

The Revamp of BEAM Plus Existing Buildings

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ABSTRACT

BEAM Plus Existing Buildings (BEAM Plus EB), a green building performance assessment tool, reflects the overall quality of management, operation and maintenance of a building that is already in use. Aimed at increasing the participation rate of BEAM Plus EB while maintaining its function in grading green buildings, the tool, as presented in this paper, was revamped through a multi-stage exercise. In the inception stage, the gaps between the standard of the original tool and the contemporary green building assessment standards were reviewed and identified. Then the draft manuals with two assessment schemes - Comprehensive Scheme and Selective Scheme - were developed. The feasibility and practicality of the revamped BEAM Plus EB were tested through sensitivity analysis. Stakeholder engagement workshops, which were organised to solicit comments and suggestions from relevant parties, helped to fine-tune the assessment criteria and grading methods of the schemes. It is anticipated that, after the revamp, more existing buildings will participate in BEAM Plus EB and strive for better building environmental performance.

Keywords: BEAM Plus, Facility Management, Green Buildings, Maintenance, Sensitivity Analysis, Stakeholder Engagement

1. INTRODUCTION

Built upon the Hong Kong Building Environmental Assessment Method (HK-BEAM) that was launched in 1996 (Man et al., 2012), the Building Environmental Assessment Method (BEAM) is a significant private sector initiative in Hong Kong that was introduced in 2004 to promote sustainable buildings through enhancing the planning, design, construction, commissioning, management, and operation and maintenance practices. It is a comprehensive scheme for assessing the environmental performance of buildings on a voluntary basis.

BEAM Plus for Existing Buildings (BEAM Plus EB) is a particular scheme that aims to reduce the environmental impacts of existing buildings while improving quality and user satisfaction through adoption of the best techniques available within reasonable cost and good management practices. An assessment under BEAM Plus, which covers the management, operation and maintenance of a building, may be initiated at any time.

By October 2017, over 700 projects have been registered under BEAM Plus. Among them, only less than 1% are EB projects, even though good operation and maintenance practice is regarded as essential to sustainable buildings (Lai and Yik, 2005). Due to the relatively low participation rate of EB than that of BEAM Plus for New Buildings (BEAM Plus NB), the Hong Kong Green Building Council Limited (HKGBC) conducted a preliminary study on the major issues of BEAM Plus EB V1.2 from December 2012 to May 2013. The study found that the BEAM Plus EB V1.2 was too focused on building's inherent characteristics and its coverage was not up-to-date. Its assessment also included the occupiers' areas which are normally outside the applicant's control. The submission materials required too much scientific analysis such as computational fluid dynamics simulation and daylight modelling, and the duration of records keeping is too long.

The above findings led to the initiation of revamping BEAM Plus EB. Intended to revise the BEAM Plus EB V1.2 based on the results of the preliminary study, a new rating tool incorporated with a stepwise improvement approach has been developed as an alternative route to recognise the effort made by the facility management of existing buildings. This paper presents the development and results of the revamp process.

2. LITERATURE REVIEW

Across the world, many green building assessment tools, including the following, have been developed.

- i. Leadership in Energy and Environmental Design for Existing Buildings: Operations &

Maintenance (LEED-EBOM), developed by the U.S. Green Building Council (2009) and launched in 2009, is a voluntary, consensus-based, and market-driven assessment tool. Based on existing and proven technologies, LEED-EBOM evaluates the environmental performance from a whole building perspective over a building's life cycle, providing a definitive standard for what constitutes a green building in design, construction, and operation.

ii. Green Star-Performance was developed by the Green Building Council of Australia (2013). It is the Australia's only national, voluntary rating system for fit-outs, buildings and communities. The assessment tool allows the building owners and managers to measure the operational performance of their buildings, identify opportunities for improvement, and realise the many benefits of sustainable building operations.

iii. Comprehensive Assessment System for Building Environmental Efficiency – Existing Building (CASBEE-EB) was launched in 2010. With the support of the Ministry of Land, Infrastructure, Transport and Tourism of Japan, it was developed by a research committee established in 2001 as part of a joint industrial/ government/ academic project (Japan Sustainable Building Consortium, 2010). CASBEE is a method for the evaluation and rating the environmental performance of buildings. It is a comprehensive assessment of the quality of a building, evaluating features such as interior comfort and scenic aesthetics, in consideration of environmental practices which include using materials and equipment that save energy or achieve smaller environmental loads.

