



Discussion on China's Construction of Green Manufacturing Standard System in Furniture Industry

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Abstract. To implement the "green" development concept proposed at the Fifth Plenary Session of the 18th CPC Central Committee [1-3], the furniture industry, as an important livelihood sector, has actively advanced the construction of a green standard system in response to the demands of the times and the current state of the industry. By reviewing and analyzing the content and scope of existing and drafting green development-related standards in the furniture industry (including green factories, green design, green products, green supply chains, carbon emissions, etc.), this paper briefly discusses the guidance provided by green manufacturing standards for the furniture industry's green development, as well as their role in establishing exemplary green leadership and promoting the pursuit of green transformation. It also offers relevant references for further filling gaps in the standard system.

Keywords: Furniture industry, green manufacturing, standard system.

1 Introduction

In the context of the deepening global climate governance and the acceleration of the energy revolution, the green and low-carbon transformation of the manufacturing industry has become a common consensus among the international community. As a responsible manufacturing powerhouse, China has set achieving new industrialization as its key task. It regards green and low-carbon development as the ecological foundation of the new industrialization process, and jointly promotes carbon reduction, pollution reduction, green expansion, and economic growth. China has contributed its wisdom and solutions to global sustainable development. <Made in China 2025> identifies green development as one of its primary directions, explicitly advocating the comprehensive implementation of green manufacturing. Green manufacturing is a modernized production model characterized by low consumption, low emissions, high efficiency, and high benefits. Its essence lies in holistically considering factors such as industrial structure, energy and resources, ecological environment, health and safety, and climate change during the development of the manufacturing sector, integrating green development concepts and management requirements throughout the entire product life cycle.

2 Green Manufacturing Standard System in Furniture Industry

2.1 General

The information age and globalized industrial operations have posed severe challenges to the traditional furniture manufacturing industry. The concept of environmental protection is also a major challenge for the furniture industry's development. The Chinese furniture manufacturing industry is particularly under great pressure for transformation and upgrading. Adhering to the single competitive strategy of cost leadership is no longer suitable for the new competitive landscape. Therefore, the Chinese furniture manufacturing industry must take effective measures to enhance its competitiveness. During the '13th Five-Year Plan' period, guided by the principles of green development, the furniture industry has released relevant standards for energy consumption management of panel furniture, green design, green products, and cleaner production. With the deepening of green manufacturing and the establishment of China's 3060 goals, the furniture industry has embraced the objectives of carbon peak and carbon neutrality, continuously improving its standard system. Revisions to existing green manufacturing standards have added requirements related to low-carbon and energy, as well as standards related to greenhouse gas emission accounting and carbon footprint assessment. All these actions filled the gaps in the industry and established a green manufacturing standard framework for the furniture sector.

This framework encompasses foundational standards, green products, green factories, green enterprises, green supply chains, as well as carbon emissions and carbon footprint standards, providing a structured approach to guide the green and low-carbon development of the furniture industry.

2.2 Standards for Green Product

To establish an unified system for standards, certification and labeling of green products, the National Standardization Technical Group for Green Product Evaluation drafted and issued GB/T 33761—2017<General principles for green product assessment>, guiding various industries to draft green product standards in corresponding industry. The furniture sector also actively responded to policy requirements by issuing GB/T 35607—2017<Green product assessment—Furniture>, which was drafted under the guidance of the general principles in GB/T 33761—2017. This standard became a crucial benchmark for green evaluation in the furniture industry and was included in the first batch of green product evaluation standards and certification catalogs released by the State Administration for Market Regulation in April 2018. The furniture industry subsequently adopted this standard to conduct green product certification.

On September 22nd, 2020, the "3060" carbon peak and carbon neutrality goals were established. Driving national technological innovation and development transformation through carbon peaking and neutrality is an inherent requirement for addressing prominent resource and environmental constraints and achieving sustainable development.

In 2021, China formulated the "14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-Range Objectives Through the Year 2035", which put forward new requirements for the furniture industry. Consequently, GB/T 35607—2017 needed to be modified in areas such as "energy" and "low-carbon." On June 29, 2024, the revised version, GB/T 35607—2024 <Green product assessment—Furniture> was released. This updated standard incorporates requirements for energy attributes and low-carbon properties, optimizes measurement methods for harmful substances in wooden and other furniture, improves the determination methods for formaldehyde, benzene, toluene, xylene, and TVOC in upholstered furniture, and added new requirements for carbon footprint reporting in furniture products.

The implementation of GB/T 35607—2024 will facilitate foundational work for carbon peaking actions in the furniture sector. It will promote the clean, low-carbon, safe, and efficient use of energy in the industry, further advance green transformation and upgrading, and support the green, ecological, and healthy development of the furniture sector.

