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Green Building Assessment Schemes: A critical comparison among BREEAM, LEED, and Green Star NZ

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ABSTRACT

To assess the performance of construction projects, green rating systems, such as LEED (Leadership in energy and Environmental Design), BREEAM (Building Research Establishment Assessment Method), and Green Star, has been initiated. In the past, they focus only on “green”, which has been usually used interchangeably with “sustainability”; however, these two terms are far from synonymous. To catch the sustainable trend of building developments, green rating systems are continually updating their criteria and tools. This paper aims to 1) provide an inclusive review of green rating systems’ criteria and their development; 2) identify their similarities and differences besides highlighting strengths and weaknesses; 3) determine whether these systems have been effective in enhancing sustainability. BREEAM, LEED, and Green Star New Zealand are analysed in this paper being the major green certifications. The results indicate that although the number of categories and credits are different with different systems, core categories consisting of Indoor Environment Quality, Energy, Transport, Water, Materials, Land Use, Ecology, and Emissions, are always considered in each rating system, in which Indoor Environment Quality and Energy are the most important criteria. Several prerequisite criteria are also enumerated to avoid greenwashing. While LEED are tailored to assess the social sustainability and Green Star encourages the economic transparency, BREEAM has a new scheme to assess both social and economic sustainability.

KEYWORDS: sustainability, BREEAM, LEED, Green Star

1. INTRODUCTION

The construction industry has been heavily criticized for being a major contributor to carbon emissions, environmental degradation, and global warming (Wong & Kuan, 2014), although “going green” and “environment sustainability” has been introduced for many years (Wong & Zhou, 2015). This could be due to the passive attitude of construction practitioners towards adopting sustainable solutions (Wong & Kuan, 2014). However, facing with the rising energy costs and growing environmental concerns, the demand for sustainable building facilities with minimal environmental impact has been advocated recently (Jalaei & Jrade, 2015). Both authorities and organizations have been initiating the rating systems for green buildings. BREEAM (Building Research Establishment Assessment Method) is known as a first real rating tool to assess building performance based on certain target values for different criteria (Alyami & Rezugui, 2012). In addition, numerous schemes such as the United States’ LEED (Leadership in energy and Environmental Design), Canada’s LEED Canada, New Zealand’s Green Star, Japan’s CASBEE (Comprehensive Assessment System for Building Environmental Efficiency) are currently being used to evaluate the building performance. Although a substantial amount of literature study on Green Certifications has been conducted in the last 20 years, to the best of authors’ knowledge, there is still no systematic review of the detail criteria

and the updated process of each rating system. This paper, therefore, aims to 1) provide an inclusive review of green rating systems’ criteria and development, focusing on BREEAM, LEED, and Green Star New Zealand; 2) identify their similarities and differences besides highlighting their strengths and weaknesses; 3) determine whether these systems have been effective in enhancing sustainability.

2. REVIEW OF GREEN CERTIFICATION RATING SYSTEMS

BREEAM is seen as the first and longest assessment rating systems for the building industry (BREEAM, 2016; WaidyaseNara et al., 2013). Since 1990, over 2.2 million buildings has been registered for assessment while European market share accounts for 80% (BREEAM, 2016). Although LEED rating tool was released later, it could be considered as the most popular and widely used. Over 15 billion square feet of projects in 160 countries and territories have been certified by LEED (LEED, 2016). While Green Star NZ is the result of the adoption of major rating schemes, BREEAM, LEED, and Green Star Australia (Green Star NZ, 2016). It has developed significantly; the number of certified buildings has increased 10 times since 2009, reaching 125 certifications (NZGBC, 2016).

Although these three schemes are voluntary tools, they are anticipated to become mandatory in the near future. BREEAM has been a “mandatory mechanism” for all government procurement in the UK since 2000 (Schweber, 2013). San Francisco is the first state in the U.S. which required high rise-residential projects to be certified LEED silver by 2010 (Hupp, 2009), whereas Auckland Council has included requirements for Green star in the Proposed Unitary Plan (Green Star NZ, 2016).

Figure 1 shows BREEAM, LEED, and Green Star development. Both BREEAM and LEED has focused on measuring the sustainable aspect with the release of BREEAM Communities and LEED Neighbourhood Development. The economic and social credits has been set up to globally assess a project. BREEAM is completely dominant, with a new version every year since 2011.

