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PERFORMANCE LABELLING OF BUILDINGS

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Abstrak

Pelaksanaan konstruksi bangunan yang cukup tinggi pada abad ini telah menggunakan sumber daya material dan energi yang cukup besar baik pada saat pembangunan maupun masa penggunaan bangunan tersebut. Hal ini dapat menyebabkan krisis energy dan memicu pemanasan global jika tidak adanya fungsi pengendalian dan penilaian terhadap hasil pembangunan serta rekomendasi terhadap pembangunan kedepan. Dalam rangka menjaga keberlanjutan sumber energy perlu dikembangkan program-program khusus untuk meningkatkan kesadaran para pemain kunci dalam dunia konstruksi, sepert iperancang, pengembang, pemilik bangunan, kontraktor dan pemerintah serta pihak lainnya. Langkah-langkah strategis yang akan mendorong industry konstruksi untuk lebih memperhatikan isu-isu lingkungan dalam pembangunan dapat dilakukan dengan melembagakan system penilaian dampak lingkungan dan kinerja bangunan sehingga konsep pembangunan yang ramah lingkungan dapat di motivasi dan dicapai. Beberapa Negara maju telah menerapkan system penilaian bangunan terhadap penggunaan energi, seperti LEED di United States, BREEAM di Inggris, CASBEE diJepang, NABEERS di Australia, ABRI di Taiwan, HK-BEAM di Hongkongdan Green Mark for Buildings di Singapore dengan tujuan mempercepat adopsi pembangunan lingkungan binaan yang ramah lingkungan dengan menggunakan konsep arsitektur hijau. Gambaran konsep penilaian bangunan yang ramah lingkungan di Negara maju tersebut apakah dapat diterapkan di Negara Malaysia sebagai Negara berkembang.

Kata kunci: *Performance, Labelling, Green Building, LEED, BREEAM, CASBEE, NABERS, ABRI, HK – BEAM, Green Mark for Buildings*

I. INTRODUCTION

It is generally reckoned that the building industry consumes considerable quantities of material resources and energy. In order to promote sustainability in the sector, specific means and programmes need to be developed for raising awareness among the key players, which encompass developers, building owners, designers, engineers, contractors and occupants. Instituting an assessment system to rate the environmental impact and performance of buildings is one strategic measure that will encourage the industry to pay greater attention to such issues, and to subscribe to 'green building' practices. The labelling scheme that is an integral part of the assessment system will accord due recognition to the participants for their corporate responsibility and commitment to sustainability, and will contribute to institutionalising such practices in their management system.

In many developed countries, such as United Kingdom, United States, Japan, Australia, Taiwan, Hong Kong and Singapore, building performance assessment and labelling systems are already operational, aiming essentially at accelerating the adoption of green building practices by the building sector concerned. An overview is made of these systems as a basis for considering whether a similar system is timely to be introduced in Malaysia.

II. OVERVIEW OF EXISTING BUILDING PERFORMANCE ASSESSMENT AND LABELLING SYSTEMS

All the building performance assessment and labelling systems under review cover almost invariably elements associated with best practices that minimise adverse environmental impacts, and incorporate criteria that identify the environment-friendly features of the buildings.Bellow is the existing building performance assessment and labelling systems acording their countries :

1. LEED , Energy Star (United States)
2. BREEAM (United Kingdom)
3. CASBEE (Japanese)
4. NABERS, Green Star (Australia)
5. ABRI (Taiwan)
6. HK – BEAM (Hong Kong)
7. Green Mark for Buildings (Singapore)

2.1 LEED

The LEED (Leadership in Energy and Environmental Design) Green Building Rating System, developed and managed by the United States Green Building Council (USGBC), is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. It has been created to define 'green building' by establishing a common standard of measurement in order to promote integrated, whole-building design practices. It recognises environmental leadership in the building industry and stimulates green competition. Its adoption has raised consumer awareness of green building benefits and transformed the building market.

LEED provides a complete framework for assessing building performance and meeting sustainability goals. Based on well-founded scientific standards, LEED emphasises state-of-the-art strategies and assessment in the following aspects:

a. Sustainable site development
b. Water savings
c. Energy efficiency
d. Materials and resources selection
e. Indoor environmental quality
f. Innovation in operation, upgrades and maintenance (existing buildings)
g. Innovation in design (new construction and major renovations)

The assessment is rated based on the total score for CERTIFIED, SILVER, GOLD and PLATINUM. Currently, LEED is implementing four variants, namely

a. New commercial construction and major renovations
b. Existing buildings
c. Commercial interiors
d. Core and shell construction

Two more versions, for homes and for neighbourhood developments, are under development. The LEED Green Building Rating System is gaining a big market as it has gained the confidence of the key stakeholders – developers, designers, contractors, consumers and policymakers

2.2.1 Energy Star

Energy Star is a voluntary labelling programme backed by the US government to assist businesses and individuals in environmental protection through superior energy efficiency.

