Research on the Development Strategy of Platform-based Integrated Energy Service Providers in Power Internet of Things

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Abstract. The Power IoT (Power Internet of Things) has brought new commercial ecosystem for the whole energy industry, and that will greatly influence the IES (integrated energy services) market. With the continuous exploitation of IES market space, the commercial value of IES market is being re-evaluated by various market subjects. As a growing number of emerging market entities are trying to enter IES market, the development and maturity of IES market will be significantly promoted, and further competition of IES market will be intensified. This paper analyzes the commercial ecosystem of the Power IoT, based on its core technology architecture and industrial chain and the intrinsic association between Power IoT and IES. This paper also analyzes the pattern of the integrated energy service market, classifies the main body of the integrated energy service market, studies different types of IES market competition and the evolution path of market development, and puts forward the ecological development strategy for the core platform enterprises in IES market.

1. Introduction

Power IoT is one of the strategy target of State Grid Corporation of China. The main purpose of it is to realize the interconnection of things and the interaction between human and computer with the technology of big data, cloud computing, internet of things and artificial intelligence[1]. Meanwhile, the Power IoT will help to build a brand new commercial ecology for the whole industry. IES is an important business form and emerging market of the Power IoT, which helps to improve the efficiency of energy integrated use, promote interaction between enterprises in different industries, and meet the diversify needs of end-users[2]. It is obvious that the Power IoT will bring both opportunities and challenges to IES market, so it is necessary to study the pattern of IES market and the development strategy of the main IES providers.

This paper analyzes the connotation and characteristics of the commercial ecology of the Power IoT, and studies the market participants of the IES market in the Power IoT. This paper also focuses on the platform-based integrated energy service provider, which play key role in the IES market, and analyzes its development strategy, including competition strategy and cooperation strategy.
2. The technology structure of the Power IoT
From a technical point of view, the core technology structure of the Power IoT includes four layers, as perception layer, network layer, platform layer and application layer[3].

Perception Layer: making use of various intelligent measurement devices to fully realize the state perception, environmental monitoring and behavior tracking of power source, power net, loads and users in each and every program of power generation, transformation and consumption, to provide the massive data basis for the Network Layer and Platform Layer.

Network Layer: Using Internet of Things technology and wireless communication technology to access the data and information of the perceptual layer, and using light network technology and internet technology to transmit standardized information to the Platform Layer.

Platform Layer: using massive joint management, open sharing data governance, high-performance intelligent analysis and other core technologies to achieve data information allocation and asset management and to provide data basis for all kinds of applications.

Application Layer: building standard data source, power net information and business line for power company, and providing IES, internet financial service and virtual power plant application for market.

3. The industrial chain of the Power IoT
The industry chain of the Power IoT is composed of diversified enterprises, organizations and users[4], is shown in Figure 1. Benefiting from the "policy dividend" of the energy reform and the "technological dividend" of the power Internet of Things technology, the hidden data information resources and potential market demand in the energy market have been further developed[5]. Under the guidance of the spirit of "openness, cooperation and win-win situation" of the Power IoT, business cooperation between different market subjects has been greatly enhanced, and the overall industrial chain structure has become more diversified and enriched[6]. In the industry chain of the Power IoT, energy enterprises, operators, equipment manufacturers, internet enterprises, financial institutions, users are finally integrated into one platform, and realize digital interaction and continuously expand their industrial chain.

Figure 1. The industry chain of the Power IoT

4. IES in the commercial ecology of the Power IoT
IES is an important business form and emerging market of the Power IoT, and its value realization and market development is depending on the data information resources and core technology support of the Power IoT.
The realization path and value ecosystem of IES based on Power IoT is shown in Figure 2. IES can collect all kinds of data and information of the terminal users from the perception layer of the Power IoT, so as to obtain the user's energy information and behavioral characteristics data[7]. IES can implement the intelligent clustering and potential demand mining of user data information through the data cleaning, mining and fusion technology of network layer of the Power IoT. With the help of the Platform Layer technology of the Power IoT, IES can make full use of the photo-voltaic cloud network, smart vehicle network and other business platform, to satisfy the data information and platform source requirements of application, and to provide support for the market-oriented diversified IES applications.

From the perspective of value ecology[8], the four layers of IES value realization (support layer, operational layer, coordination layer, and strategic layer) are also closely related to the technology architecture of the Power IoT. Among them, the perception layer and the network layer of the Power IoT provide the software foundation and hardware foundation for the support layer of the IES value ecology, the network layer and platform layer of the Power IoT provide the operating platform for the operation layer of the IES value ecology, realize the multilateral transaction of various market subjects, and the platform layer of the Power IoT realizes the coordination of information, business and funds through unified resource scheduling. Finally, the realization of the ecological value of IES is achieved through a variety of business applications of the application layer of the Power IoT.

5. The market participants of IES in the Power IoT

According to the commercial ecological theory and the current situation of the IES market, its market participants can be classified as the follows[9]:

- **Core platform enterprise.** Specifically to the IES market, the core platform enterprises are mainly power grid enterprises, power plant enterprises and other large traditional energy resources enterprises that can provide platform-based and plate-based IES business.

