Integrated energy service business operation model and key issues research and prospects

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Abstract. At the present stage, China is faced with the problems of unreasonable energy consumption structure, difficult coordination of energy utilization and imbalance of energy supply and demand. Under the background of energy Internet, the commercial operation of comprehensive energy services will have a favorable impact on solving the problem of comprehensive utilization of energy in China and stabilizing the balance between energy supply and demand. This paper reviews the current research on the business operation mode of integrated energy service, summarizes the key problems in the business operation process of integrated energy service, and finally draws relevant conclusions based on the above content, and puts forward the improvement of the business operation mode of integrated energy service at the current stage.

1. Introduction  
Constructing a clean, low-carbon, safe and efficient modern energy system is an important content to ensure the security of energy structure and energy supply. Constructing a comprehensive energy system is a key step to build a modern energy system in China. Power grid companies, power generation enterprises and related energy enterprises urgently need to open up new markets and economic growth points through business innovation. In this context, power grid companies, power generation groups and other large energy enterprises have gradually set foot in the integrated energy market and developed integrated energy services. Power distribution companies and energy service companies established by social capital have also joined the competition in the integrated energy service market. Comprehensive energy service is bound to become an important service mode and business form of energy industry in the future. The development of integrated energy service requires the design of its business operation mode and the definition of value positioning and profit model of the whole process of integrated energy service business operation. For this purpose, this paper reviews the business operation mode of integrated energy service and its key issues.

2. Research status of integrated energy service business operation mode  
2.1. Development status of comprehensive energy services  
Comprehensive energy integrates various energy supply resources within the region to meet the multi-type energy consumption demands within the system, so as to achieve energy conservation and emission reduction and reduce the energy consumption cost of users[1]. Integrated energy on the one hand is to provide multiple forms of energy supply services, on the other hand to provide energy projects from development to operation of the overall system services. Integrated energy systems can
effectively improve energy efficiency and help promote the consumption of renewable energy. The research and application of integrated energy has made some progress in various countries. Literature [2] studied the optimization of the capacity setting of comprehensive energy, aiming at improving the utilization efficiency of the energy system and meeting the demands of multiple types of energy use. Literature [3] studied the problem of system optimization operation of multi-type technology, and verified that the operation cost could be reduced. Literature [4] studied the operation mode of distributed energy system from the perspective of economic feasibility and environmental benefits. Literature [5] studied the feasibility of an integrated energy system in off-grid areas under the condition that it meets the energy needs of users.

2.2. Analysis of commercial operation mode of comprehensive energy service

Integrated energy service business operation model design. Under the background of energy Internet, integrated energy service, as a new energy service mode to meet customers' diversified energy production and consumption needs, will have diversified business models for its future development. This paper analyzes the business operation mode of integrated energy service based on energy Internet from the following aspects.

Value proposition. From a value proposition perspective, integrated energy services are an extension of power supply side services. In the energy ecological chain, the traditional energy supply enterprises only participate in the production link, not the electricity circulation and consumption link. With the continuous advancement of the energy industry revolution and the energy Internet field, new features such as multi-energy grid complementarity and technological innovation drive have gradually taken shape, thus giving birth to the proposition of diversified and comprehensive energy services.

Customer segmentation and customer relationship. By improving the ubiquitous connection capability, power grid enterprises can realize the all-time and ubiquitous interconnection of internal equipment, users and data, which is conducive to the accurate analysis of customer demand positioning in the context of big data, and to provide precise and differentiated services for users in line with the energy service needs of customers in the park and end customers. From the four dimensions of lean production, lean scheduling, accurate trading and lean energy efficiency, we can provide customers with personalized and customized service matching.

Core resources and capabilities. Energy Internet is based on the wide application of information and intelligent technologies such as big data, cloud computing, Internet of Things, mobile Internet, artificial intelligence, blockchain and edge computing. By pooling resources from all sides, it can provide sufficient and effective information and data support for the development of new businesses and new models including integrated energy services.

Key business. Integrated energy service generally covers three business models: multi-energy supply model, Internet + energy service model and technology service model. Multi-energy supply mode is a business model that integrates power grid, heat network and gas network through collaborative distribution of multiple distributed energy sources, and optimizes multiple energy sources, reduces costs and sells them to customers together. Internet + energy service mode is to deeply integrate Internet technology and energy field, give full play to platform advantages and data value, connect energy industry stakeholders, and provide diversified value-added services; service-oriented mode is a multi-directional expansion of energy service business based on advanced technologies of technical enterprises with advantages in distributed energy, regional energy Internet technology, and energy conservation transformation technology.