iv. Ecological/ Energy Saving/ Waste Reduction/ Health Evaluation Manual IV-Renovation (EEWH-RN), launched in 2012, was initiated by the National Council for Sustainable Development under the Ministry of the Interior of Taiwan (Architecture and Building Research Institute, 2012). To achieve the goal of sustainable global and regional development and carbon reduction, EEWH-RN has been designed specifically for the renovation of existing buildings. It encourages the existing buildings to upgrade to more ecological, energy-saving, waste-reducing and healthy in order to toward the sustainable development of ecological cities.

v. Green Mark for Existing Non-Residential Buildings (Green Mark – ENRB), launched in 2012, was developed by the Building and Construction Authority (2012), Singapore. It is an initiative to drive the construction industry towards achieving more environment-friendly buildings. It is intended to promote sustainability in the built environment and raise environmental awareness of developers, designers and builders during project conceptualisation design and construction.

Most of the above assessment tools cover the assessment of existing commercial, institutional

and residential buildings. Existing buildings can only be certified at least 12 months to 36 months after obtaining the occupancy permit or in operation and they welcome buildings to undergo improvement work before certification.

The tools typically cover different aspects of building performance evaluations: Management (MAN), Site Aspects (SA), Materials and Waste Aspects (MWA), Energy Use (EU), Water Use (WU), Indoor Environmental Quality (IEQ), and Innovation (IA). In terms of credits allocation, EU contributes to the largest portion of the assessment for the tools except CASBEE-EB. Most of the tools assign equal importance to MWA and WU although these two aspects play a less dominant role in the assessment.

3. METHODOLOGY

The revamp of the BEAM Plus EB rating tool was divided into six stages:

3.1 Stage 1 - Inception Stage

It involved a gap analysis of the current green building (existing building) assessment standards:

3.1.1 Review of BEAM Plus EB V1.2

As the basis of the study, the BEAM Plus EB V1.2 manual was reviewed. The aim of the review was to identify the credits, credit requirements, associate codes and references that need to be updated or revised for the new version. Credits related to inherent design (i.e. out of the scope of control of building management) and credits requirements that are unclear, outdated or controversial were identified.

3.1.2 Review of HKGBC's Preliminary Study

The HKGBC Task Force conducted a preliminary study on the major issues of BEAM Plus EB. Based on 14 case studies of existing buildings, the study identified credit items in BEAM Plus EB that might require modification as well as a number of stakeholder opinions on how to enhance the scheme. The results of the preliminary study were reviewed and then formed the basis of recommendations for how the scheme could be improved to increasing its participation rate.

3.1.3 Review of International Standards

The gap analysis included benchmarking BEAM Plus EB with the internationally recognised green building rating tools. Their scopes of application, performance categories, credit requirements and grading methodologies were reviewed.

3.1.4 Review of Other Relevant Guidelines, Standards, Award Schemes and Campaigns

To set a clear position of BEAM Plus EB, its relationships with other BEAM Plus rating tools, guidelines, standards and award schemes and campaigns were reviewed.

i. Other Rating Tools in BEAM Plus Family

The scope of application of BEAM Plus EB was reviewed against the counterparts of the other rating tools in the BEAM Plus family, i.e. BEAM Plus NB and BEAM Plus Interiors.

ii. Government Guidelines

The BEAM Plus rating tools should have a clear position with regard to statutory requirements and guidelines. The latest versions of the guidelines were reviewed for the updates of the BEAM Plus EB requirements. Other green labelling/certification schemes and the green building related tools and schemes implemented by the HKGBC and the Construction Industry Council (CIC) were reviewed to analyse the feasibility of integrating them into BEAM Plus EB so as to enable recognition to be given to participants who had made effort in greening their buildings.

3.1.5 Development of New Rating Tools (Comprehensive Scheme B and Selective Scheme)

To increase the participation rate, the new rating tools should be designed to suit the needs of different types of existing buildings, i.e. buildings with the recent or earlier versions of BEAM Plus certifications and buildings, especially the old ones, without such certifications. For the new version, it was proposed to incorporate two different certification routes other than the existing one-step comparison against an absolute benchmark (Comprehensive Scheme A). Stepwise assessment (Comprehensive Scheme B) and individual category assessment (Selective Scheme) were also developed to recognise the effort of old buildings in improving their environmental performance.

