

AN OVERVIEW OF GREEN BUILDING RATING SYSTEMS IN THE WORLD

世界各国のグリーンビルディング評価システムの概要

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Abstract 人間活動が地球環境に与える影響がますます世界中から関心を集めている。アメリカ連邦政府環境庁の報告書によると、建設セクターの温室効果ガス排出量が全体の 40% も占めている。したがって、建築行為の各段階における資源の有効利用と環境保護を主眼とするグリーンビルディングの動きが各国から見られている。それぞれの国や地域は各自の指標を作り、評価を行っている。本稿は、北米、イギリス、中国、香港、韓国、シンガポール、マレーシアなどの国で推奨或いは実践しているグリーンビルディング評価システムを概観し、世界共通基準の可能性の検討に基礎的資料を提供することを目的とする。

Keywords: green building, rating system, environmental performance
グリーンビルディング, 評価システム, 環境パフォーマンス

1. Introduction

The increasing human populations and the galloping economic development have brought numerous environmental problems, including climate change, pollution and other severe phenomenon. According to the United Nations Environment Program, building industry accounts for 40% of the energy consumption with the equivalent levels of greenhouse gases emission, 30% of raw materials use and waste generation and 20% of water consumption¹⁾. It is necessary to pay prior attention on the emission and waste reduction of buildings in order to combat the climate change. U.S. Environmental Protection Agency indicated that building industry is the easiest and cheapest industrial sector for reducing emission²⁾ and wastes. Green building as the practice of creating and using healthier and more resource-efficient models of construction, renovation, operation, maintenance and demolition³⁾, becomes a popular objective in the construction industry, real estate and consumer market all over the world. A mass of green buildings are constructed or constructing in every countries. Meanwhile, number of standards, codes and rate systems of green building that evaluate the performance of buildings are developed or under development. For instance, the Leadership in Energy and Environmental Design (LEEDTM) Green Building Rating System developed by the U.S. Green Building Council is one of the popular evaluation tools which help consumers determine a structure's level of environmental performance in many countries. The BCA Green Mark is another assessment of green building, which is widely used in Singapore.

According to OECD/DAC, an indicator provides a simple and reliable means to measure achievement, to reflect changes connected to an intervention, or to help assess the performance of a development actor⁴⁾. "Indicators arise from values (we measure what we care about), and they create values (we care about what we measure)"⁵⁾.

Therefore, the need for integral systematic rating systems is recognized in order to evaluate the performance of green buildings and promote the development of green building industry. Green building assessments provide a set of criteria and targets to guide design decisions, recognize and encourage good practices and improve management and prioritization. At the same time, it is a useful tool to let policy makers, building professionals and consumers embrace green building with confidence. Many governments or associations in the world have stipulated indicators and codes to accredit green buildings. However, there has yet been an international standard for rating. This paper will review the current rating systems, tools in the developed and developing countries, and provide basic information for the

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future study.

2. Green Building Rating Systems Review

In the following sections, various indices and rating systems which are widely-using and recognized in the industry and governments are reviewed.

2.1 Building Research Establishment Environmental Assessment Method (BREEAM), UK

BREEAM is one of the world's foremost environmental assessment method and rating system for buildings, and it used as a reference in many countries. It was first launched in 1990 by Building Research Establishment, and now 200,000 buildings are certified BREEAM assessment ratings and over 1 million registered for assessment⁶⁾. BREEAM is the rating system for non residential building and has different versions for various building types. BREEAM uses a broad range of categories and indicators of performance to evaluate the design, construction and utilization of buildings. They include aspects related to energy and water use, the internal environment (health and well-being), and pollution, transport, materials, waste, ecology and management process⁷⁾. It provides different types of assessment, including pre-assessment, design and procurement assessments, management and operation assessments, post construction reviews, covers the whole life cycle of buildings⁸⁾.

2.2 Leadership in Energy and Environmental Design (LEED), US

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System provides a suite of standards and indicators for what constitutes a "green building". LEED provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions⁹⁾. It was developed by the U.S. Green Building Council (USGBC) in 2000, and until now, nearly 9 billion square feet of building space participating in the suite of rating systems and 1.6 million feet certifying per day around the world¹⁰⁾. The LEED rating system is applied in assessing the built environments from individual buildings and homes to entire neighborhoods and communities. The type of rating systems is more comprehensive, includes new construction, existing buildings, commercial interiors, core & shell, schools, retail, healthcare, homes, neighborhood development. LEED works to transform the performance of building in design, construction and operation stages, in key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

2.3 Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), Japan

The CASBEE, developed by Japan GreenBuild Council (JaGBC) and Japan Sustainable Building Consortium (JSBC), is a tool for assessing and rating the environmental performance of building and built environment in Japan. It was launched from 2001, and has developed into 10 categories, which are new construction, existing building, renovation, heat island, urban development, urban area+buildings, cities, home, market promotion, property appraisal. By December 2011, 24 Japanese local governments have introduced CASBEE systems to promote the development of green buildings. And over 6600 building constructions (December 2011) reported their assessment results by CASBEE. CASBEE employed 2 categories of assessment: 1) Q (Quality)—Built Environment Quality, 2) L (Load)—Built Environment Load. They evaluates the improvement in living amenity for building users within the hypothetical enclosed space, and the negative aspects of environmental impact which go beyond the hypothetical enclosed space to outside. CASBEE mainly focuses on 4 assessment aspects, which are energy efficiency, resource efficiency, local environment, and indoor environment¹¹⁾.

