Research on the Multi-energy Management Strategy of Power Grid Enterprises in the New-type Electric Selling Market

Ming Zeng¹, Yiqun Liu¹, Jiawen Ye¹*, Ting Pan¹, Xianxu Huo², Baoguo Zhao²

¹ State Key Laboratory for Alternate Electrical Power System with Renewable Energy Sources, North China Electric Power University, Beijing, China
² State Grid Tianjin Electric Power Company, Tianjin, China

*Corresponding author e-mail: 875295265@qq.com

Abstract. With the large-scale development and utilization of clean energy and the improvement of the level of energy marketization, the multi-energy interconnection operation has become the operation and development direction of future energy companies. This paper focuses on the related strategies of power grid company for the development of multi-energy interconnected operations in the new electric selling market environment, which is the major power service provider. First of all, the strengths and weaknesses are analyzed from the perspective of the power grid companies in the new electric selling market. Second, the opportunities and threats faced by power grid companies in the new electric selling market are studied from the external environment. Based on the above, this paper provides management strategies from five points for power grid companies implementing multi-energy interconnection operations, in order to promote grid companies to develop new business modes, broaden profit ways and enhance market competitiveness.

Keywords. new electric selling market; multi-energy interconnection operation; power grid company; management strategy.

1. Introduction

With the large-scale development and utilization of clean energy, the interconnection operation of various energy sources and the improvement of energy marketization level, a new generation of energy systems will focus on the realization of various clean energy sources that can be used together to enhance the clean and efficient use of energy [1]. In February 2016, the National Development and Reform Commission, the Energy Bureau, and the Ministry of Industry and Information Technology jointly issued the Guiding Opinions on Promoting the Development of “Internet +” Smart Energy, which put forward a road map for the energy Internet, clearly stipulating the guiding ideology, basic principles, key tasks, and organizational implementation for advancing the development of the energy Internet. On May 14, 2017, "a new round of energy structure adjustment and energy technology reform to build a global energy Internet." Was called on the One Belt and One Road conference. Under this background, the integration of new energy and the Internet will fundamentally change the way of energy production and utilization. Energy supply will shift to a decentralized production and
network sharing mode. Traditional grid companies must gradually transform into multi-energy interconnection operators [2,3].

The new generation of energy systems will be centered on electricity, enabling a variety of clean energy sources to be synergistically complemented and improve the clean and efficient use of energy. Therefore, the multi-energy interconnection operation should take the new power system as the core and hub, and the energy will become the link and interface for all kinds of energy interconnection. As a result, grid companies occupy an important dominant position in multi-energy interconnected operations [4,5]. This paper studies the multi-energy business strategy of the power grid companies in the new power sales market, and actively explores and practices new business models. While accelerating the transformation of power grid companies into multi-energy interconnection operators and satisfying their customers' all-round multi-energy service needs, it will help improve the efficiency of urban comprehensive energy utilization, innovate grid service models, and promote new business development.

2. Analysis of Internal Environment of Multi-Energy Operation Implemented by Power Grid Companies in the New Electricity sale Market

2.1. Advantages of Multi-Energy Operation for Power Grid Enterprises in the New Power Market

The grid company occupies an important leading position in the multi-energy interconnection operation. With years of enterprise development and experience accumulation, it has many advantages at the network level, user level, technical level, and economic level.

(1) Network level

The primary system of the grid is responsible for the task of transmitting electric energy. The secondary communication system that has been constructed synchronously has formed a powerful information network, combined with the professional information communication system, and becomes an information and communication infrastructure that is coordinated with the primary energy system. Transforming the traditional power system with Internet and vigorously promoting the deep integration of energy and information can take the unique network advantages of wide power system coverage, energy and information transmission of electric power system and overcome the limitations and existing weaknesses of conventional thinking. Moreover, it is also helpful to build a energy systems and ecosystem where backbone generation combined with distributed generation, trunk network coordination with local network and micro-grid, multiple energy is optimized and complementary, supply and demand is interacted open and shared.

It can be seen that grid companies can play a key role for building an open and shared energy internet ecosystem, establishing a new energy market trading system and commercial operating platform, developing distributed energy, energy storage and electric vehicle applications, smart energy use and value-added services, green energy flexible trading, energy big data New models and new business conditions such as service applications [6].

