

## Research on the Investment Operation Mode of Garden Energy Internet

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**Abstract.** As a breakthrough in the energy industry revolution, energy internet has received much attention from the state. Studying and formulating the energy internet operation and management model is an important means to accelerate the development of energy internet. Combined with the characteristics of the possible operating entities in energy internet construction, this paper analyzes the feasible investment operation mode, and proposes the implementation path based on the influencing factors during the selection of investment operation mode. It aims to provide theoretical support for energy internet investment operations and accelerate the development of energy internet.

### Introduction

On July 26, 2016, 'the National Energy Administration's Notice on Organizing the Implementation of the "Internet +" Smart Energy (Energy Internet) Demonstration Project' pointed out that with the full use of internet means, make market as guide, and make enterprises as the mainstay, it can excavate the economic, environmental and social benefits from deep integration among the internet, energy systems and energy markets. According to this, it can carry out pilot demonstrations of different types and sizes of energy internet.

The enterprise operation management mode refers to the planning, organization, implementation and control of the business operation process, it is also the general term for various management tasks closely related to product production and service creation. Under the background of rapid development of energy internet, researching and formulating enterprise operation mode, which adapts to the development of energy internet, is an important means to improve the management level of enterprises.

As one of the main forms of the national energy internet comprehensive pilot demonstration, the Garden Energy Internet is very promising. In addition, it can provide a huge development space for the power industry. Therefore, it is necessary to explore and research its investment operation model for enterprises sustainable development.

### Analysis of the characteristics of operating entities in garden energy internet

**Power-company-led.** Power-company-led model is a model in which power companies are the mainstay of energy internet construction and operation. It can be further subdivided into two types: the direct-led mode of the power company and the indirect-led mode of the power company.

**The direct-led mode of the power company .** The direct-led mode of the power company refers to an operation mode in which the power company directly engages in the related operation and maintenance work and provides value-added services for the combined supply of cold, heat and power.

**The indirect-led mode of the power company.** The indirect-led mode of the power company is that the power company establishes a special operating company which is responsible for the operation and management of the energy internet. The power company can lease the use of the micro-grid for the cold and hot electricity, and share the cost and share the benefits with community users. Users can prioritize their own energy needs according to their needs. At the same time, the power company also has the dominant control right of the cell micro-network, which can carry out

remote power dispatching, and realize the support and regulation of the micro-grid to the external public grid operation.

**Regional-energy-stations-led.**Regional-energy-stations-led refers to the operation and management mode of power generation enterprises providing hot and cold electricity services based on existing or newly built thermoelectric production equipment. Power generation enterprises represented by thermal power plants have sufficient manpower, material resources and technical support for heating and power supply. It can realize the free distribution of cold and hot electricity in the microgrid by constructing incremental distribution networks and heating pipes in the area. The power generation margin can participate in the electricity market transactions, realize the balance of the Internet, and reduce the waste of clean energy.

**Sales-company-led.** Sales-company-led is refers to the model in which sales company is responsible for the construction, operation and maintenance of the energy internet, and obtains the corresponding benefits of cold and heat. Referring to the method of selling electric energy by a power sales company, it can supply purchase value-added service by purchasing heat energy from a heating company and sell it to users in the area. The relevant distribution network and heating pipe network can either use the original equipment or create new ones as permitted by law.

**Garden-committee-led.** In this mode, garden committee is an operating entity in energy internet construction, It responses part of the construction investment, operation, and value-added services after the completion of the construction. This model is characterized by that the garden committee is responsible for the operation and maintenance of user energy and related equipment within its own service, and provides value-added services (energy saving services, etc.). Garden committee can purchase energy storage equipment, new energy power generation equipment and energy conversion equipment by self. Also, it can build micro-grid and heating network, so as to supply electricity, heat and cold by itself. When meeting the standards of the grid connection with the external public grid, the regional micro-grid can buy electricity from the external public grid. It can also sell electricity to the external public grid at certain times.

