Chinese green product standards: international experience and pathway for a unified system

Fu Yun*, Lin Ling, Gao Dongfeng, Yang Shuo
China National Institute of Standardization, No.4 Zhichun Road Haidian District, Beijing 100191, China

* Corresponding author. Tel.: +086-010-5881-1701; fax: + 086-010-5881-1701.
E-mail address: fuyun@cnis.gov.cn.

Abstract: The establishment of a unified green product standard system is of great importance regarding the effective supply of green products and meeting trend of the consumption upgrade. It also is helpful to reduce the cost of green information disclosure of enterprises, and facilitate the supply-side structural reform. Based on the experience of developing and implementing green product standards in the EU, Germany, America, Japan and so on, combined with current Chinese standard systems including environmental protection, energy conservation, water conservation, low carbon, recycling, regeneration and organic, with the adoption of the life cycle thinking, this paper brings forward basic requirements on organizations including pollutant emissions, establishment of management system, energy conservation and emission reduction technology and green supply chain management, and proposes indicator requirements on product including resource attributes, energy attributes, environmental attributes and quality attributes, so as to guide the establishment of green product evaluation standards in the context of China.

1. Introduction
With China's economy leaping to the second place in the world, people's consumption demand is transforming from low price to the features of good quality, green and environmental-friendly. The market demand for products with high quality, safety and environmental-friendliness is very urgent, especially for intelligent toilet lid, painting material, furniture and other construction materials for house decoration. Chinese overseas consumption boosted to 1.5 trillion Yuan in 2015, and hit a new high of 90 billion Yuan during the Spring Festival in 2016 [1]. The strong overseas consumption reflects the structural contradiction between the supply and demand sides in China, especially in the middle and high-end consumption market, highlighting the situations of lacking confidence in the domestic products, as well as the low-end overcapacity but the inadequate supply of the high-end products.

China's insufficient supply of the middle and high-end products and the production and sale of counterfeits are also important reasons for the outflow of purchase. Only by gradually eliminating low-quality products by strengthening the implementation of the quality, environmental protection, energy conservation and safety standards, so to improve product's quality, level of safety and brand reputation, and make intelligence, green, soundness and security as the core elements of Chinese products, the oversea purchase can be redirected back to the China market step by step.

At present, with the enhanced awareness of environmental protection and the transformable consuming behaviors, more and more consumers pay close attention to the environmental-friendly
performance of the products. In addition, enterprises in the downstream of the supply chain are increasingly concerned about the environmental performance and green properties of upstream enterprises, so green supply chain has gradually become a hot spot. However, a Euro barometer survey shows that currently 48% consumers are confused about the various eco-labels for green products in the EU [2]. There are many green-related labels worldwide, such as carbon footprint label, water footprint label, energy-conservation label, energy efficiency label and ecological label. Each label is in accordance with the specific standards, which are mostly unrelated or even contradicted with each other. Most of them just disclose the environmental information of one or several aspects and mostly only focus on the production process without taking the environmental impact of the whole life cycle into account. Therefore, not only for the international or the regional, but also for China and other developing countries, it needs to establish a standard and labeling system based on a unified and harmonized approach, and integrate the currently independent, green-related labels and systems.

2. Current situations of green product standards in China and other countries

2.1. Domestic Situations
Different departments in China have set up a number of “green-related products” evaluation systems based on to their specific needs, such as environmental protection, energy conservation, water conservation, recycling, low carbon, organic and so on, so that various green-related labels exist in China’s domestic market and are sometimes hard to identify.

In terms of energy conservation, in order to support the implementation of energy efficiency labeling system and energy-conservation product certification, the Standardization Administration of the People’s Republic of China (SAC) has developed 64 mandatory national energy efficiency standards for the terminal energy-using products including household appliances and industrial energy equipments, such as household refrigerator, household air-conditioner, electric washing machine, small and medium-sized three-phase asynchronous motor, water chilling unit and so on.

In terms of low carbon, the SAC is organizing to develop the national low-carbon product evaluation standards for small and medium-sized three-phase asynchronous motor, flat glass and Portland cement. At the same time, the Certification and Accreditation of the People’s Republic of China (CNCA) has issued low-carbon product certification directives for Portland cement, flat glass, aluminum alloy architectural profile as well as small and medium-sized three-phase asynchronous motor, which serve as the basis for low-carbon product certification.

In terms of water conservation, in order to support the implementation of water efficiency labeling system and water-conservation product certification, the SAC has developed 7 mandatory national water-efficient standards for water-using products, including pedestal pan, faucet, shower, urinal, squatting pan, toilet flushing valve and electric washing machine.