2.4 Korea's Green Building Rating System Criteria

Green Building Certification System (GBCS) is the assessment tool to evaluate environmental performance of buildings and promote dissemination of green building in Korea. GBCS was launched in 2000, until now, it has developed into an integrated certification system, which measures the environmental performance of multi-unit residential buildings, mixed-use dwellings, office buildings and schools. The major indicators cover land development, commuting transportation, energy, resource consumption, environmental loads, ecological environment,

and indoor environmental quality (Multi-unit residential building)¹²⁾. And some indicators will be add or remove according to the different types of building.

2.5 BCA Green Mark Scheme, Singapore

The BCA Green Mark Scheme is an initiative to drive Singapore's construction towards more environment-friendly buildings since 2005. It was developed to promote the sustainability in the built environment as well as to raise environment awareness of people during the design and construction period of buildings. Buildings will be awarded the Green Mark based on 5 key criteria area, energy efficiency, water efficiency, environmental protection, indoor environmental quality and other green features and innovation. One of the features of BCA Green Mark different from other rating systems is the pre-assessment in the assessment process in order to give the project team a better understanding of BCA Green Mark requirements. And every 3 years, certified Green Mark buildings need to be re-assessed to maintain the Green Mark status. BCA Green Mark system evaluate new buildings and landed houses, existing buildings, schools, office interior, restaurants, districts and infrastructure. Based on the background of tropics area, Green Mark addresses focuses more on the priorities and needs of Singapore.

2.6 Green Building Index (GBI), Malaysia

The Green Building Index (GBI) is Malaysia's industry recognized rating tools for green buildings. Different from other rating system such as LEED, GBI is designed specifically for the tropical climate while integrate Malaysia's current social, infrastructure and economic development¹³⁾. The GBI rating system is developed by Pertubuhan Akitek Malaysia and the Association of Consulting Engineers Malaysia. There are 6 main criteria of GBI rating tool to assess commercial and residential properties, which are energy efficiency, indoor environment quality, sustainable site planning and management, materials and resources, water efficiency, innovation. Two rating assessments, Design Assessment and Completion and Verification Assessment should be attained in order to get the GBI rating. And the buildings are awarded by "Platinum, Gold, Silver or Certified rating" based on the rating scores.

2.7 Evaluation Standard for Green Building, China

The Evaluation Standard for Green Building (GB/T 50378-2006) is the national-level standards of China by the Ministry of Housing and Urban-Rural Development of the People's Republic of China. The evaluation standards system contains 6 criteria, 1) land-saving and outdoor environment, 2) energy conservation and energy use, 3) water saving and water resource utilization, 4) material saving and material resource utilization, 5) indoor environmental quality, 6) operation production management¹⁴⁾. Every criterion has control indicators, general indicators, and optimal indicators. And a three star Green Building certificate will be awarded to the qualified buildings. The Evaluation Standard for Green Building is similar to LEED in structure and rating process.

2.8 Hong Kong Building Environmental Assessment Method Plus (HK-BEAM Plus)

Hong Kong Building Environmental Assessment Method Plus (HK-BEAM Plus) is the comprehensive environmental assessment scheme to assess, improve, certify and label the environmental performance of buildings. BEAM plus has been officially launched since April 2010 by the Hong Kong Green Building Council¹⁵⁾. It provides comprehensive assessment details for both new building and existing buildings. The main criteria include site aspects (SA), materials aspects (MA), energy use (EU), water use (WU), indoor environmental quality (IEQ), innovation and additions (IA). The overall assessment grade divided into 4 levels, platinum, gold, silver, bronze, and SA, EU and IEQ must meet with the minimum percentage.

3. Conclusion

The design and management of green building are critical to global environment and sustainability. This paper covers an overview of various green building rating tools which are practically implemented to measure the environmental performances of building at the national level. Their criteria stretch across a range of environmental issues, from energy to ecology. Site development, energy, water, resource consumption, and indoor environment seem to be the 5 major fields that all the rating tools involved in the criteria. Some of the rating tools, like GBI and

BCA Green Mark, mention the innovation indicators in the evaluation. While consumption and degradation of environment and resources continue to grow, green innovation becomes important steps to achieve environmental sustainability and green society. Moreover, another similar point among these rating tools is that the modes of implementation are voluntary. The voluntary structure of green building rating system provides better advertisement for buildings. It allows consumers to choose their preference more than policy decisions require¹⁶⁾.

Each rating tools has different strengths and weaknesses however, all of them are proposed for evaluating the environmental performance of building in order to build an environmental-friendly society. A integrate set of rating criteria for assessing the environmental performance of building seems to be the top priority of the development of green building industry.

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