**Third-party-companies-led.** The last operation mode is third-party-companies-led. Here the operation and value-added services of energy internet will realize pure commercial operation. This mode can be commercialized in accordance with the principle of market discipline. In this mode, part of equipment investment, equipment operation and maintenance are all undertaken by third-party companies. At the same time, third-party companies are responsible for value-added services, all of which are owned by third-party companies.

### Analysis of the Investment Operation Mode of Garden Energy Internet.

The commercial operation of the energy internet can take various modes. Entities, such as grid companies, power generation companies, property companies and industrial parks, can invest in building energy internet. For users who are not good at energy management, they can also entrust third parties to invest and operate it. Some common energy internet construction and operation modes are shown in Figure 1.

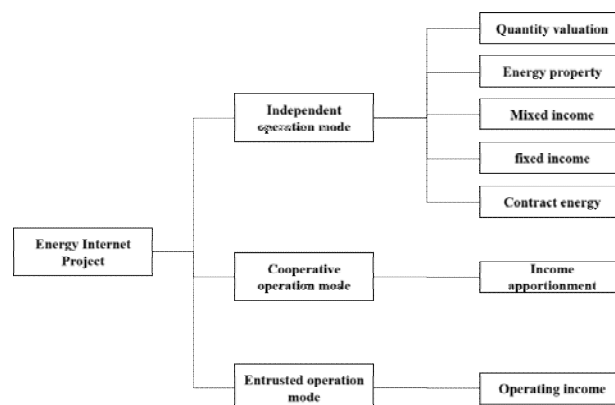


Fig. 1 Construction and operation modes of energy internet

**Integration of construction and operation.** Energy service providers are responsible for the investment, construction and operation of distributed energy projects. Providers can get investment return by energy supplying, which is based on users' needs. This method is suitable for non-professional, smaller or more dispersed energy users. Users are exempt from fixed-asset investment in distributed energy, and professional management is provided by professional energy service providers. This improves equipment operation efficiency significantly.

**Cooperation of construction and operation.** This mode means that the hybrid energy interconnection system is constructed and operated by two or more companies. Power companies, power generation companies, management committees, and power sales companies, as investment entities, invest in the construction of a combined heat and power system. After the system is completed, it will be operated by various investment entities in cooperation. It can also be solely responsible by one of the companies or third-party companies for the operation.

**Owner construct it but operate it by commission.** The owner is responsible for the investment and construction of the energy internet project, while it entrusts the energy service provider to operate and manage the project. The project operation cost is borne by the owner, and the energy service provider obtains the operation management fee. Therefore, in this model, the owner bears the investment risk and the energy service provider obtains the fixed income. This model realizes the separation of construction and management of the cogeneration project of cold, heat and power, separation of management rights and ownership. It is a method of realizing franchising or entrusted operation of public utilities or natural monopoly industries by means of market-based means through franchising or entrustment.