(2) User level

The grid company has a wide supply of electricity, a large population of power supply services and a good customer resource base. The grid company can carry out energy Internet construction and multi-energy interconnection operations, relying on existing customer resources, especially high-quality users such as industrial parks and large users.

The new business model created by the multi-energy interconnection operation has resulted in the monopoly of the energy sector being broken and full and effective competition has been achieved. Users have a variety of choices and interactions between supply and demand become frequent. The large amount of user resources and user data accumulated by the power grid companies over the years, as well as the diversified user services available in the future, have laid a solid foundation for multi-energy interconnection operations, which promote two-way interaction between market competition and supply and demand, and increase market efficiency and resource allocation efficiency.

(3) Technical level
In the future, the power grid needs to coordinate and control all power sources and power users from the perspective of global optimal operation, and guarantee the security, stability and reliability of the power grid. In order to achieve this goal, the power grid introduced information internet technology on the basis of further upgrading the physical infrastructure of the power grid. Second, renewable energy will play a leading role in future energy. Renewable energy-rich regions are often far from the load center and therefore rely on long-distance transmission technologies. At the same time, renewable energy has wide-area space-time complementarity. Building a wide-area interconnected power grid can greatly reduce the demand for energy storage equipment and reduce the complexity of power grid operation control. In addition, renewable energy source is decentralized, and it is necessary to develop on-site distributed renewable energy technologies and their corresponding microgrid technologies.

The grid company has a relatively mature technological foundation and experience in the above-mentioned information Internet technology, long-distance transmission technology, renewable energy technology, and microgrid technology, and thus has obvious technical advantages over other entities.

(4) Economic level

In the field of energy, the power grid companies have abundant funds, and they have the capital to actively explore more new technologies, new models, and new formats on the new platform for multi-energy interconnected operation, and pursue the five majors “innovative, coordinated, green, open and shared” development. The implementation of the concept of development continues. Moreover, through a new round of reforms, the power grid companies can have a certain degree of innovation capability, improve the efficiency of capital utilization, and enhance employees' innovation drive. All these will enable state-owned enterprise to have stronger overall strength advantages and play a more important role in the reform process.

2.2. The Disadvantages of Multi-Energy Operation for Power Grid Enterprises in the New Power Market

China has already launched a series of explorations of urban energy internet technologies, construction and operation models. However, the existing urban energy internet demonstration projects still have certain gaps from expectations, mainly reflected in the following three aspects.

(1) Energy supply level

In terms of energy supply, the multi-energy complementary collaborative optimization is low. Most of the existing multi-energy interconnection construction involves the introduction of “Internet +” concepts and technologies into the original smart grid to build a smart grid 2.0, and initially realize the complementarity of various types of power sources such as wind power, photovoltaics, hydropower, and thermal power in the power sector. Coordinated planning and optimized scheduling. In the construction of multi-energy interconnection, there are few considerations for other types of energy, and the degree of multi-energy complementarity and optimization between electricity, gas, heat, and cold is relatively low, and it has not yet reached the goal of “horizontal multi-energy complementarity” for multi-energy interconnection operations.

(2) Energy transmission level

In terms of energy transmission (pipe network and information network), multi-energy coupling needs to be strengthened. The basic idea of multi-energy interconnected operation and construction is to realize the interconnection, intercommunication and sharing optimization of various energy sources such as “electricity, gas, heat, and transportation”. However, the current multi-energy interconnection operation has not realized the unified planning of various energy transmission networks and energy conversion hubs such as power grids, natural pipe networks, and heat pipe networks in terms of energy flows, which can effectively promote the interconnection and intercommunication of multiple energy sources; In terms of information flow, due to the imperfect data collection and communication facilities of natural gas, thermal power, and other networks, and the existence of industry barriers among various types of energy sources, it is very difficult to realize the communication interconnection and information sharing between multiple energy sources [7].
(3) Energy use level
In terms of energy utilization, the user-side multi-energy interconnection operation service supply system based on the flexible price mechanism has not yet been formed. Multi-energy interconnection operation is a multi-functional, intelligent and advanced social public platform. It can provide new services that meet different needs of users, such as charging and discharging of electric vehicles, home energy efficiency management, energy saving of industrial systems, power grid asset management, distributed power grid connection, and more Web convergence, virtual power plants, etc. Most of the market-oriented business relies on the price signal in the electricity market. However, China’s electricity market is currently in the construction phase. The market-oriented electricity price has not yet been formed, and the user’s own choice of energy resources is limited. The development of multi-energy interconnection operation services is restricted, which hinders the operation of the multi-energy interconnection and user-oriented integrated energy service supply system form.