It is a dynamic government-industry partnership that offers businesses and consumers energy-efficient and cost-effective solutions. The programme was established by the US Environmental Protection Agency (USEPA) in 1992 for energy-efficient computers, and since then it has expanded to encompass more than 40 product categories.

For the building sector, USEPA provides a national energy performance rating system that recognises top performing buildings with the Energy Star label. This rating system measures how well the building systems are integrated and how well the building is operated and maintained. The online version is available for office buildings, schools, hotels, grocery stores and hospitals. Major organisations have also adopted the national rating system as part of their energy management efforts. To date, businesses have already used the system for over 21,000 buildings across the country. Based on results from the national energy performance rating system, USEPA offers the Energy Star label as a way to distinguish buildings that score in the top 25% of their class which also meet industry standards for indoor air quality. Up to July 2004, 729 buildings, which mostly include office buildings and schools, have been rated as top energy performing buildings, earning the right to display the Energy Star label. These buildings have been found to be 40% more energy-efficient than average buildings

2.2 BREEAM

The Environmental Assessment Method of the Building Research Establishment Ltd. (BRE) United Kingdom, popularly known as BREEAM, has been used over a decade to assess the environmental performance of both new and existing buildings. It is regarded by the UK's construction and property sectors as the measure of best practice in environmental design and management. BREEAM's success stems from its unique ability to cover a wide range of environmental issues within one assessment, and to present the results in a way that is widely understood by those involved in the property procurement and management. BREEAM assesses the performance of buildings in the following areas:

a. Management – overall management policy, commissioning site management andprocedural issues
b. Energy use – operational energy and carbon dioxide issues
c. Health and well-being – indoor and external issues affecting health and well-being
d. Pollution – air and water pollution issues
e. Transport – transport-related carbon dioxide and located-related factors
f. Land use – greenfield and brownfield site

g. Ecology – ecological value conservation and enhancement of the site
h. Materials – environmental implication of building materials, including life-cycle impacts
i. Water – consumption and water efficiency

Credits are awarded in each area according to performance. A set of environmental weightings then enables the credits to be added together to produce a single overall score. The building is then rated on a scale of PASS, GOOD, VERY GOOD or EXCELLENT, and a certificate awarded that can be used for promotional purposes.

2.3 CASBEE

The Comprehensive Assessment System for Building Environment Efficiency (CASBEE) is a new home-grown Japanese rating and labelling system for different types of buildings including offices, schools and multi-unit residential buildings. It is being developed under the Japan Sustainable Building Consortium (JSBC) with government support, and is expected to be used in certification soon. The system is intended to cover the whole life cycle in separate modules when completed, designed for use along with the building design processes.

CASBEE comprises a variety of assessment tools along with the design process. These include:

a. Pre-design Assessment Tool, which enables owners and planners to identify the basic context of the project, such as proper site selection and basic impact of the project
b. Design for Environment Tool, a simple self-evaluation check system for designers and engineers for improving the building environmental efficiency during the design process
c. Eco-labelling Tool, which is used to rate buildings in terms of building environmental efficiency, and is also intended to determine the basic market value of the labelled property
d. Sustainable Operation and Renovation Tool, which provides building owners and managers with information concerning means of improving the building environmental efficiency

The system adopts an environmental efficiency approach by providing results that are based on the quality of environmental performance in relation to the environmental load, representing assessments made within and outside the hypothetical boundary of the building concerned. It is expressed by a term called the Building Environmental Efficiency (BEE) as a key concept of CASBEE, which is used to communicate the assessment results translated into a simple ratio:

$$BEE = \frac{Q, \text{Building Environmental Quality \& Performance}}{L, \text{Building Environmental Load}}$$

CASBEE covers the following aspects in the assessment:

a. Energy efficiency
b. Resource efficiency

c. Local environment
d. Indoor environment.