3.2 Stage 2 - Preparation of First Draft with 2 Schemes

In order to suit the needs of existing buildings with or without BEAM Plus or its earlier versions of certificate, two (2) different certification schemes were developed for the revised rating tools.

3.2.1 Comprehensive Scheme A: One-step Assessment

Under this scheme, a one-step assessment is made against an absolute benchmark as developed for those relatively new buildings certified to previous BEAM standards. Similar to other ratings tools in the family of BEAM Plus, it is expected that with a reasonable effort, these buildings can be awarded with BEAM Plus EB certification.

3.2.2 Comprehensive Scheme B: Stepwise Assessment

Comprehensive Scheme B assessment allows buildings with different types and ages to get phased recognition of its efforts by accumulating improvement achievements. In addition, a quantified assessment of the extent of energy and resource reduction achieved by existing buildings was developed in order to gauge the achievement of the revised rating tools in contributing to territory-wide campaigns such as the HK3030.

3.2.3 Selective Scheme: Individual Category Assessment

The Selective Scheme is completely a brand new assessment that allows certification of existing buildings in some specific aspects, thereby recognising the effort made in improving environmental performance in those aspects.

3.3 Stage 3 - Sensitivity Analysis

The robustness of the draft rating tools was tested on some existing buildings to ensure the standards are reasonably achievable.

3.3.1 Data Collection

A total of 22 buildings, which were typical existing buildings in Hong Kong, were investigated. These buildings covered different building uses (e.g. office buildings, shopping centres, hotels, educational buildings, residential buildings, and government buildings etc.), under different scenarios (e.g. single-ownership, multi-ownership, new buildings and aged buildings etc.) and with BEAM EB ratings. The relevant building data were collected by way of questionnaire and interview. A questionnaire was used for gathering the general building information (e.g. age, location, type, size, etc.) and BEAM EB credit related information. The questionnaire was sent to the building management of each sampled building in advance. Meetings, each with a duration of 2 to 3 hours, were held with the building management representatives of the sampled buildings.

3.3.2 *Data Analysis*

Using the draft rating tools, a desktop assessment was conducted on each of the sampled buildings. The data collected from the buildings were processed to yield scores for compilation into overall assessment results. The robustness of the rating tools was evaluated according to the practicality of the assessment criteria and the grading methodology.

3.4 Stage 4 - Stakeholder Engagement Exercise

3.4.1 *Method of Engagement*

To gather views and opinions of industry stakeholders on the draft rating tools, three workshops were conducted. The workshops were focused on two main themes: framework and incentive measures; and technical contents. During the workshops, the results and findings from the inception stage and the draft rating tools were presented and discussed in order to gain a deeper understanding of the constraints, challenges and benefits associated with the assessment of the rating tools.

3.4.2 *Stakeholder Composition*

Over 100 stakeholders were invited to the workshops. They included representatives of academic institutions, building management companies, chambers/associations, developers, government/quasi-government units, and professional institutions. Figure 1 shows the composition of the stakeholders.

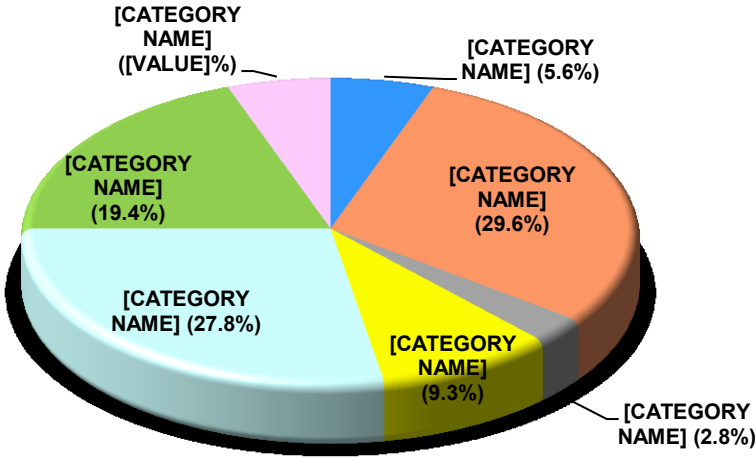


Figure 1 Stakeholder Composition

3.4.3 *Data Collection and Analysis*

The questionnaire was sent to the stakeholders, who were allowed sufficient time to complete the questionnaire during the workshop. With the stakeholders divided into different focus groups, a facilitator was assigned to each group to facilitate their discussion and answer the questions raised by the stakeholders. For those stakeholders who were not available to attend the workshops, they were requested to submit the questionnaires they completed after the workshops. The views collected from the stakeholders were organised and summarised to form the basis of recommendations for revising the draft rating tools.