3. The analysis of the external environment of multi-energy operation of power grid enterprises in new-type electricity market.

3.1. Opportunities for Power Companies to Develop Multi-Energy Operation in the New Power Market
The continuous advancement of reforms and the continuous liberalization of the market have provided grid companies with many opportunities in terms of market competition, policy environment, business development, and personnel training to develop opportunities and favorable conditions for multi-energy interconnected operations, mainly in the following aspects.

(1) Market competition creating new opportunities with transformation of innovation
For a long time, due to its own natural monopoly, grid companies have become accustomed to taking the initiative. They have insufficient awareness of the crisis and lack of innovation. Under the new situation, although power grid companies have been greatly impacted by their efforts to break monopoly and introduce competition, they have also ushered in the best time for corporate innovation and transformation. Grasping this opportunity will promote the employees of power grid enterprises to strengthen their sense of competition, crisis awareness and service awareness, accelerate the pace of innovation and transformation, and effectively improve the market competitiveness and sustainable development capabilities.

(2) "Two Replacements" opening up new areas of growth.
According to the national energy development strategy, non-fossil energy will account for 15%, 20% and 60% respectively in 2020, 2030 and 2050. "Two Replacements" is an important measure for implementing the national energy development strategy, that is, implementing clean alternatives in energy development, promoting the transformation of the energy structure mainly from fossil-based energy to clean energy, and implementing energy substitution in energy consumption to increase electric energy. The proportion of terminal energy consumption. The "Two Replacements" have provided support to the grid to further its role as a basic platform for clean energy allocation and to achieve new growth in efficiency.

(3) Value-added services bringing new benefits to enterprises.
In recent years, technologies such as large data, EPC network, and cloud computing have developed rapidly and penetrated into all areas of life. The new generation of customers has the characteristics of strong interactive demand and multiple service requirements. Based on the maturity of technical conditions and customer market, in the near future, we will provide energy value-added services such as energy-saving consultation and electricity bill financing to customers, which will become new growth points for the company.

(4) Reform and development guiding talents to create new business.
In the field of power supply and energy consumption, power grid companies have a large number of professional and technical backbones and experts. If we can use this reform as an opportunity to establish a mechanism for the selection, use, motivation, and development of talents that are...
compatible with market competition and business development, this will surely effectively motivate employees and promote excellent talents to new field to do business. To realize its own value and provide better talent support for reform and development

3.2. Challenges faced by power grid companies in carrying out multi-energy operations in the new electricity sales market

The multi-energy interconnected operation with the new power system as the core and hub enables power grid companies to occupy an important position among them. They need to play the roles of grid operator and energy service provider. Therefore, the development of multi-energy interconnected operations will pose challenges to power grid companies in many aspects such as market environment, profitability model, and system operation.

(1) Diversity of competitive subject

In multi-energy interconnected operations, energy production and supply will shift from a single supply model to a diversified supply model. Energy suppliers must have the ability to provide a variety of energy sources including electricity, natural gas, and oil. Traditional grid companies, oil companies, natural gas companies, etc. will all become integrated energy suppliers that have a variety of energy resources. In addition, new market players that can provide value-added services, such as information service companies, energy-saving service companies, equipment manufacturing companies, and energy finance companies, will also participate. The main body of multi-energy interconnected operation market is developing in a diversified direction, and grid companies will face competition from multiple entities.

(2) Variety of profit model

The development of new technologies and new markets in multi-energy interconnected operations will promote the diversification of profit models for grid companies. The grid company will be transformed from a single electric energy supplier to an integrated energy supplier with multiple energy resources, and from a traditional “energy selling” model to a new “service selling” model. On the basis of the traditional grid construction and operation and power sale business, the grid company can also carry out some services such as distributed energy development, micro-grid construction and operation, demand side management services, and information service system construction. The grid company collects energy supply, energy internet construction and operation and information service fees, shares energy-saving benefits with users, and enhances market competitiveness by increasing business methods and service levels.