There is a total of 80 sub-items which are re-categorised into:
Q1 – Indoor environment
Q2 – Quality of service
Q3 – Outdoor environment on site
L1 – Energy
L2 – Resources and materials
L3 – Off-site environment

BEE values are represented in a plot by the gradients of the lines connecting the assessment data and the origin. Larger gradient, that is with higher value of Q and lower value of L, represents higher sustainability of the building. With this approach, it will be possible to graphically present the assessment results using areas bounded by these gradients for label grading.

2.4 NABERS

The Australian Government Department of Environment and Heritage (DEH) has developed Australia's first comprehensive building rating system, known as the National Australian Built Environment Rating System (NABERS). NABERS, as a voluntary management tool rather than a regulatory tool, is a performance-based rating system that measures an existing building's overall environmental performance during operation against a set of key impact categories, which include energy, refrigerants (greenhouse and ozone depletion potential), water, storm-water runoff and pollution. It is intended to provide information on the sustainability of the building that will entice greater investment in sustainable building alternatives.

Since the first draft in 2001, the system went through a final public review end 2003, and in August 2004, the Sustainable Energy Development Authority of NSW (SEDA) was awarded the tender to make NABERS a commercial reality. SEDA itself has a number of years of experience in implementing energy rating schemes for operational buildings via its own Australian Building Greenhouse Rating and Energy Smart Home Rating.

Listed below is the set of key impact categories against which NABERS measures the environmental performance of buildings classified according to Commercial Office Buildings, Commercial Office Tenancy, and Residential Home. The system is structured in order to recognise:

a. the different realms of accountability and responsibility for commercial building owners, commercial tenants, or home owners
b. the varying key environmental issues relevant to different building types :
   1. Energy use and greenhouse emissions
   2. Refrigerant use (global warming potential and ozone depletion potential)
   3. Water use
   4. Storm-water runoff
   5. Storm-water pollution
   6. Sewage outfall volume
   7. Transport
   8. Landscape diversity
   9. Toxic materials
   10. Waste
   11. Indoor air quality
   12. Occupant satisfaction

2.4.1 Green Star

Green Star is another national voluntary rating system promoted by the Green Building Council of Australia (GBCA), which evaluates the environmental performance of buildings. While aiming to create rating tools for various building types, GBCA's initial focus has been commercial office buildings. To date, rating tools have been developed for:

a. Green Star – Office Design, design of commercial office buildings
b. Green Star – Office As Built, construction of commercial office buildings
c. Green Star – Office Interiors, fit-out of office buildings

Green Star has rating tools for different phases of the building life cycle, e.g. design, construction and operation, and for different building classes, such as office, retail, industrial, residential, etc. These rating tools use the best regulatory standards to encourage the property industry to improve the environmental performance of development. The star rating certification system is similar to the LEED and BREEAM systems, essentially as a market transformation tool demonstrating good practice rather than building performance itself.

Green Star establishes a number of categories under which specific key criteria are grouped and assessed. These categories include:

a. Management
b. Indoor Environmental Quality
c. Energy
d. Transport
e. Water
f. Materials
g. Land Use, Site Selection and Ecology
h. Emissions

Within each category, the credits awarded have an effective weighting by virtue of the number of credits awarded versus the total credits available. The credits available correlate with, but are not always linearly proportionate to, the environmental impact. Each credit has the following supporting information:

a. Aim of Credit
b. Number of Credits Available
c. Credit Criteria
d. Compliance Requirements
e. Additional Guidance
f. Background Information
g. References and Further Information Sources

The score is determined for each category based on the percentage of credits achieved. An environmental weighting, derived by considering a variety of scientific and stakeholder opinion, is applied to each category score (except Innovation). The overall score is then determined by adding together all the weighted category scores plus the innovation points (which are not weighted). The maximum possible score for the weighted categories is 100 with an additional 5 points available for innovation.

The Green Star rating is determined by comparing the overall score with the rating scale shown below:

Star Rating	Score Required	Comment
One	10	
Two	20	
Three	30	
Four	45	Best Practice
Five	60	Australian Excellence
Six	75	World Leader

Only buildings achieving a rating of Four, Five, or Six Stars will receive official certification from GBCA.

2.4.2 Green Building Label of Taiwan

The Architecture and Building Research Institute (ABRI), Ministry of the Interior has developed a building rating and labelling system which focuses on nine issue areas as follows:

a. Biodiversity
b. Greenery
c. Soil Water Content
d. Energy Conservation
e. Carbon Dioxide Emission
f. Waste Reduction in Materials
g. Indoor Environmental Quality
h. Water Conservation
i. Sewer and Garbage

Buildings being evaluated under this system must pass two pre-requisites, namely energy and water conservation, plus two from among the other seven indicators.