2.3 Standards for Green Factories

Green factories constitute the core component of the green manufacturing [4]. On May 14th, 2018, the national standard GB/T 36132-2018<General principles for assessment of green factory> was issued, providing a fundamental framework and guidelines for green factory assessments. Various industries have subsequently developed standardized evaluation requirements for green factories within their respective sectors based on these general principles. Differences in green evaluations across different types of factories primarily manifest in aspects such as infrastructure, management systems, energy and resource inputs, products, environmental emissions, and performance of the factory. Accordingly, the furniture industry formulated and released QB/T 5704—2022 <Guidelines for evaluation of green factory in furniture industry> in 2022, establishing an evaluation framework tailored to the characteristics of the sector.

Given the diversity of typical factory types in the furniture industry—including wooden furniture, metal furniture, plastic furniture, glass furniture, and upholstered furniture factories, there are significant differences among these factories in all aspects of green evaluation. For instance, processes such as cutting and drying in wooden furniture factories, foaming in upholstered furniture factories, and spraying in metal furniture factories involve distinct equipment, facilities, energy inputs, and environmental emissions, making it impractical to apply uniform evaluation criteria.

Table 1. Five evaluation standards for green factories in the furniture industry.

No.	Standardizing document	Publish date	Effective date
	QB/T 5971-2024		
1	Evaluation requirements for green factory in wooden furniture industry	2024-03-29	2024-10-01
2	QB/T 5972-2024	2024-03-29	2024-10-01

Evaluation requirements for green factory in glass furniture industry			
QB/T 5973-2024			
3	Evaluation requirements for green factory in metal furniture industry	2024-03-29	2024-10-01
QB/T 5974-2024			
4	Evaluation requirements for green factory in upholstered furniture industry	2024-03-29	2024-10-01
QB/T 5975-2024			
5	Evaluation requirements for green facto- ries in plastic furniture industry	2024-03-29	2024-10-01

On March 29, 2024, the furniture sector released five green evaluation standards targeting different types of furniture factories (specific standard details are provided in the Table 1). Through comprehensive consideration and validation of green evaluation indicators, these standards establish targeted and applicable requirements for green factory assessments, guiding and standardizing the implementation of green manufacturing practices while providing support for green factory evaluations in the furniture industry.

2.4 Standards for Green Enterprise

According to the green manufacturing standard system model based on <Guidelines for the Construction of Green Manufacturing Standards System>, enterprises can obtain standardized support for implementing green strategies, promoting green culture, building green brands, and fulfilling environmental social responsibilities by formulating and revising relevant green enterprise standards. This provides a basis for enterprises to pursue green development pathways.

Driven by global sustainable development goals, the ESG (Environmental, Social, and Governance) investment concept has gained traction, and corporate performance in these areas has attracted increasing attention from all sectors of society [5]. In June 2022, China's Ministry of Ecology and Environment explicitly stated that it would vigorously foster a policy environment conducive to ESG development in China. Excellent ESG performance by enterprises lays a solid foundation for the smooth implementation of internal controls and creates a harmonious and orderly internal and external environment. Internal control, as a key mechanism for stable corporate operations, focuses on safeguarding and balancing the legitimate rights and interests of various stakeholders, ensuring stable development amid complex interest structures.

As a major global manufacturer and exporter of furniture, many Chinese furniture enterprises have begun conducting ESG assessments to align with global sustainability goals and enhance their international competitiveness. To effectively leverage the guiding role of group standards in quality improvement, the China National Furniture Association issued the group standard T/CNFA 036-2025 <Guidelines for environmental, social and governance (ESG) evaluation of furniture enterprises>. This standard speci-

fies the principles, specific evaluation indicators, evaluation levels, and evaluation processes for ESG assessments in furniture enterprises. It can guide third-party evaluation institutions in conducting ESG evaluations for furniture enterprises and serve as a reference for self-assessment. This initiative contributes to optimizing ESG management systems in furniture enterprises and promotes high-quality development.