- **Dominant enterprises.** Specifically to the IES market, the dominant enterprises are mainly GCL, ENN, TGOOD and other industrial chain extension enterprises, which are mainly focused on single or several sub-sectors industrial chain, and large-scale energy-saving technology companies.

- **Gap enterprises.** Specifically to the IES market, the gap enterprises are a group of small volume companies, which are facing the most intense market competition in every sub-sectors of IES market, such as small energy-saving technology enterprises, equipment manufacturers, design and construction enterprises.

- **Speculation enterprises.** Specifically to the IES market, speculation enterprises are mainly Internet enterprises, financial institutions and other cross-border enterprises, which combining their own business and some IES market demands together, as a market entry point.
6. The development strategy of platform-based IES providers

6.1. The role and significance of platform-based IES providers
An IES commercial ecosystem is built around the platform sympathizing with platform-based IES providers. It is composed of consumers, merchants, brands, other businesses, third-party service providers, and strategic alliance partners[10]. Platform-based IES providers will shift their focus from the enterprise to the commercial ecosystem model. They will also shift their focus from the ability of operating their own resources to the ability of mining the value of platform-related enterprises, as to promote the coordinated development of all participants in the ecosystem, to realize the matching optimization of business, information, capital and other elements, and to form a new value network.

Therefore, the platform-based IES provider is the core element of the formation and development of the IES commercial ecosystem, and its market development strategy will directly affect the development scale and life cycle of future commercial ecosystem centered on it. Therefore, in the early stage of the development of IES market, it is necessary to carry out relevant research on the development strategy of the platform-based IES providers.

6.2. The competitive development strategy of platform-based IES providers

6.2.1. Find the right market position, combining its own ecological advantages. In the early stage of market development, the platform-based IES providers should combine their own resource characteristics, business characteristics and user characteristics, to build their own business ecological advantages, from the technical level, channel level, brand level and product level. IES providers should establish market competitiveness based on their core business, and combine their services and user demands. An accurate and reasonable market position is the establishment of the platform-based IES provider.

6.2.2. Design differentiated service products and seize the high quality customer resources. From the view of current situation of IES business, various market players are still relatively limited on the conception of "integrated energy" and "integrated services". The current IES business modes mainly focus on energy efficiency services, multi-energy supply, distributed clean energy, energy transportation and other fields, that will lead to intense competition in same industry. It is especially true for platform-based IES providers. It is necessary for them to satisfy personalized needs of users, and design differentiated service products, in order to seize the high quality customer resources in a faster way.

6.2.3. Link the upstream and downstream enterprises of core business to build the core business industry cluster in a timely manner. After the platform-based IES providers complete to built their ecological advantages, found their own market position, and won the high quality customer resources through differentiated product services, they will gradually consolidate their core business sector advantages, and continue to expand their influence in related areas. At this stage, the platform-based IES providers will make use of their own brand effect, market influence and customer resources, to build their core business clusters, reduce the marginal cost between cooperative enterprises, and to improve the overall market competitiveness. This is also the basis for platform-based IES providers to build a commercial ecosystem.

6.2.4. Implement intra-system competition to ensure the dominance of the commercial ecology. When the platform-based IES providers initially established commercial ecosystem centered around them, they should always pay attention their dominant position in the commercial ecosystem and ensure their competitiveness, in other words, the network power in commercial ecosystem. There have been studies showing that the rational use of network power by core platform-based enterprises can actively and effectively guide the behavior of enterprise members in the cooperative commercial ecology, guide different members to establish mutual trust relationship, and promote the high level of
synchronized behavior of multi-members in order to maintain the long-term development of the commercial ecosystem[11].

6.3. The collaborative development strategy of platform-based IES providers

6.3.1. Enhance core competitiveness and build a core business platform. Platform-based IES providers should have accurate grasp of their own positioning, resources and advantages, so as to build and continuously enhance the core competitiveness, and a business platform around one or more of their own advantages of core business. So they can use the platform network effect to attract multilateral market players, to make the amount of platform users reaching a critical scale, and to drive the formation of the commercial ecological system.

6.3.2. Optimize resources and demand in the system to improve the overall level of collaborative operation. In a commercial ecosystem, different types of enterprise and their resource, capabilities, and development needs are different. Such as the core platform-based enterprises have mature brand advantages and channel advantages, which may not be available for many gap enterprises and speculation enterprises. Gap enterprises and speculation enterprises may have unique technology and products, which will cost lots of capital and time for core platform-based enterprises and dominant enterprises to achieve. Therefore, platform-based IES providers must give full play to the role of the platform, split and match the resource capacity and development needs of different enterprises in the ecosystem, and improve the overall level of collaborative operation.

6.3.3. Explore the market demand, innovate and expand the business modes. With the development of the Power IoT technology, the potential value of massive user data will be fully exploited, and the IES business will gradually transform into a data-driven business. User demand is the fundamental driving force for all business development in IES market, and the future IES business will truly realize the diversified development oriented by user demand. As the core of the commercial ecosystem, the platform-based IES providers need to explore the potential needs of users and respond to the long tail demand in a timely manner.

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