3. Analysis of key problems in comprehensive energy service operation

This part of a comprehensive energy service is summarized, the key issues in the business operations on the one hand, this section from a comprehensive energy service modeling technology, the related key technologies were summarized, on the other hand, this part from the perspective of integrated energy services business operation process, comprehensive energy service providers, service content and business mode) some key problems in summary.
3.1. User Multi-level Portrait Technology
Centering on the business related to integrated energy services, multi-level user portrait technology can be divided into three stages according to the business process: data preparation, modeling and analysis, and label processing, as shown in the table below.

| Phase                  | The main content               | The specific content                                                                 |
|------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Data preparation       | Data acquisition and transmission | Meteorological data, electrical characteristic data, marketing data, etc               |
|                        | Data preprocessing            | Data cleaning, data conversion, data protocol, data integration, etc                   |
|                        | User behavior                 | Category dimension, time dimension, response dimension and so on                      |
| Modeling analysis      | The user needs                | Basic energy supply demand, increase value demand                                      |
|                        | The user value                | Business profit, business risk, user loyalty, etc                                     |
| Label processing       | Label model library           | History use energy fact tag, data analysis model tag, etc                             |
|                        | User similarity               | Behavior similarity, demand similarity, value similarity                               |

3.2. Comprehensive portrait technology of energy service providers
Different from the simple objective evaluation, the evaluation subject of the comprehensive energy service provider is usually the user, and the difference of the user's selection criteria and conditions of emphasis will lead to the selection and weighting of the evaluation index cannot be generalized. Generally, human intervention is needed, and the comprehensive integrated weighting method combining the subjective and objective can be adopted.

3.3. Accurate market portrait technology
Market portrait technology is of great significance to the market operation of energy service providers, information operators and integrated energy service platforms, but in the specific implementation process, the emphases of market portrait should be different for each subject.

3.4. Service recommendation strategy
Service recommended strategy should build the automatic recognition and extraction of market main body similarity model, mining and energy between the user service, the difference and commonness between the theory of composite service, association rule mining, association recommended, collaborative filtering recommendation, frequent pattern tree theory, we can realize the scale of service product recommendations.

4. Conclusions and prospects
Integrated energy service is still a new thing in China. In order to promote the sustainable development of integrated energy service in China in the future, the author believes that the following aspects should be promoted:

4.1. Market organization
Reasonable is the key to promote market concentration and openness, promote comprehensive energy service market to industrial ecological evolution stages: one is to strengthen market supervision, especially must pay attention to comprehensive energy services basic energy services link of this kind of natural monopoly and competition in the market segment the market behavior of fusion, the second is, moderate strengthening market "superior" mechanism, in the fiscal and taxation, finance, credit
outstanding economies of scale, the development momentum of the relevant market players moderate
tilt, but should be in system of market information, market trading abide by the red line; third, dredge
the "bad" channel, improve the bankruptcy liquidation as the core of the market entities exit system
and its implementation mechanism; fourth, attach importance to the incubation of technological
innovation, encourage all kinds of market participants, especially the professional development of
energy service providers, and avoid the policy orientation of "helping the big while limiting the small"
to hinder the improvement of market quality and efficiency, as well as the transformation and
upgrading.

4.2. Integrated energy service business model design

4.2.1. Utilizing comprehensive energy services to promote the optimization of energy flow in the park.
Through distributed energy trading within the park, new investment and financing of distributed
energy, energy derivatives trading and other services, promote local sources and nearby consumption
of clean energy such as scenery, so as to realize clean and low-carbon park; through intelligent energy
management, contract energy management, electric energy substitution and other services, the park
will improve the traditional extensive energy production and consumption mode, promote the optimal
allocation of various energy resources and the improvement of comprehensive energy utilization
efficiency.

4.2.2. Use comprehensive energy services to promote the integration of multiple services. Through the
integration of energy supplies, professional intelligent operational maintenance, diversified energy
finance, big data information, the Internet and other services, accelerate the new mode and a new
forms of energy in the park innovation and development, to break the traditional restrictions and
barriers of the energy management system, electricity, heat (cold), gas and other energy services
coordination fusion, different link service "one-stop" integrated upstream and downstream, "energy +"
Shared a variety of peripheral industry service cycle.

4.2.3. Use integrated energy services to promote coordination of internal and external markets. The
integrated energy service will change the traditional centralized market organization form into the
coordinated centralized and distributed market organization form, which is essentially a decentralized
process.Organize direct transactions internally, customize comprehensive energy retail packages,
agent energy purchase and sale and energy derivatives transactions externally, participate in demand
side response and peak frequency modulation auxiliary services as flexible resources, provide
reasonable investment return channels for the energy system in the park, and realize optimal allocation
and value enhancement of resources inside and outside the park.

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