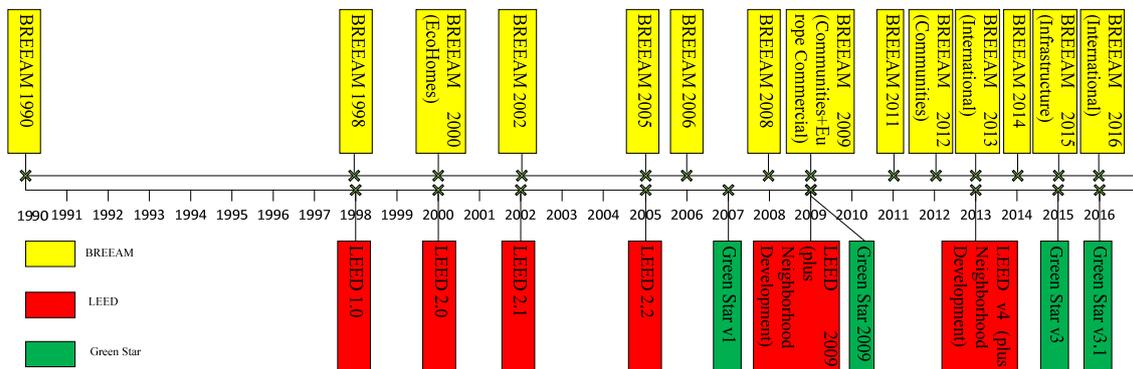


Figure 1. Green Star, BREEAM, and LEED timeline

Main features of these three rating systems are compared in Table 1. BREEAM has the highest number of categories and certified projects, but the requirement points to have a project certified is lowest, 30/110 comparing to 40/125, and 45/110. Although Green Star NZ has only 4 mandatory credits, which could be easy in terms of leading to the greenwash, it requires much higher points to receive a certification compared to the rest. The most influence rating systems belongs LEED, with LEED projects across 161 countries and territories.

Table 1. Main features of BREEAM, LEED, and Green Star NZ

| | BREEAM | LEED | Green Star NZ |
|----------------------|--------------|---------------|---------------|
| Country | UK | US | NZ |
| Organizations | BRE | USGBC | NZGBC |
| Flexibility | 77 countries | 161 countries | 3 countries |
| First version | 1990 | 1998 | 2007 |
| Latest version | 2016 | 2013 | 2016 |
| Number of categories | 10 | 9 | 9 |

| | | | |
|------------------------------|-----------------------|---------------------|--|
| Number of criteria | 53 | 68 | 68 |
| Number of mandatory credits | 15 | 16 | 4 |
| Total points | 110 | 125 | 110 |
| Rating approach | Pre-weighted credits | Additive credits | Pre-weighted credits except Innovation |
| Rating level | Pass ≥ 30 | Certified ≥ 40 | Best practice ≥ 45 |
| | Good ≥ 45 | Silver ≥ 50 | Excellent ≥ 60 |
| | Very good ≥ 55 | Gold ≥ 60 | Leadership ≥ 75 |
| | Excellent ≥ 70 | Platinum ≥ 80 | |
| | Outstanding ≥ 85 | | |
| Number of certified projects | 549,749 | 79,100 | 125 |



Figure 2. Versions of Green Star, BREEAM, and LEED

Although Green Star, BREEAM, and LEED use different terminologies to describe their criteria, most of them share common purposes, focusing on the environment issues. Indoor Environment Quality, Energy, Transport, Water, Material and Waste, Land Use, Ecology and Pollution, and Innovation all appear in these three schemes (see Figure 2). In the later versions, categories and points tend to increase to assess a project more comprehensively. The number of mandatory credits, which ensure a project achieves a certain minimum score in each category, slightly increase to prevent greenwash action, which is normally planned to achieve green certification thus applying easiest and lowest credits without giving due care to the true meaning of its purpose. It is clear from the schemes that Indoor Environment Quality and Energy are key categories, accounting for a considerable number of points and including mandatory credits in any versions.

Figure 3 displays sub-categories of Green Star, BREEAM, and LEED. The number of sub-categories of BREEAM tend to reduce in the later versions, which is totally opposite with LEED's. This could be because of the limited number of categories and sub-categories in the earlier version of LEED, v2 (see Figure 2). Whereas, the figures for Green Star remain stable across four versions.

