Research on Evaluation System of World-Class Energy Internet Enterprises

Haixu Song¹, Rui Li¹, Xiaodong Li¹, Guang Tian² and Yang Yang³

¹Department of Corporate Strategy, State Grid Energy Research Institute Co., Ltd, Beijing, 102209, China
²Administration office, State Grid Hebei Electric Power Co. Ltd, Shijiazhuang, 050021, China
³Energy Development Research Department, State Grid Hebei Economy Research Institute, Shijiazhuang, 050021, China
*Corresponding author’s e-mail: shxstudent@126.com

Abstract. The paper analyses the connotation and characteristics of world-class Energy Internet companies. And on this basis, it builds an evaluation index system of world-class Energy Internet companies. The evaluation index system includes four aspects: smart grid platform, superior energy services, steady company operation, and sustainable value creation, which contains 13 secondary dimensions totally. It provides reference and support for companies to accelerate the construction of Energy Internet.

1. Introduction
Changes in the energy field have a decisive impact on industrial and social development. In 2011, Rifkin proposed that the Energy Internet is one of the cores of the third industrial revolution. Thus it set off a new round of global upsurge in the Energy Internet. The world’s major economies such as the United States, Germany, the European Union, and Japan have all begun to pay attention to promoting the development of the Energy Internet [1-2]. In 2008, the National Science Foundation launched the “Future Renewable Electric Energy Delivery and Management System (FREEDM)” at North Carolina State University. In 2011, Europe launched the “Future Internet for Smart Energy (FINSENY)” project. In 2010, Japan launched the “Smart Energy Community” program to carry out research in the fields of energy and smart grid. In 2011, Japan began to promote the “Digital Grid” program. In 2016, the National Development and Reform Commission of China issued the “Guiding Opinions on Promoting the Development of ‘Internet +’ Smart Energy”, which clarified ten key tasks such as intelligent energy production and consumption infrastructure, multi-energy collaborative integrated energy network, and deep integration of energy and information and communication infrastructure [3-5]. At present, a consensus has been reached on the development trend of the power grid to the Energy Internet. However, there is little research on how to evaluate Energy Internet companies. This paper takes grid companies as the main research object, and aims to construct a world-class evaluation index system for Energy Internet companies, so as to provide reference for Energy Internet companies.
2. Research on the connotation of Energy Internet enterprises

From the traditional power grid to the Energy Internet, it is the transformation and upgrade of the power grid development in the new situation, including power grid functions, technical characteristics, business services and management models.

The power grid platform has been upgraded comprehensively, becoming an integrated platform for the deep integration of energy resource allocation platform, user interaction platform, and market trading platform. In terms of energy resource allocation platform, it has changed from a simple electrical energy allocation platform to a comprehensive allocation platform for multiple energy sources such as cold, heat, electricity, gas, etc. In terms of user interaction platform, Energy Internet will achieve in-depth interaction with users and form an open and shared ecosystem. In terms of market trading platform, users, electricity sales companies, distributed energy sources, electric vehicles and other market subjects will participate in market transactions, and the types of transactions are more diverse.

Energy technology will be integrated with information technology deeply. The breakthrough and popularization of technologies such as energy storage, flexible transmission, and coordinated control can provide more flexible adjustment methods and resources for the power system. The traditional power grid mainly regulates power supply. Energy Internet will coordinate power supply, load, energy storage, and multi-variety energy sources actively.

The service type will be changed from a single power supply service to a high-quality and accurate energy supply service. Energy Internet can provide customers with higher-quality integrated energy services, including electricity services, comprehensive energy utilization, personalized and customized energy solutions, and so on. The business model will be transformed from a vertical model to a platform model. And the value creation will be realized in the form of “innovation-driven + network effect + ecosystem”. Energy Internet can gather energy producers, transmitters, consumers, equipment vendors, service providers on a unified platform, which will promote more cross-border integration and innovation.