2.5 Standards for Greenhouse Gas Emission

With the ongoing advancement of modern industrialization and the continuous expansion of human activities, climate change has garnered widespread international attention since the 21st century. A key driver of this phenomenon is the increasing concentration of greenhouse gases in the atmosphere. Data reveals that global annual greenhouse gas emissions currently reach 51 billion tons, making greenhouse gasses the foremost among the world's top ten environmental challenges. Carbon neutrality is a crucial goal for combating climate change and creating a sustainable future. It means balancing the amount of carbon dioxide emitted into the atmosphere with the amount removed or offset, resulting in a net-zero carbon footprint. Achieving carbon neutrality requires a collective effort from individuals, businesses, and governments[6-7]. In the changing landscape of global political economy and greenhouse gas emissions, China is gradually playing an increasingly important role under the global climate governance mechanism. On September 22, 2020, China first announced to the world at the general debate of the 75th United Nations General Assembly that China would increase its nationally determined contributions, proposing the "dual carbon" goals, namely striving to peak China's carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060.

China is the world's largest furniture producer. The primary raw materials used in furniture manufacturing—wood, metal, glass, and plastic—all involve carbon emissions, as does the process of transforming these materials into finished furniture products. In 2024, the furniture industry established the national standard GB/T 32151.20-2024, <Requirements of the greenhouse gas emissions accounting and reporting Part 20:Furniture production enterprise> which specifies the accounting boundaries, measurement and monitoring requirements, accounting procedures and methods, data quality management, as well as the content and format of reports for greenhouse gas emissions by furniture manufacturers. Enterprises primarily engaged in furniture production can use the methodologies provided in this standard to calculate greenhouse gas emissions and compile corporate greenhouse gas emission reports.

Additionally, the national standard <Greenhouse gases Quantification requirement and method for carbon footprint of products-Furniture> is currently under development. This standard will define the objectives and scope of carbon footprint quantification for furniture products, along with requirements for data, data quality and preservation, life cycle inventory analysis, interpretation of product carbon footprint results, and the preparation of carbon footprint research reports. Adopting a full life cycle perspective, the standard aims to ensure the comprehensiveness and accuracy of carbon footprint accounting. It will employ scientific methodologies to avoid double-counting and enhance precision in calculations. To address the unique characteristics of the furniture

industry, such as material diversity and production process complexity, specific accounting rules and methods will be formulated to meet the carbon footprint accounting needs of different furniture products.

2.6 Standards for Green Supply Chain

The supply chain is a functional network chain centered around core enterprises, formed through the integration of upstream and downstream resources. Establishing a green supply chain standard system will help build a procurement, production, marketing, recycling, and logistics system oriented toward resource conservation and environmental friendliness, implementing the extended producer responsibility system. This includes aspects such as green supply chain construction, green procurement, green marketing, green logistics and warehousing, recycling, and comprehensive utilization.

The furniture industry involves numerous links in the supply of raw and auxiliary materials, manufacturing, and other processes. The creation of a green supply chain will contribute to the overall green development of the furniture industry. Taking furniture enterprises (factories) as points, chains are formed between upstream and downstream entities, gradually expanding into areas (industrial parks), ultimately fostering a green development trend across the entire industry. The furniture sector is currently formulating relevant green supply chain evaluation standards, such as the 'Green Supply Chain Evaluation Requirements for the Furniture Industry'. These standards aim to guide enterprises in integrating green manufacturing, product life cycle management, and extended producer responsibility concepts into supply chain management. By coordinating various supply chain links (suppliers, manufacturers, logistics providers, retailers, users, recyclers, disposal agents, etc.), the standards seek to identify and manage the green attributes of products throughout their life cycle, reducing resource consumption, environmental pollution, and health hazards during manufacturing, transportation, storage, usage, and disposal. This promotes resource recycling and drives sustainable supply chain development.

At the same time, in response to the challenges posed by furniture replacement and disposal, the furniture sector is actively conducting research on standards for recycling and comprehensive utilization. The goal is to achieve green treatment at the 'final stage' of the furniture life cycle through standardized constraints, minimizing resource waste and environmental pollution.

3 Conclusion

Under the framework guidance of the <Guidelines for the Construction of Green Manufacturing Standards System>, the furniture sector has initially established its own green manufacturing standard system. In terms of green product (design) and green factory evaluation, targeted evaluation standards have been formulated for different categories of furniture and their factories. For green enterprises, ESG evaluation standards have been developed, while for green supply chains, relevant evaluation standards

are currently being formulated. In the area of green and low-carbon development, standards for greenhouse gas emission accounting and carbon footprint quantification have been established. By fully leveraging the respective advantages of national, industry, and association standards, gaps in corresponding standards are promptly filled, ensuring timely and effective standard supply. This not only provides a basis for green manufacturing evaluation and certification in the furniture industry but also offers pathways for furniture enterprises seeking green development and transformation. Large furniture enterprises enhance their core competitiveness through green products, while small and medium-sized enterprises take green products as benchmarks, significantly promoting the green development of the furniture industry. This holds profound significance for the green development of China's furniture sector.

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