Research on the Background of Effectiveness Evaluation of New Power System Technical Standards System

Chao Lv[1(✉)], Pengwei Cong[2], Pengyue Zhang[1], Shuning Zhao[1], Jing Zhang[1], Zhen Wei[3], Nuoling Sun[3], and Xin Wei[3]

[1] College of Standardization, China Jiliang University, Hangzhou 310018, Zhejiang, China
1336562890@qq.com, zhang_pengyue@cjlu.edu.cn
[2] State Grid Energy Research Institute Co., Ltd., Beijing, China
[3] State Grid Fujian Economic Research Institute, Fuzhou, China

Abstract. This article studies the key technical directions and system framework of the new power system technical standard system; This paper studies the effectiveness evaluation of the implementation of the domestic new power system technology standard system; The connotation of the effectiveness evaluation of the new power system technical standard system was analyzed from three aspects: the definition of effectiveness, the evaluation content of enterprise technical standard effectiveness, and the evaluation method of enterprise technical standard system effectiveness; Finally, the significance of conducting the effectiveness evaluation of the new power system technical standard system is studied and analyzed from the three major roles of ensuring the fundamental, leading, and strategic performance of technical standards, providing a fundamental basis for the effectiveness evaluation of the new power system technical standard system.

Keywords: technical standards · standard system · effectiveness evaluation

1 Introduction

As a fundamental industry, the power industry has supported the rapid development of China's national economy in recent years, and standardization work has also played an important fundamental role in the healthy and orderly development of the power industry [1]. The implementation efficiency of technical standards is an important aspect that reflects the standardization level, construction and implementation capacity of enterprises. It plays an important role in improving the quality of enterprise technical standards, improving production and operation management efficiency, and promoting high-quality development.

The research on the benefits of grid technology standards in foreign countries is deepening with the construction of smart grids. The "Smart Grid Cost and Benefit Assessment Report" released by the American Academy of Electric Power Sciences proposes a methodology, main ideas, and analysis results for quantitative analysis of

S. Tehseen et al. (Eds.): ICEDBC 2023, AEBMR 258, pp. 552–558, 2024.
https://doi.org/10.2991/978-94-6463-246-0_67

investment demand for smart grids. It also provides a preliminary evaluation of the benefits of comprehensive construction of smart grids in the United States, roughly dividing the construction of smart grids into indicators such as productivity, safety, environment, quality of life, safety, and reliability for accounting [2]. With the gradual development of the strong smart grid construction led by State Grid Corporation of China, more and more scholars in China have recognized the enormous economic and social benefits contained in smart grids. Therefore, research on the evaluation of smart grid benefits has also been rapidly carried out in China.

As a leader in the power industry, State Grid Corporation of China (SGCC) has conducted in-depth work on technical standardization, but research on the effectiveness evaluation of technical standard implementation is still blank. Evaluating the effectiveness of implementing technical standards in a systematic manner can provide a clearer and more accurate analysis of various factors and mechanisms of benefits in the power grid, and provide important basis for the next stage of standardization work. It comprehensively improves the efficiency of standardization work, ensures the efficient and accurate implementation of standards, and fully guarantees the safety, stability, economy, and high-quality operation of the power grid [3].

2 Research on the Technical Standard System and Evaluation of New Power Systems

2.1 New Power System Technical Standard System

In order to thoroughly implement the National Standardization Development Outline, actively promote the implementation of the goal of "carbon peaking, carbon neutrality", and promote the construction of a new power system with new energy as the main body, the State Grid Corporation of China organized more than 100 experts inside and outside the system to jointly prepare the National Grid New Power System Technical Standard System. The new power system technology standard system is constructed based on the principles of systematicity, coordination, openness, and scalability. It is decomposed into modules according to the professional technology of the new power system, highlighting key technical directions such as new energy, energy storage, microgrid, and digitization, forming a system framework of "8 branches, 34 fields, and 122 series". However, there is currently a lack of scientific evaluation methods for the effectiveness of constructing the new power system technical standard system, and there is still insufficient research on the implementation effectiveness of the new power system technical standard system. It is necessary and urgent to carry out relevant research to provide decision-making support for the company to achieve closed-loop management of standardization work, and further optimize and improve the new power system technical standard system to provide technical support [4].

2.2 Evaluation of the Effectiveness of the New Power System Technical Standard System

In recent years, foreign scholars have also conducted research on the effectiveness evaluation of enterprise technology standard systems, which will be discussed from three

aspects: the definition of effectiveness, the content of evaluation of enterprise technology standard effectiveness, and the methods of evaluation of enterprise technology standard system effectiveness.