### **Factors that influence the choice of energy internet investment operation mode**

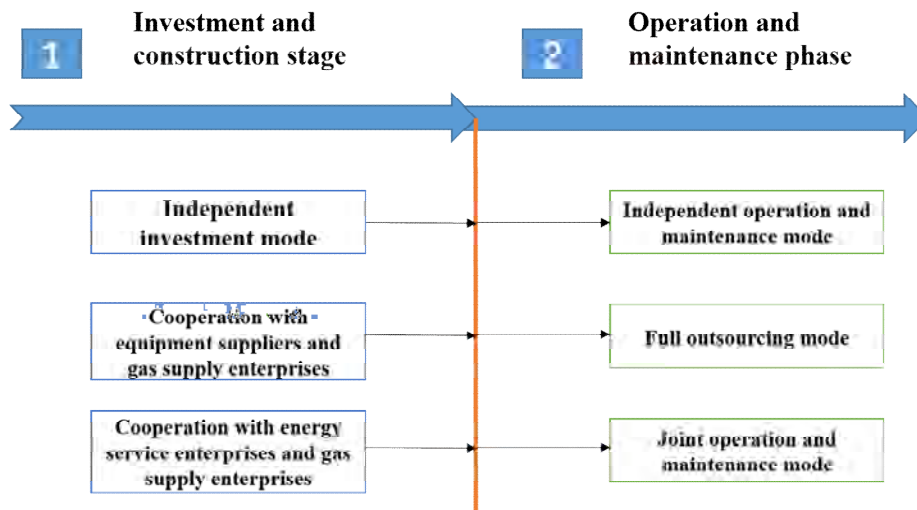
**Cost of investment .** The construction of the energy internet includes the construction and installation of power, pipe network, energy storage, metering devices, etc. In the early stage, a large investment is required, and the investment recovery period is relatively long. Therefore, the company's financial strength and financing ability are the basis for ensuring the normal operation of the project. The cost of investment is also an important factor for enterprises to choose whether to carry out the construction of mixed heat and power energy. Projects with excessive investment costs will take up most of the company's funds, its' potential risks will increase obviously. Therefore, enterprises with insufficient financial strength generally do not dare to invest easily. They need to consider the overall feasibility of the project and the recovery of benefits in the later period.

**Operation management capability.** The choice of the operating mode of the energy internet should not only consider the factors of investment cost, but also the operational management of the latter is a very important factor. When selecting an operating model, it is necessary to consider the operational efficiency, operational quality, and operating costs of different operating entities. When the investment entity has rich experience in the combined supply of cold, heat and power, then it can consider the choice of independent operation mode. Otherwise, it should choose to cooperate with a specialized company to operate or take commission operations. Therefore, when selecting an operating model, the impact of later operational management factors is important and must be considered.

**Ownership.** Ownership is also a factor influencing the choice of energy internet operating models. For example, for investors, the ownership of systems such as energy information collection systems and intelligent energy service interactive platforms is what enterprises want to master. To master the ownership of these systems, they need to invest in them. They can choose an independent operating model, or a lease operating model to take ownership. If there's some sub-systems need to be shared by several companies, they can choose cooperate model to invest and construct it.

### Implementation Path of Energy Internet Investment Operation Mode.

Energy internet operations are divided into investment construction phase and operation and maintenance phase. Due to the difference between the business content and the participating market players, there are also differences in the investment models of these two phases. This paper attempts to study the investment operation modes, which are suitable for the development of hybrid heat and power sources from the perspective of investment recovery and management mode. Research ideas are shown in Figure 2.



**Fig. 2** Development Path of Energy Internet Investment Operation Mode

The form of energy internet investment has evolved from “independent investment” to “co-investment” and then to “financing”. From the perspective of the development trend of energy internet and business operation, it can be divided into the initial development stage, the medium-term large-scale development stage, and the later stage of commercial development. According to the advantages and disadvantages of various investment operation modes, the energy internet investment operation modes corresponding to different development stages are different. This is shown in Table 1.

**Table. 1** Investment mode of energy internet at various stages

Growing stage	Operation mode
Early stage: development stage	Independent investment mode + joint operation and maintenance mode
Medium term: large-scale development stage	Cooperation mode with equipment supplier (garden) + joint operation and maintenance mode
Late stage: commercial development stage	Cooperation mode with energy service companies + joint operation and maintenance mode

### Conclusions

Based on the operation of the park-level energy internet, this paper analyzes the characteristics of each entity and explores different investment operation modes. Then it puts forward the influencing factors and implementation paths of the choice of garden energy internet investment operation mode. On the one hand, the exploration of the realization path of the park-level energy internet investment operation mode can provide theoretical guidance for the development of each enterprise and help enterprises to develop rapidly under the background of energy internet. On the other hand, through the analysis of the energy internet investment operation mode, it can provide guidance for the energy internet investment operation, which will help the rapid development of the energy internet.

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