2.5 HK-BEAM

HK-BEAM, the acronym for the Hong Kong Building Environmental Assessment Method, is a private sector initiative owned and operated by the HK-BEAM Society of Hong Kong on a self-financing basis. The society, which consists of individual and corporate members from all disciplines – owners, developers, facility managers, designers, researchers, contractors, product and material suppliers, etc, oversees the on-going development and implementation of HK-BEAM standards for building assessment, performance improvement, certification and labelling. The system, which was inspired by BREEAM, has been in existence since 1996, and modified extensively since then to suit the unique conditions of the city. The initiative has been designed as:

a. A mechanism to measure, improve, certify and label the whole-life environmental sustainability of buildings
b. A comprehensive standard and supporting process covering all building types - including residential, commercial institutional buildings and mixed-use complexes, both new and existing
c. A means by which to benchmark and improve performance in the planning, design, construction, commissioning, operation and management of buildings
d. A voluntary scheme developed in partnership with industry stakeholders
e. A driver for and means by which to assure healthier, higher quality, more durable, efficient, and environmentally sustainable working and living environments.

The main aims of the system are to:

a. Stimulate demand for more sustainable buildings in Hong Kong, giving recognition for improved performance and minimising false claims
b. Provide a common set of performance standards that can be pursued by developers, designers, architects, engineers, contractors and operators
c. Reduce the environmental impacts of buildings throughout the planning, design, construction, management and demolition life cycle
d. Increase awareness in the building sector, and ensure that environmental considerations are integrated right from the start rather than retrospectively

Two major building types are priority areas for labelling, namely office buildings and apartment buildings. The labelling systems respond to very different demands in these two cases: private developers of large, sophisticated and expensive office space need to show the performance potential of their products in an extremely competitive marketplace, while the Hong Kong government is an active developer of low- and middle-income housing, and looks at labelling systems as a way of demonstrating their responsiveness to social, economic and health needs, as well as the functional requirements of their clientele. HK-BEAM defines over 100 best practice environmental criteria covering:

a. Hygiene, health, comfort, and amenity
b. Land use, site impacts and transport
c. Use of materials, recycling, and waste management
d. Water quality, conservation and recycling
e. Energy use, efficient systems and equipment, as well as energy management

Buildings are assessed independently against the above criteria, and those which qualify receive a HK-BEAM certificate with a rating of either Bronze, Silver, Gold or Platinum according to their performance.

Since the launch in 1996, over 100 buildings spanning some 5.5 million m^2 have been assessed under the HK-BEAM system, making it one of the most used assessment and labelling schemes for buildings in the world on a per capita basis.

2.6 GREEN MARK FOR BUILDINGS

The Green Mark for Buildings has been developed by the Building and Construction Authority (BCA) of Singapore, and supported by the National Environment Agency, as a strategic programme to encourage developers, building owners, designers and contractors to adopt "green building" practices right from the conceptualisation, design and construction phases for new projects, or during building management and operations for existing buildings. It is designed to promote sustainable

development in the construction industry through raising environmental awareness and commitment in the sector, and according due recognition to those which comply with the set criteria. The scheme's objectives are to:

a. Recognise developers and building owners who build and maintain buildings that are environment-friendly
b. Promote best practices in the development, design and maintenance of buildings that minimise adverse environmental impact
c. Provide a benchmark for buildings in Singapore

The assessment system focuses on five key areas of global concern, namely:

a. Energy efficiency
b. Water efficiency
c. Project development and management for new buildings, or building managementand operations for existing buildings
d. Indoor environmental quality
e. Environmental innovations

The assessment criteria are specified in two categories: New Buildings and Existing Buildings. The new building scheme aims to provide the opportunity for building developers to construct green, sustainable buildings that promote energy savings, water savings, healthier indoor environments and adoption of greenery for their projects. The existing building scheme enables building owners and operators to meet their sustainable operation goals and to reduce impacts of their buildings on the environment and occupant health over their entire life cycle.