In terms of effectiveness definition, ISO defines quality effectiveness as the measurement of the degree to which an organization completes technical activities and meets technical standards, that is, the degree to which the set quality policy and quality objectives are achieved through the operation of the quality management system, the completion of the processes or activities required by the system, including compliance with laws and regulations, customer satisfaction, etc. Samuelson P. A. proposed the concept of market efficiency, believing that in an efficient market, returns above average profit margins cannot be obtained through price expectations. Eugene Fama further divides efficient markets into three different types: weak form efficient markets, semi strong form efficient markets, and strong form efficient markets. Yu mingfu et al. defined the effectiveness of the real estate market as the degree to which the trading prices of real estate stocks and the actual trading prices of real estate react to information. Cronbach, L.J. et al. believe that standard validity is an evaluation based on standard metrics, from test scores to performance inference, and can also be seen as an evaluation of overall judgment from test samples to target content [5].

In terms of evaluating the effectiveness of enterprise technical standards, Roberto Giordano et al. conducted research on the design guidelines, maintenance procedures, and evaluation of expected performance indicators of technical standards through the lifecycle, and provided a technical standard effectiveness evaluation plan that includes information and specifications [6]. Kate Kazlovich et al. divided the effectiveness evaluation of technical standards into three consecutive levels: evaluating the availability and sufficiency of information provided by the design, evaluating basic relevant performance parameters, and evaluating the compliance of technical standards. Each successive level analyzed the data from the previous stage at a higher resolution [7]. Jo Ann Morrison et al. analyzed the various stages of technical standard evaluation, emphasized the importance of the audit process, and believed that continuous improvement activities are crucial to ensure the authenticity of the effectiveness evaluation of technical standards [8].

In terms of the evaluation method for the effectiveness of enterprise technical standards, Elisabetta Monaldo et al. conducted a rigorous evaluation of the effectiveness of existing technical indicators and used a least squares fitting program to recalibrate the empirical correction coefficients introduced in the technical criteria [8]. Hamzeh Alimohammadi et al. proposed a fuzzy set recognition standard to ensure the accuracy of the effectiveness evaluation of technical standards, which mainly includes three parts: tool construct validity testing, prioritization, and the relationship between variables [9].

3 The Significance and Purpose of Evaluating the Effectiveness of the New Power System Technical Standard System

3.1 Significance of Conducting Effectiveness Evaluation of the New Power System Technical Standard System

Ensure that technical standards play a fundamental role and assist power enterprises in achieving the "dual carbon" goal of high standard services. Building a new type of power system with new energy as the main body is one of the important measures for China to achieve the "dual carbon" goal [10]. Achieving "carbon peak and carbon neutrality" is a broad and profound economic and social systematic change. The research on the effectiveness evaluation of the new power system technical standard system can accurately assess the scientificity of the development of the new power system technical standard system, effectively ensure that the technical standards play a fundamental role, standardize the industry order, optimize the development environment, help coordinate the relationship between clean development, power security, and system security, and help the company achieve the goal of "carbon peak, carbon neutrality" high standard service.

Ensure that technical standards play a leading role and help power enterprises lead the high-quality development of new power systems. Building a new type of power system carries the historical mission of energy transformation, is an important component of a clean, low-carbon, safe and efficient energy system, and is also a highly challenging and pioneering strategic project faced by power enterprises. Conducting research on the effectiveness evaluation of the new power system technical standard system can accurately measure the unity of the standard system and technical system, effectively ensure the leading role of technical standards, and help accelerate the improvement of related core technologies, equipment, and service levels. It can solve the coordination difficulties of the construction of the new power system at the levels of project implementation, market transactions, information exchange, and technological innovation, Boost the company to lead the development direction of new power systems.

Ensure that technical standards play a strategic role and support power enterprises in participating in international scientific and technological cooperation and competition at a higher level. International standards are an important technological foundation for the global governance system and economic and trade cooperation development, and an important means for companies to represent their countries in global energy technology cooperation and global governance [11]. Conducting research on the effectiveness evaluation of the new power system technology standard system can accurately assess the consistency between the standard system and the company's strategy, effectively ensure the strategic role of technical standards, advance the internationalization direction of standards, and produce more international standard achievements, which helps to effectively enhance the company's international influence and discourse power, and support the company's participation in international cooperation and competition at a higher level.

3.2 Purpose of Conducting Research on the Effectiveness Evaluation of the New Power System Technical Standard System

The new power system technical standard system has just been established, and effective evaluation methods have not yet been formed to ensure the unity of the standard system and technical system, and to meet the goals of promoting scientific and technological innovation, promoting the construction of the new power system, and driving industrial development. At present, most research mainly focuses on exploring the evaluation of the implementation process and benefits generated after the implementation of technical standards, and the evaluation of the effectiveness of the technical standard system is still blank. This article delves into the effectiveness evaluation model of the new power system technology standard system, with a focus on proposing a quantitative evaluation model and evaluation method for the effectiveness and implementation benefits of the construction of the new power system technology standard system. Pilot demonstration applications are carried out to verify the effectiveness, ensuring that the new power system technology standard system can promote technological innovation, promote the construction of the company's new power system, and assist the company's green and low-carbon development.