In terms of environmental protection, the Ministry of Environmental Protection of the People’s Republic of China has published more than 90 industrial standards of technical specifications for the evaluation of environmental labeling products, as the basis of environmental labeling certification, which cover furniture, building materials, household appliances, daily necessities, textiles, automobiles and so on.

In terms of the recycling, the SAC has formulated more than 20 product standards for the resource recycling processes, including fly ash reuse in cement and concrete, recycled coarse aggregate used by concrete, steel slag used on the road, magnesium slag Portland cement and steel slag Portland cement and so on. More than 10 national standards for recycled products are developed, such as for the regenerated tin-based bearing alloy ingot and the regenerated rubber.

In terms of the organic products, the SAC has issued four national standards covering the production, processing, labeling, distribution, and management of organic products. The abovementioned standards provide the basis for organic product certification.

2.2. Situations in other Countries
With the ever-worsening environmental crisis, green product evaluation systems have been actively carried out around the world. In particular, a variety of evaluation systems with different concerns have been established in developed countries, such as eco-labeling system, carbon labeling evaluation system and energy efficiency labeling system. Although there are different concerns in various systems, the overall goal is to reduce the impact of production, and increase the utilization and recycling of the materials. The comparison of green evaluation systems among major countries or regions is shown in Table 1.

Table 1. Comparative analysis of green evaluation systems in foreign countries

| Country/Region | Certification system | Certification type | Management organization | Evaluation mode | Excitation mechanism | Label |
|----------------|----------------------|--------------------|-------------------------|----------------|---------------------|-------|
| Canada         | Maple leaf label     | Voluntarily        | Secretariat and advisory committee of Environment Canada, Canadian Standard Association | Preliminary review, Expert review, Recheck, Public discussion, Supervision | Government green procurement |
| Japan          | Eco-labeling plan    | Voluntarily        | Japan Environment Association (JEA) | Discussion, Check, Sign licensing contract | Green procurement |
| South Korea    | Eco-labeling plan    | Voluntarily        | South Korea Ministry of Environment (MOE) and South Korea Institute of Eco-Products Council | Detection, Notification, Supervision | Government procurement |
| United States  | Green Badge          | Voluntarily        | Environmental Quality and U.S. Environmental Protection Agency | Test, Evaluation, Supervision | Government procurement |
| EU             | Flower of Europe     | Voluntarily        | European Union Eco-labeling Board and related authority | Document review, Test, Payment, Supervision | Government procurement, publicity and recommendation |
| EU             | Product Environmental Footprint | Voluntarily | Secretariat, steering committee, technical advisory committee, technical support center, virtual consultation forum of Product Environment Footprint | Document review, Supervision | Under study | Under study |
On April 9, 2013, the European Commission issued an announcement on Establishing the Single Market for Green Products and a proposal for Improving the Environmental Performance Information Disclosure of Product and Organizational, aiming to establish a harmonized evaluation approach based on Life Cycle Assessment (LCA) for the EU to determine the product and organizational environmental performance, and to establish a unified market for green products. The EU has also published a guideline for assessing green products and green organization, namely the Product Environmental Footprint Assessment (PEF) and the Organizational Environmental Footprint Assessment (OEF), to avoid causing confusions of consumers and purchasers as a result of different environmental information based on different evaluation approaches, and to reduce the cost of environmental information disclosure.

Internationally, a number of international standards such as Type I, Type II and Type III environmental labels, life cycle assessment and eco-design have been issued by the ISO. Moreover, an international standard of the environmental awareness design for electrical and electronic products has been developed by the IEC.

3. Connotations and Evaluation Methods of Green Products

3.1. Connotations of Green Products
Some foreign scholars have defined green products as recyclable products that can be stored without contaminating land or consuming natural resources [3]. Green products are also defined as products that conserve energy and resources, as well as reduce pollution, waste and toxic substances to preserve the natural environment [4]. Green products should be conducive to the protection of the ecological environment, not producing or minimizing environmental pollution, and be beneficial to energy conservation. These features should be manifested through the whole life cycle process of the product, including product design, raw material acquisition, production and manufacture, distribution, utilization, as well as recycling, reuse and disposal after the end of use. Green products are the products that meet the requirements of environmental protection, and are harmless or make minimal harm to the ecological system, with high utilization rate of resources and low energy consumption in the whole life cycle [5, 6, and 7].