The measurement scale used in the Green Mark assessment system is based on a points scoring approach. Points are awarded for incorporating environment-friendly features which are better than normal practice. The assessment identifies and credits designs where specific targets are met. Meeting one or more indicates that the building is likely to be more environment-friendly than buildings where the issues have not been addressed. Therefore, the total number of points obtained provides a benchmark of the building's environmental performance and allows comparison between buildings. The allocation of Green Mark points is as follows:

For New Buildings

Category	No. of Points
Design for Energy Efficiency	30
Design for Water Efficiency	20
Site/Project Development & Management	20
Design for Good Indoor Environmental Quality & Environmental Protection	15
Innovation	15
Total	100

For Existing Buildings

Category	No. of Points
Building Management & Operation	25
Energy Efficiency Performance	25
Water Efficiency Performance	15
Indoor Environmental Quality Performance & Environmental Protection	15
Innovation	20
Total	100

Apart from achieving the minimum points in each rating scale, the participant has to meet all pre-requisite requirements, and score a

minimum of 50% of the points in each category, except the Innovation category. The assessment process consists of an initial assessment leading to the award of the Green Mark. Subsequently, buildings are required to have biennial assessment to maintain the Green Mark status. This is to ensure that the Green Mark labeled buildings continue to be well-maintained. For new buildings, they will be assessed under the Existing Buildings criteria during the biennial assessment. For existing buildings, they will continue to be assessed under the Existing Buildings criteria unless they have undergone a major refurbishment programmed.

III. RECOMMENDATIONS

3.1 MS 1525:2001 – Code

Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings provides only the criteria and minimum standards for energy efficiency in the design of new buildings and retrofit of existing buildings, so that they may be constructed, operated and maintained in a manner that reduces the use of energy. Even with the ultimate implementation of these provisions or their updates under the Uniform Building By-Laws, thereby making them mandatory requirements, the main target group will essentially be the new buildings. The introduction of an appropriate building assessment and labelingprogrammed on a voluntary basis therefore merits serious consideration to complement the implementation of MS 1525 as a strategic means of promoting greater awareness and commitment in practicing energy efficiency in buildings, both new and existing. The programmed will be able to distinguish the star performers to whom due recognition is accorded, to enhance the visibility of the use and end results of best practices, as well as to provide benchmarks for the industry concerned.

3.2 Almost all the building assessment and labeling systems.

Almost all the building assessment and labeling system currently operational in a number of countries, address all the major environmental aspects, both in building design and construction for new buildings, as well as in building management and operation for existing buildings. Energy efficiency and energy management are but a part of the assessment criteria set. In the Malaysian context, however, it is justifiable to focus initially in these aspects alone should a building assessment and labelling initiative be introduced, which may be expanded subsequently to cover other criteria as and when the need arises. A good example can be found in the Energy Star programme described above. The initial phase of the programme could be comparatively simplistic, yet covering sufficiently the essential criteria, in order to attract participation. The target group should be just non-residential buildings only for a start.

3.3 Taking the cue from countries like USA (Energy Star).

Australia, Taiwan and Singapore, the initiation, development and promotion of a building assessment and labelingprogrammed, albeit on a voluntary basis, should be undertaken initially by an appropriate government agency, such as SuruhanjayaTenaga (ST), or PusatTenaga Malaysia (PTM), which possesses the required resources, in collaboration with other authorities, notably the Ministry of Housing and Local Government. Such an arrangement will give credence to the programmed in attracting participation by the building sector, and in gaining confidence of the stakeholders and the public at large.

3.4 The development of a building assessment.

The development of a building assessment and labeling scheme should preferably be in accordance with the principles and procedures laid down in MS ISO 14024:1999 – Environmental Labels and Declarations – Type 1 Environmental Labeling – Principles and Procedures. While the initial focus would be on energy efficiency and energy management, criteria should be set at attainable levels and give consideration to relative environmental impact, measurement capability and accuracy. Consideration could be made at a later stage, when deemed appropriate, to transform these criteria through the established standardization protocols and procedures into Malaysian standard labeling criteria for integration into the national standardization system.

3.5 The establishment of assessment and labeling.

The establishment of assessment and labeling scheme focusing on building energy efficiency could facilitate spearheading an annual competition for a national energy award for the building sector. This will not only promote greater interest in the programmed, thereby creating increased awareness and practice, but also serve to prepare our building industry to participate in regional and international competitions, such as the ASEAN Energy Award, thereby contributing to the uplifting of the industry to the international levels.

REFFERENCES

GREEN BUILDING INDEX – MS1525

Performance Labeling of Buildings, Danida Project in Malaysia RE + EE Component

Uniform Building By Laws (UBBL), clause 41, schedule 3, Mechanical Ventilation & Air Conditioning

www.tenaganasionalberhad.com

ASHRAE, ASHRAE Standard 55: thermal environmental conditions for human occupancy, America society of heating, refrigerating and air conditioning engineers, 1992.