3.5 Stage 5 - Preparation of Second Draft and Related Working Documents

Incorporating the views and suggestions from the stakeholder workshops, the second draft of the revised rating tools was prepared. Meanwhile, other related materials such as submission templates and assessment flow chart and procedures were also prepared.

3.6 Stage 6 - Soft Launch and Preparation of Final Version and Related Training Materials

3.6.1 *Analysis the Public Views*

During the soft launch stage, the revised manuals of BEAM Plus EB were posted on the website for public preview and comments. The comments, completed by the public on the feedback forms provided, were analysed and used for making recommendations for possible revisions.

3.6.2 *Preparation of Final Version of Manual*

The manuals were revised with due consideration of the accepted comments. A brief version of the revised rating tools, which aims to facilitate the building owners to perform a quick evaluation of their buildings, was also formulated. In addition, the training and examination materials and public talk materials were developed.

4. RESULTS AND DISCUSSION

Based on the findings of the gap analysis (including the benchmarking study with other internationally recognised rating tools, standards and guidelines), some potential improvements of the BEAM Plus EB V1.2 were proposed. The major recommendations for improvement were: i) BEAM Plus EB Certification covers all types of EB but limits to those areas that are under the control of the landlord or facility management; ii) add a new category “Management (MAN)” in order to enhance environmental management in property

management practice; iii) keep the existing four assessment grades unchanged; and iv) revise the category of Materials Aspects (MA) to Materials and Waste Aspects (MWA) so as to recognise the importance of waste management for existing buildings. New rating routes for stepwise improvement of existing buildings (Comprehensive Scheme B and Selective Scheme) were also proposed in order to encourage more buildings to upgrade their environmental performance.

The practicality of the revamped rating tools was tested by performing sensitivity analysis on 22 existing buildings. The test results showed that in general, the interviewees accepted the revamped framework and were interested to register their buildings for the proposed new tools - Comprehensive Scheme B or Selective Scheme. All the sampled buildings fulfilled the pre-requisite requirements although some of the buildings encountered financial and technical difficulties. The sampled buildings scored highest in MAN and lowest in WU and thus some of the credits in WU were reviewed and adjusted. Revisions on credit requirements were also made for credits attained by less than 50% of the sampled buildings. The overall ratings of the sampled buildings were different under different grading criteria. The results supported the revamped rating tool to have: a grading method with pre-requisites requirements, specific category weightings, minimum percentages for overall and specific aspects, and bonus credits in certain aspects.

The views from the industry were solicited through the stakeholder engagement workshops. The stakeholders generally welcomed the revamped framework and expressed their interest to register, especially for the Comprehensive Scheme B. All the stakeholders agreed to include the proposed new “Management (MAN)” category and believed that the credits of this category, which are practically achievable, could encourage sustainable green maintenance. Most of the stakeholders agreed that EU and MAN are the most important aspects while SA is the least important; they also agreed to adopt specific category weightings for different aspects in determining the overall grading. More than half of the stakeholders agreed with the proposed changes made for the assessment credits discussed.

Based on the findings of the sensitivity analysis and stakeholder engagement workshops, the grading methodology of the revamped tools is as shown in Tables 1 to 3.