(3) Complication of system operation

Realizing the large-scale utilization and sharing of renewable energy is the core connotation of multi-energy interconnection operations. Renewable energy is characterized by randomness, intermittency, and volatility. Large-scale renewable energy, especially distributed renewable energy, grid-connected and electric vehicle access will lead to bilateral random fluctuations in energy supply and demand. The safe operation has a significant impact. At the same time, under the goal that generation-generation complementary in the orientation and generation-grid-load-storage coordination control in the portrait for multi-energy interconnected operations, the grid company needs to ensure the economics and safety of the system, and at the same time further improve the system Large-scale accommodation and consumption of renewable power sources. The system is more complicated to run.

4. Research on multi-energy management strategies of power grid companies in the new power market

Grid companies are the backbone of building multi-energy interconnection operations, and multi-energy interconnection operations have also brought new development opportunities for power grid companies. This is an opportunity to develop new business models, broaden profit channels, enhance market competitiveness, and take the lead in multi-energy interconnected operation markets [8]. It is recommended that grid companies implement the "Five-Four-Three-Two-One" strategy, that is, five networks, four tables, three technologies, two platforms, and one program.
(1) Fusing Five Network

Five-network convergence, namely, Internet + power grid + telecom network + broadband + internet of things. Years ago, the power grid company had prepared to integrate the power grid with the telecommunications network, radio and television networks, and the Internet through the implementation of smart grid projects such as optical fiber. At present, China's informatization construction and information system construction are increasingly perfected, and five-network convergence promises to become an important support for multi-energy interconnection operations. Only the power grid can support the historic mission of five-network convergence in the future [9].

(2) Combining four meters

The four tables are unified, that is, the information collecting networks of four kinds of energy, electricity, gas, heat, and water are combined. It is necessary to expand the centralized collection, information fusion, data transmission and data processing capabilities of the four energy sources of electricity, gas, heat and water. At the level of information integration, it is necessary to take the lead in implementing multiple energy interconnections to lay the foundation for multiple energy interconnections at the physical level in the next phase.

(3) Relying on Three technologies

Relying on three technologies, namely, energy storage technology, smart home technology, and comprehensive control technology of demand side resources. On the one hand, the power grid company can rely on these three technologies to deploy its own energy storage resources and promote the use of distributed renewable energy resources; on the other hand, it can conduct fine data collection and function control for each node-type power unit of users. The user's demand side resources are fully invoked to implement load dispatch.

(4) Building two platforms

Build two platforms, a multi-functional trading platform and an active distribution network platform. First of all, the multi-functional trading platform can realize the diversification of trading functions. Users can not only purchase electric energy on this platform, but also can customize electric energy services and even energy services according to their own needs. Secondly, the active distribution network platform can realize automatic and flexible control of user loads and grid currents through various active deployment control technologies and reduce the adverse effects of distributed renewable energy grid-connected and diversified user energy demand on grid operation.

(5) Providing one solution

Providing one solution is that to provide an integrated energy solution. The grid company should not only be satisfied with the sale of electricity and provide users with various electric power supporting services. Instead, it should conduct comprehensive energy use analysis for the users, and provide users with integrated energy including water, electricity, heat, cold, and gas. Service package. “Comprehensive Energy Solutions” is the main business model for the energy Internet market. Power generation companies, power grid companies, and social capital sales companies all have implementation conditions. However, the current grid companies have special industry advantages, so it is more convenient to develop this business.

5. Conclusion

During the “Thirteenth Five-Year Plan” period, profound changes have taken place in the characteristics of the energy market and the operating environment of the industry. The realization of multi-energy interconnection operations is the key to the development of energy companies. The multi-energy interconnection operation should take the new power system as the core and hub. This article takes power grid companies as research objects, comprehensively analyzes the advantages, disadvantages, opportunities, and challenges of power grid companies in the new-type power sales market and puts forward the main development ideas and business strategies for multi-energy interconnection operations. The first is multi-energy coordination, which includes both unit-level coordination and system-level coordination; both physical layer coordination and information layer coordination; both macro-policy coordination and micro-technical coordination. The second is that all
kinds of energy production, transportation, distribution, use, storage and other aspects need to be organically coordinated and coordinated to achieve multi-linked, all-round chain development. The third is to implement the "Five-Four-Three-Two-One" business strategy, that is, five-network integration, four-in-one integration, and relying on three technologies, build two platforms, and provide a program, which provides a powerful guarantee for power grid companies to develop multi-energy interconnection operations.

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