. In the process of actual power supply for users, price concessions and paying roof rents can make power suppliers share distributed photovoltaic power generation revenue with users.

**Energy Storage System Mode.** The current business model of energy storage system mainly includes "peak and valley spread", "fire power paid auxiliary service" and "independent production in auxiliary services."

Under the influence of the current peak-valley time electricity price, the energy cost can be controlled by arranging the electricity consumption period. Energy storage power station store energy during off-peak hours and consume energy during peak hours, obtaining peak and valley spread income.

**Optical Storage Micro-grid Synergy Mode.** Solar energy has a strong intermittent and random, direct access to the grid will lead to energy fluctuations. The micro-grid energy management system

can improve the reliability and economy of micro-grid operation by coordinating the operation of micro-power, load and energy storage system, which is an important guarantee for the stable operation of the system.

During the high electricity price period, the power supply should be given priority to wind power and other forms, if the power of the scenery is insufficient, the energy storage device can be used to discharge it to the micro-grid, if the energy storage device is insufficient to discharge the power, it is purchased by the power grid system; In the flat price segment, the load power is given priority in the form of wind power generation, if there is excess power, it is stored in the energy storage device, if the power of the scenery and other power is insufficient, the discharge of energy storage device can meet the need of load. If the SOC value is low, the power grid is purchased. In the valley electricity price segment, the priority is to use the power generated by the landscape to power the load, and to recharge the energy storage device, and to meet the load demand by purchasing power from the big power grid when necessary.

### **Park Distribution Service Mode**

Park distribution network operation and maintenance is the key to protect the park's energy supply, but also the basis of carrying out electricity sales services. Park network operation and maintenance service mode mainly has the following points.

**Establish a Distribution Network Operation Management Prevention System.** The main prevention and control of the distribution network operation management is to control the equipment in advance, reduce the accident rate of the equipment, reduce the accident rate of power supply, and optimize the operation of the equipment.

- Improve database information: establish and improve the database information, ultimately achieve online reporting and query, be able to timely revise data, realize resource sharing, timely discover problems and solve problems.
- Establish tour inspection system: check the inspection record in the inspection, so that maintenance personnel can analyze the equipment operation status according to the record, find the defects in time, master the operation rules of the equipment, and realize the control of the equipment operation.

**Make Maintenance Management of the Distribution Network Equipment.** Strict maintenance of the grid equipment can effectively eliminate the hidden dangers, ensure good operation, and avoid major accidents. The main content of distribution network equipment maintenance are: routine inspection of the distribution network equipment, management of operating technical information of distribution network equipment, updating the information of distribution network equipment, and the fault repair of distribution network equipment.

**Improve the Equipment Defect Management.** The management of equipment defects should be mainly from the following aspects: 1) advanced control of equipment defects. 2) the establishment of analysis system of equipment defects. 3) management of equipment defect analysis.

### **Park Sales Service Mode**

The basic model of sale electricity companies to buy electricity from the wholesale market, and then sale to the power users through retail market, so that they can earn the difference.

#### **Typical Service Mode.**

- **Park Power Use Load Forecast.** Load forecasting is divided into long-term forecast, medium-term forecast and short-term forecast. The electricity sales firms are more concerned with short-term forecasts, and sign long-term purchase contracts and arrange the day power trading scheme based on load forecast results.
- **Study on the Sale Mode of the Park.** Along with the market competition in the sales of the market, in addition to the price, the competitive advantage of the company is customization

service based on customer demand, or innovation of products and services. The park should select suitable selling mode suitable for its development according to its own characteristics.

- **Park Sales Information Service Platform Construction.** The sales information service platform is the core infrastructure of the electricity sales business. the customer access, electricity inquiry, repair and settlement business are carried out on this platform. Sales information service platform should meet conditions as follows: support the efficient operation of park power supply business, effective support value-added business development, use advanced and reliable technical structure.
- **Wholesale-retail Mode.** Sales electricity to users in the pilot area, and buy electricity from the wholesale market (bilateral, centralized, etc.) to meet the user's electricity demand, by earning profit margins.
- **Power Product Design and Price Strategy.** Electricity trading companies develop the annual power transaction profit principle and market competition strategy according to market conditions, and introduce a number of tariff packages and products for users to choose.

**Retail Service System of Sale Electricity.** The park sale electricity system includes four aspects: support, operation, product and service. The support layer is human resources, finance, procurement, informatization and other parts, is the basic support for the sale of electricity business; the operational level mainly conduct customer research, customer segmentation, marketing planning and market development, doing basic analysis and research for the sale of electric business.; product level includes electricity sales business, energy efficiency services, electricity services and other value-added products; service level is directly to the power users, providing payment, business admissibility, consulting and troubleshooting service.

**Sale Electricity Service Mode Benefits.** Through the comprehensive analysis of the park energy structure, power grid status, user characteristics, research the park sales business mode, construct electricity sales information service platform, form effective competitive park sales business pattern, promote the park to optimize the allocation of energy resources, and improve the park's economic vitality.