Table 1 Grading Methodology for Comprehensive Scheme - Weighting





Category	Weighting (%)
Management (MAN)	24
Site Aspects (SA)	10

Materials and Waste Aspects (MWA)	14
Energy Use (EU)	24
Water Use (WU)	14
Indoor Environmental Quality (IEQ)	14
Overall	100

Table 2 Grading Methodology for Comprehensive Scheme - Score

Grade	Overall Score	MAN	SA	MWA	EU	WU	IEQ
Platinum	75	70%	70%	70%	70%	70%	70%
Gold	65	60%	60%	60%	60%	60%	60%
Silver	55	50%	40%	40%	50%	40%	40%
Bronze	40	40%	20%	20%	40%	20%	20%

Table 3 Grading Methodology for Selective Scheme

Grade	Every Applied Category
 (Excellent)	70%
 (Very Good)	60%
 (Good)	50%
 (Satisfactory)	40%

After the implementation of BEAM Plus EB V2.0, the building owners and building management companies gave positive feedbacks on the feasibility and practicality of the revamped tool. Since the official launch of the EB V2.0, around 50 projects have been registered, which is almost a triple of the number of the EB V1.2 projects. Among the registered EB V2.0 projects, around one-third opted for the new Selective Scheme. A wide spectrum of building types have been registered with the EB V2.0 and Figure 2 shows the composition of the projects of the Comprehensive and Selective Schemes.

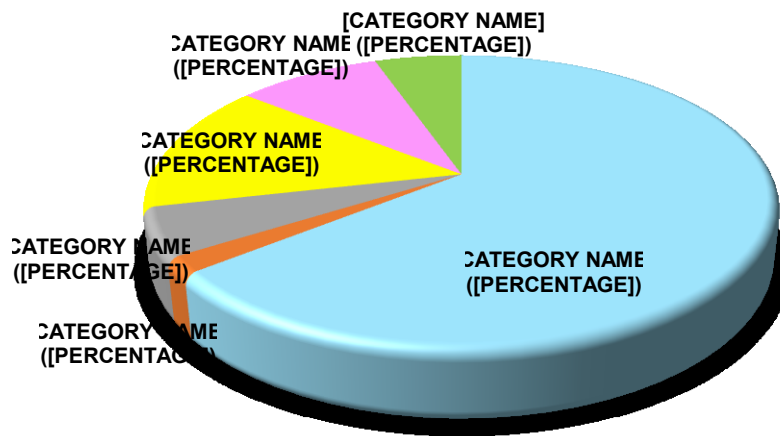


Figure 2 Registered EB V2.0 Projects Composition

5. CONCLUSIONS

The project planning and collaboration ideas are vital for the successful revamp of a green building rating tool. The gap analysis was conducted to determine the scope of application, performance category and grading methodology of BEAM Plus EB. Aimed at encouraging more existing buildings towards sustainability, the BEAM Plus EB was revamped into two assessment schemes (Comprehensive and Selective) that offer all-round and flexible assessment. The feasibility and practicality of the revamped tools were tested successfully through sensitivity analysis and stakeholders engagement workshops. It is anticipated that more existing buildings will join the BEAM Plus EB assessment, making Hong Kong a more sustainable city.

REFERENCES

Architecture and Building Research Institute, 2012, *Green Building Evaluation Manual for Building Renovation (EEWH-RN)*, Architecture and Building Research Institute, Ministry of The Interior, Taiwan.

BEAM Society Limited, 2012, *BEAM Plus Existing Buildings Version 1.2 (2012.07)*, Hong Kong Green Building Council, Hong Kong.

Building and Construction Authority, 2012, *BCA Green Mark for Existing Non-Residential Buildings (Pilot Version 3.0)*, BCA, Singapore.

Green Building Council of Australia, 2013, *Green Star-Performance*, Green Building Council of Australia, Australia.

Hong Kong Green Building Council Limited, 2015, *HK3030 Market Drivers for Transformation of Green Buildings in Hong Kong (Executive Summary)*, Hong Kong.

Japan Sustainable Building Consortium, 2010, *CASBEE® Existing Building. Japan Sustainable Building Consortium*, Tokyo, Japan.

Lai, J.H.K., Yik, F.W.H., 2006, Knowledge and perception of operation and maintenance practitioners in Hong Kong about sustainable buildings, *Facilities*, Vol. 24, No.3/4, pp. 90-105.

Man, C.S., Lai, J.H.K., Yik, F.W.H., 2012, A review of green building assessment methods of the US, UK, China and Hong Kong, *Proceedings of the 3rd Greater Pearl River Delta Conference on Building Operation and Maintenance: 绿色建筑与绿色运维*, Guangzhou, China, 10 November, pp. 29-40.

U.S. Green Building Council, 2009, *LEED Reference Guide for Green Building Operations and Maintenance – For the Operations and Maintenance of Commercial and Institutional Buildings*, U.S. Green Building Council, Washington DC.