4 Conclusion and Prospect

This article first studies the key technical directions and system framework of the new power system technical standard system; This paper studies the effectiveness evaluation of the implementation of the domestic new power system technology standard system; The connotation of the effectiveness evaluation of the new power system technical standard system was summarized and analyzed from three aspects: the definition of effectiveness, the evaluation content of enterprise technical standard effectiveness, and the evaluation method of enterprise technical standard system effectiveness; Finally, research and analyze the significance of evaluating the effectiveness of the new power system technical standard system from the three major roles of ensuring the fundamental, leading, and strategic performance of technical standards, in order to ensure that the new power system technical standard system promotes scientific and technological innovation, system construction, and green and low-carbon development of power enterprises.

Acknowledgement. This project is supported by the project "Research on the Effectiveness Evaluation Model of the New Power System Technical Standard System and Demonstration Application in Typical Fields" (project number: SGFJJY00GHJS2200133).

References

1. Zhao Lei. Research on the Impact of Power Standardization on the National Economy [D]. China Institute of Water Resources and Hydropower Research, 2017. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CDFDLAST2017&filename=1017092553.nh.

2. Li Ruochen. Research on the Indicator System and Evaluation Model for Smart Grid Benefit Analysis [D]. North China University of Electric Power (Beijing), 2017. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201801&filename=1017222418.nh.
3. Li Xiaojun, Ma Huizhuo, Liu Xiangyu, Yu Tengkai. Investment Benefit Evaluation of Distribution Network Projects Based on Grey Hierarchy Model [J]. Power Supply and Consumption, 2017,34(01): 46–50. https://doi.org/10.19421/j.cnki.1006-6357.2017.01.010.
4. Gao Qian, Yang Yang, Hu Guangwei, Xu Chao, Shen Gaofeng, Zhao Jian. Research on Investment Benefit Evaluation of New Energy Projects Driven by Electric Power Big Data: Taking the SG-ERP System of Y City Power Grid Company as an Example [J]. Modern Library and Information Technology, 2016 (12): 57–65. https://kns.cnki.net/kcms/detail/detail.aspx?FileName=XDTQ201612008&DbName=CJFQ2016
5. Roberto Giordano, Elena Montacchini, Silvia Tedesco, Alessandra Perone. Living Wall Systems: A Technical Standard Proposal, Energy Procedia, Volume 111,2017,Pages 298–307,ISSN 1876-6102. https://doi.org/10.1016/j.egypro.2017.03.093.
6. Kate Kazlovich, Soumya Ranjan Mishra, Kamran Behdinan, Aviv Gladman, Jesse May, Azad Mashari, Open ventilator evaluation framework: A synthesized database of regulatory requirements and technical standards for emergency use ventilators from Australia, Canada, UK, and US, Hardware X, Volume 11,2022,e00260,ISSN 2468-0672. https://doi.org/10.1016/J.OHX.2022.E00260.
7. Jo Ann Morrison, Nate Spofford, Mingyin Yang, Emi Saito, Lorna Lambert, Karen Faunt, Development and implementation of veterinary anesthesia medical quality standards for primary care, Veterinary Anaesthesia and Analgesia,2022,ISSN 1467-2987. https://doi.org/10.1016/J.VAA.2022.01.009.
8. Elisabetta Monaldo, Francesca Nerilli, Giuseppe Vairo, Effectiveness of some technical standards for debonding analysis in FRP-concrete systems, Composites Part B: Engineering, Volume 160,2019,Pages 254–267,ISSN 1359–8368. https://doi.org/10.1016/j.compositesb.2018.10.022.
9. Hamzeh Alimohammadi, Shengnan Nancy Chen, Performance evaluation of outlier detection techniques in production timeseries: A systematic review and meta-analysis, Expert Systems with Applications, Volume 191,2022,116371,ISSN 0957-4174. https://doi.org/10.1016/J.ESWA.2021.116371.
10. Li Zhijie, Wang Yan. Construction and application of a low-carbon power grid benefit evaluation model under a new power system [J]. Light Source and Lighting, 2023 (01): 198–200. https://kns.cnki.net/kcms/detail/detail.aspx?FileName=GYZM202301064&DbName=CJFQ2023.
11. Zhao Shukuan, Yan Fang, Chen Dan. NGO and China's Technical Standardization [J]. Industrial Technology and Economics, 2006,25 (5): 22–24. https://kns.cnki.net/kcms/detail/detail.aspx?FileName=GHZJ200605007&DbName=CJFQ2006