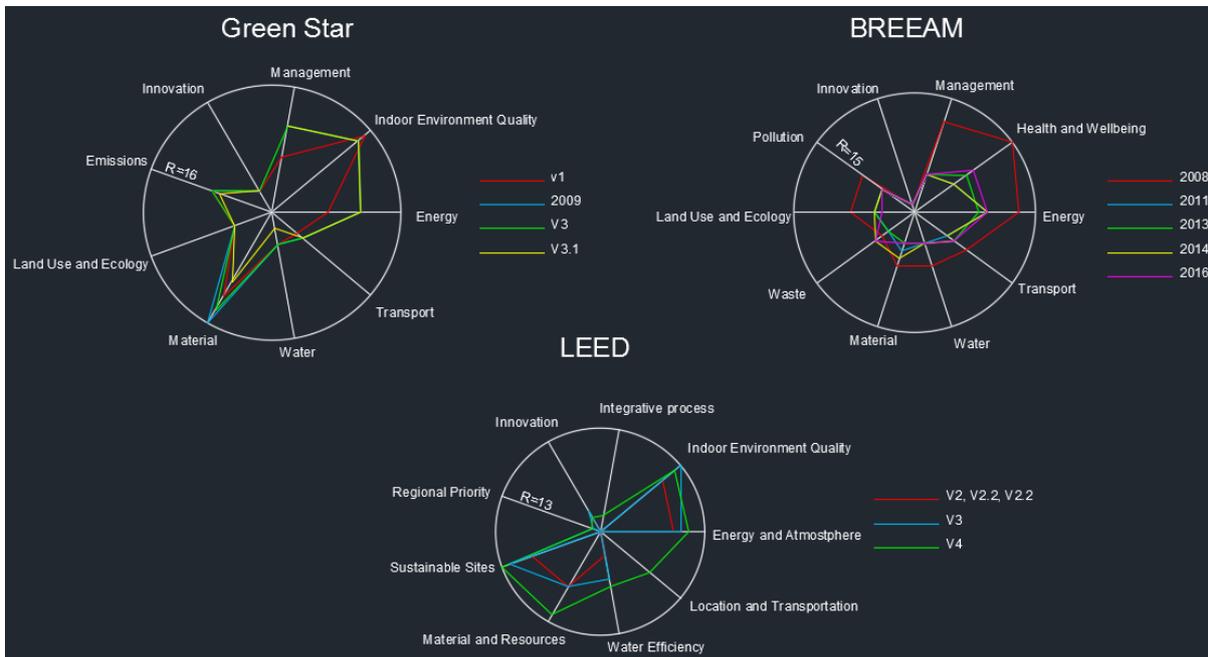


Figure 3. Sub-categories of Green Star, BREEAM, and LEED

Besides assessing the environment criteria, BREEAM has used a new scheme, BREEAM Communities, since 2009. In this rating tool, social and economic wellbeing category, two main factors in sustainability besides environmental factor, is added and it accounts for almost a half of total points. Simultaneously, LEED Neighbourhood Development scheme was also release. However, it focuses on sustainable neighbourhood development, aiming to assess the location, connectivity and walkability. Part of the credits in this schemes, regional priority, location and transportation, are added in the traditional LEED in v3 and v4. To catch up the sustainable development, Green Star recently has also proposed an innovation challenge in economic transparency to encourage construction practitioners to provide detail expenses during the construction activities.

All these three certifications consist of the same main criteria. In contrast with Green Star and BREEAM, LEED has a significant improve in categories, new and main credits in its versions release. Although LEED and Green Star assess much more criteria than BREEAM, BREEAM released many kinds of schemes, EcoHomes, Communities, International, and Infrastructure. For calculating the final points, LEED uses additive points approach, which is simpler than BREEAM's and Green Star's, weighting points before addition.

6. CONCLUSIONS

This paper investigates the most reliable and popular green rating systems in the global context, BREEAM, LEED, and Green Star. Although the number of categories and credits are different with different systems, core categories consisting of Indoor Environment Quality, Energy, Transport, Water, Materials, Land Use, Ecology, and Emissions, are always considered in each rating system, in which Indoor Environment Quality and Energy are the most important criteria in any version. Several prerequisite criteria are also enumerated to avoid greenwashing. While Green Star starts focusing on the second sustainable factor, economic one, by encouraging the economic transparency, and LEED has a new scheme to measure the social sustainability, the third sustainable factor, BREEAM Communities could be used to assess both social and economic sustainability.

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