The management mechanism of Energy Internet enterprises will be more flexible. The operation of the Energy Internet will adopt flexible organizational structure and mechanism, such as mixed ownership and platform participation, to attract different partners to participate. In the process of grid construction, platform operation, resource allocation, and process optimization, Energy Internet will make use of advanced technologies such as big data and AI, to achieve a higher degree of lean management.

3. Construction of evaluation index system for Energy Internet enterprises

3.1. Theoretical basis of index system construction

This article builds on the evaluation system of Energy Internet companies based on the balanced scorecard theory. Balanced scorecard is an important tool for the strategic management of group companies. Balanced scorecard is guided by corporate strategy and evaluate the company’s performance from four aspects: finance, customers, internal processes, learning and growth. It is not only a performance evaluation system, but also a strategic management system.

3.2. Index system construction

This paper proposes an Energy Internet enterprise index system from four dimensions: smart grid platform, superior energy services, steady company operation, and sustainable value creation. And smart grid platform reflects the development level of the Energy Internet. Superior energy services reflects energy service and customer service capabilities. Stable company operation reflects the company’s internal operation and management level. Sustainable value creation reflects the company’s value contribution and the sustainable development capabilities.
Smart grid platform mainly measures the Energy Internet network scale, basic level, platform functions, including four aspects: extensive interconnection capabilities, security control capabilities, energy configuration capabilities, and intelligent interaction capabilities.

Superior energy services mainly measures the company’s supply quality and service level for basic power and integrated energy, including three aspects: the basic grid service level, integrated energy service level, and customer service level.

Steady company operation mainly measures the company’s strategic decision-making and operation management capabilities, including three aspects: independent innovation capability, cost reduction and efficiency enhancement capability, and business expansion capability.

Sustainable value creation mainly measures the company’s contribution to the country, and the economy and society development, as well as the continuous improvement of the company’s comprehensive strength and international status, including three aspects: the fulfilment of social responsibility, sustainable development capabilities, and international influence.

Table 1. Evaluation index system for Energy Internet enterprises.

| First-dimension | Second-dimension | Definition |
|-----------------|-----------------|------------|
| Smart grid platform | Extensive interconnection capabilities | Refers to the scale of the power system, the extent of the connection range and the level of interconnection |
| Security control capabilities | | Refers to the ability of power system to resist all kinds of external interference, and the level of security control |
| Energy configuration capabilities | | Refers to the ability of power grid to configure large-scale clean energy and the complementary level of multiple energy |
| Intelligent interaction capabilities | | Refers to the intelligent level of energy system, and the extensive and convenient access level of user-side resources participation in grid |
| Superior energy services | The basic grid service level | Refers to the power supply and service quality of the power grid |
| Integrated energy service level | | Refers to the level of supply, service and comprehensive solutions for multiple energy sources |
| Customer service level | | Refers to the customer's overall satisfaction with energy services, including convenience, precision, diversification and customization |
| Steady company operation | Independent innovation capability | Refers to the company's independent R&D and application capabilities in new materials, new technologies and new equipment about Energy Internet |
| Cost reduction and efficiency enhancement capability | | Refers to the company's ability to control costs and increase efficiency |
| Business expansion capability | | Refers to the company's ability to develop new businesses |
| First-dimension        | Second-dimension                                      | Definition                                                                 |
|-----------------------|-------------------------------------------------------|-----------------------------------------------------------------------------|
| Sustainable value creation | The fulfilment of social responsibility              | Refers to the company’s social responsibility performance                   |
|                       | Sustainable development capabilities                   | Refers to the comprehensive strength of the operating efficiency, asset quality and growth ability |
|                       | International influence                               | Refers to the international level in international business, management, resource allocation, talents, corporate culture, brand, etc |

4. Conclusion
The paper analyses the connotation and characteristics of world-class Energy Internet companies. And on this basis, it builds an evaluation index system of world-class Energy Internet companies. The evaluation index system includes four aspects: smart grid platform, superior energy services, steady company operation, and sustainable value creation, which contains 13 secondary dimensions totally. It provides reference and support for companies to accelerate the construction of Energy Internet.

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