In accordance with the life cycle thinking and simultaneously satisfying the needs of consumers, green products refer to the products with small resources and energy consumption, low pollutant emission, produced by clean and advanced technology, recyclable, high quality, non-toxic and harmless in the life-cycle process of the raw material selection, production, sale, utilization, recycling and disposal. The connotations are mainly reflected in the aspects of meeting the requirements of customers and trend of consumption upgrade, which is the basic premise; resources and energy conservation; ecological and environmental friendliness with no impacting or minimal impact on the environment; posing no threat to the health of consumers, non-toxic and harmless or low toxicity and low harm. Therefore, green products are not only the simple combined of the related indexes such as energy conservation, water conservation and environmental protection and so forth, but also impose comprehensive requirements on the enterprises, upstream and downstream of the supply chain as well as the product.

3.2. Evaluation Methods
According to the connotations of green products, based on current development stage of products and
life cycle evaluation data, life cycle concept must be adopted as the foundation. The international experience must also be taken, and the evaluation method must be developed by combining quantitative and qualitative approaches covering both product and organizations, so as to establish a sound evaluation standard system for green products. Some important quantifiable indicators are selected from raw material selection, production process, utilization and recycling of the products, mainly divided into resource attribute indicators which are mainly related to the utilization of raw materials (components), water consumption, packaging material selection and recycling; energy attribute indicators are mainly related to the energy consumption in the process of production and utilization; environmental attribute indicators are mainly related to toxic and hazardous substances control, pollutant emission control and greenhouse gas management; quality attribute indicators are mainly related to product property and security. The evaluation indicators of organization level are mainly including management requirements to establish enterprise environmental management system, energy management system, quality management system, occupational health and safety management system and supply chain management system, as well as utilization requirements for energy conservation, environmental protection and clean production technologies.

4. Integration methods and suggestions for green product standards

The existing standards of the relevant green product certification are mainly divided into the single environmental element standards such as energy conservation, water conservation, low carbon, recycling and environmental protection, and the comprehensive standards such as eco-design product evaluation standard, environmental labeling product standard, and green building materials evaluation standard. For the single environmental element standards, energy efficiency standard and water efficiency standard are the active roles in the implementation of the relevant industrial policies, so they should remain. The advanced value in the standards may be incorporated into the green product evaluation standards. For example, the green product evaluation standard of household washing machine directly adopts the advanced values of energy efficiency indicator in energy efficiency standard as the choice of value for the energy attribute indicator, so do for the advanced values of water efficiency indicator in water efficiency standard as resource attribute indicator. For comprehensive standards, on the basis of inheriting the serial national standards of eco-design product evaluation, the green product standard framework is designed to be basic requirement (organization level), evaluation indicator requirement (product level) and report requirement (life cycle assessment)”.

In accordance with the national standard requirements, the environmental labels and green building materials are embedded into the green product evaluation standards, and the industrial standards of another form by other governmental sectors should not be developed. When the standards are developed for specific products, the priority will be the incorporating the current relevant standards into the green product evaluation standards with the abovementioned framework. The relationship between green product standards and the existing standards is shown in Fig. (1).

Based on the above analysis, it is recommended to keep the existing energy efficiency and water efficiency standards as the mandatory national standards for energy-conservation and water-conservation certification, while some indicators will be incorporated into the green product evaluation indicator system. Meanwhile, the recommended national standards of energy conservation, water conservation, low carbon, recycling and environmental protection will be integrated as the newly developing green product evaluation standards. The current national eco-design product evaluation standards will be revised and transformed into green product evaluation standards. Green-related technical specifications, industrial standards and local standards of green building materials standards, environmental labeling product standards and environment-friendly product standards developed by other departments or regions should be abolished if the equivalent green product standards are enacted.
5. Conclusions

Based on the experience of developing and implementing green product standards in the EU, Germany, America, Japan and so on, combined with current Chinese standard systems including environmental protection, energy conservation, water conservation, low carbon, recycling, regeneration and organic, with the adoption of the life cycle concept, this paper brings forward basic requirements on organizations including pollutant emissions, establishment of management system, energy conservation and emission reduction technology and green supply chain management, and proposes indicator requirements on product covering resource attributes, energy attributes, environmental attributes and quality attributes, so as to guide the establishment of green product evaluation standards in the context of China. At the same time, to accomplish the green product integration aim set by the central government, the paper also proposes the methods and pathways for the establishment of green product standard system mainly by incorporating the current environmental protection, energy conservation, water conservation, recycling, low carbon, regeneration and organic standard or certification systems. Main conclusions include: (1) Retaining the single environmental element standards of energy conservation, water conservation and low carbon, in order to support the
implementation of Chinese energy efficiency labeling management mandatory system, water labeling management mandatory system and low carbon product certification system; (2) Integrating environmental standards related to green building materials and environmental labeling standards into the green product standard system within the unified framework.

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