### **Demand Side Management Service Mode**

In the competitive market environment, the power supply and demand is characterized by bilateral random fluctuation. In order to adapt to this new situation, it is necessary to implement the double-sided interaction between supply and demand, that is, the demand side management service model.

**Optimize Energy Service.** The company should make full use of demand side management resources under the regional energy interconnection mode, for power users to implement the optimization services of electricity program, that is, by installing the smart meter on the user side, you can obtain the daily load curve of the various types of electricity units in the user, the hourly electricity type and electricity price, and develop a reasonable and effective demand-side management power optimization scheme based on price response. minimizing the user's cost of electricity. By optimizing the user's electricity program, you can effectively improve the level of quality service.

**Electricity Diagnostic Services.** Electricity diagnosis service refers to the phenomenon that is large power consumption but low efficiency or the unreasonable distribution of peak power supply, providing users with comprehensive electricity analysis and proposing corresponding professional suggestions. The implementation of electricity diagnostic services can greatly enhance the user's awareness of energy-saving emission reduction, and promote the completion of the whole society energy-saving emission reduction targets.

**Demand Side Management Service Mode Benefits.** Through the demand response, the park encourages the power users to reduce the peak power demand or transfer them to the trough, which can effectively reduce the park distribution network construction process, save the investment cost,

reduce the park energy company operating costs, reduce the user's electricity expenses, and promote the regional within the new energy consumption.

### Park One-stop Energy Hosting Service Mode

Establish the park one-stop energy hosting service mechanism, build park dominance, service access, energy-using units benefit from energy cloud hosting service, provide energy-using units "energy managed" full service, including: diagnosis of energy saving, energy saving project design, investment and construction, operation and management, maintenance and repair, equipment updates, so that use energy unit save the heart, save time, save money. It can not only improve the quality of users, but also make both sides share energy efficiency. The schematic diagram of service flows and economic flows is shown in Fig. 2.

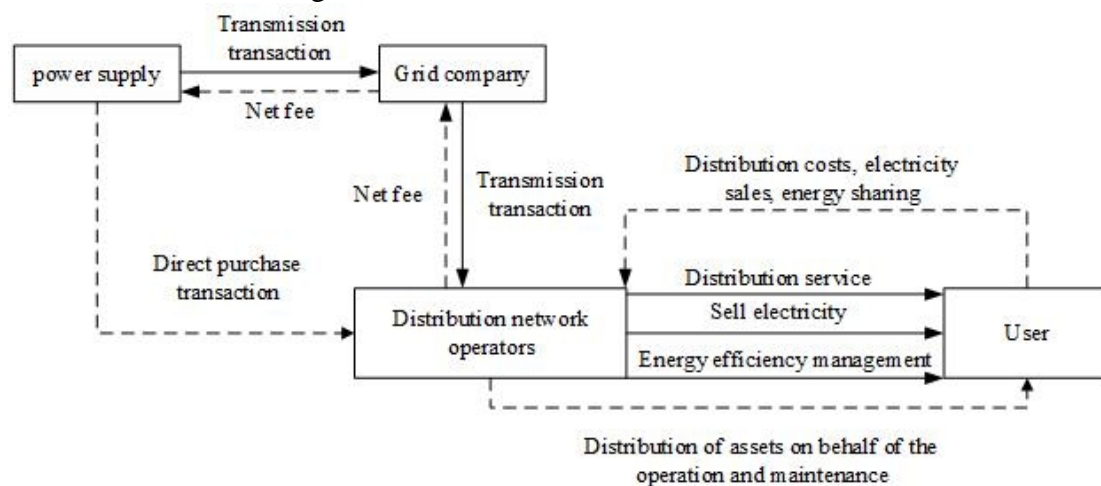


Fig 2. Schematic diagram of service flows and economic flows

### Conclusion

This paper analyzes the comprehensive energy service mode of the park-level energy Internet from the aspects of comprehensive energy supply, power distribution, electricity sales, demand side management and energy management, and tries to build integrated energy service providers. On the one hand, by carrying out the planning, design, construction, operation and maintenance work of the park distribution network, improve the intelligent level of the distribution network and reduce the operation and maintenance cost; on the other hand, through comprehensive analysis of the park energy structure, power grid status, user characteristics, study suitable park sales business model, and construct of electricity sales information service platform, promote the park to optimize the allocation of energy resources and improve the park's economic vitality.

### References

- [1] Liu Dunnan, Zeng Ming, Huang Renle, Ji Lihang, Chen Qixin, Duan Jinhui, Li Yuanfei. The business model and market mechanism of energy Internet(2) [J]. Grid Technology, 2015,39 (11): 3057-3063.
- [2] Li Yunxiu, Li Ming, Shi Chengguang, Li Wei, Liang Haishen. Study on the adaptability of intelligent grid data integrated energy service operation model based on international perspective [J]. Enterprise Reform and Management, 2017, (07): 95 + 97.
- [3] Feng Hong Li. Domestic and international integrated energy service development status and business model research [J]. Electrical industry, 2017, (06): 34-42.

- [4] Feng Jianghua, Chen Xiaoli. Energy system reform creates energy Internet era [J]. South Energy Construction, 2015,2 (03): 10-16.