

**Assessment Analysis of University Academic Building for Certified Green Building Index
Compliance (GBI)**



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**ASSESSMENT ANALYSIS OF UNIVERSITY ACADEMIC BUILDING FOR
CERTIFIED GREEN BUILDING INDEX COMPLIANCE (GBI)**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I declare that this project report entitled “Assessment Analysis of University Academic Building for Certified Green Building Index Compliance (GBI)” is the result of my own work except as cited in the references.

 Signature : 
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Date : 29 JULY 2021

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APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.



Signature

: _____

Name of Supervisor : PROF. MADYA DR. TEE BOON TUAN

Date : _____

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DEDICATION

To my beloved mother and father.



ABSTRACT

Green building concept is able to address the various issue such as energy consumption, energy cost, carbon dioxide (CO₂) emissions, and waste output. It also provides excellent indoor environment quality and a productive work environment. Green building Index (GBI) is one of comprehensive building rating tools in Malaysia. The objective of this study is to conduct the assessment and analysis to the FKM building according to GBI compliance as well as proposed the measure according to GBI compliance. GBI- NREB (Non-residential existing building) rating tool is used for conducting an assessment of the Faculty of Mechanical Engineering Building, Universiti Teknikal Malaysia (UTeM). The questionnaires and survey were conducted to understand the impact of the indoor air quality and thermal comfort on building occupants. The physical measurements and collection of existing research data were also carried out to investigate the performance of the current building. The result shows that the low performance of energy efficiency and indoor environment quality in the FKM building. From the result of the GBI assessment, the building received a low rating point which is 7 out of 100 points. Based on the findings, the improvement related to retrofitting have been proposed according to the GBI compliance. The proposed measure focus on energy efficiency and indoor environment quality. In view of retrofitting, the cost benefits, practicability, and the building policy need to be considered to address future challenges and problems.

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ABSTRAK

Bangunan hijau dapat membantu mengatasi pelbagai masalah seperti penggunaan tenaga, kos tenaga, pelepasan karbon dioksida (CO₂), dan pengeluaran sisa. Bangunan hijau juga memberikan kualiti persekitaran dalaman yang berkualiti dan persekitaran kerja yang berproduktif. Indeks Bangunan Hijau (GBI) adalah salah satu peralatan untuk penilaian bangunan hijau dan juga alat penilaian yang ketat dan komprehensif di Malaysia. Objektif kajian ini adalah untuk melakukan penilaian dan analisis untuk bangunan FKM mengikut kepatuhan GBI dan juga mencadangkan ukuran mengikut kepatuhan GBI. Alat penilaian GBI-NREB (Non-residential existing building) digunakan untuk menjalankan penilaian terhadap Fakulti Kejuruteraan Mekanikal, Universiti Teknikal Malaysia Melaka (UTeM). Soal selidik dan tinjauan dilakukan untuk memahami kesan kualiti udara dalaman dan keselesaan haba pada pengguna bangunan. Pengukuran fizikal dan pengumpulan data penyelidikan yang sedia berada juga dilakukan untuk menyelidiki prestasi bangunan semasa. Hasilnya menunjukkan bahawa prestasi kecekapan tenaga dan kualiti persekitaran dalaman di bangunan FKM adalah rendah. Dari hasil penilaian GBI, bangunan FKM mendapat kedudukan penilaian yang rendah iaitu 7 dari 100 markah. Berdasarkan hasil kajian, penambahbaikan tentang pengubahsuaian telah dicadangkan mengikut pematuhan GBI. Langkah yang dicadangkan memberi tumpuan kepada prestasi kecekapan tenaga dan kualiti persekitaran dalaman. Pada pandangan pengubahsuaian, kos efektif, kebolehlaksanaan, dan polisi bangunan perlu dipertimbangkan untuk menangani cabaran dan masalah di masa depan.

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LIST OF ABBREVIATIONS

ACE	Air Change Effectiveness
ACEM	Association of Consulting Engineers Malaysia
ACMV	Air-Conditioning and Mechanical Ventilation
BBCC	Bukit Bintang City Centre
BEI	Building Energy Intensity
BREEAM	Building Research Establishment Environmental Assessment Method
CASBEE	Comprehensive Assessment System for Built Environment Efficiency
CITP	Construction Industry Transformation Programme (CITP)
EE	Energy Efficiency
EQ	Indoor Environmental Quality
FKM	Faculty of Mechanical Engineering
GBI	Green Building Index
GEO	Green Energy Office

GSB	Greenbuildingindex Sdn Bhd
HVAC	Heating, Ventilating, and Air Conditioning
IAQ	Indoor Air Quality
IN	Innovation
LEED	Leadership in Energy and Environmental Design
MGBC	Malaysian Green Building Confederation
MIA	Malaysian Institute of Architects
MR	Material & Resources
MyCREST	Malaysian Carbon Reduction and Environmental Sustainability Tool
NGTP	National Green Technology Policy
NREB	Non-Residential Existing Building
OTTV	Overall Thermal Transfer Value
PAM	Pertubuhan Arkitek Malaysia
pH JKR	Penarafan Hijau JKR
SM	Sustainable Site Planning & Management
TRX	Tun Razak Exchange
UKGBC	United Kingdom Green Building Council
USGBC	United States Green Building Council

UTeM Technical University of Malaysia Melaka

UTM Universiti Teknologi Malaysia

WE Water Efficiency



CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Over the last decades, global extreme warming, pollution, depletion ozone, acid rain, overpopulation, natural resources, deforestation depletion, waste disposal and biodiversity loss always contribute to the environmental problem around the world. Natural resources used in unsustainable ways brought us to environmental issues nowadays. All these problems also affect the environment in Malaysia as well (Singh et al., 2016). However, these issue lead to the attention of the Malaysia construction industry on this. Minimizing the construction impacts on the environment and sustainable development, transformation in building construction and operations will play an important role. In this case, several measures are already taken to improve the quality of life of current people and also the future generation. One of the measures is the implementation of green building to achieve the goal of development in sustainable, protecting the environment and also to improve human life's quality (Shafiei et al., 2017).

The green building is a construction and also a strategy that aims for increase the effectiveness of the use of resources, energy, materials, water, and also at the meantime to minimize the effect from building to the health of human and also the environment through improved design, site location, construction, operation, maintenance, and removal during the building lifecycle. Successful of Implementation in designing and operating to the green

building will help in reducing the overall effect towards the surroundings from the built environment. There is much certified green building in Malaysia such as Tun Razak Exchange (TRX), Gamuda Cove Core Business District, Bukit Bintang City Centre (BBCC), Sunway Resort City, Bandar Gamuda Gardens and others.

The government looks forward to the impact from the green building will minimize the greatest impact to the environment from construction industry, to improve the energy of building developments and reflect energy efficiency, to reduce energy and waste. At the meantime, it will help to achieve the goals of sustainable development in the construction industry in Malaysia (Shafiei et al., 2017). The green building can become a significant strategy for the goal of government and construction industry to contribute to sustainable development in order to reduce environmental impacts.

Nowadays, Green building construction is grown exceedingly globally. It happened also in Malaysia, registered and certified with the Green Building Index (GBI) are around 636 buildings. Moreover, the fulfilled the requirements and fully certified with GBI is around 45 buildings (Yang et al., 2017). At the same time, other buildings are in the transitional certification stage. The reversible impacts on ecosystems can be fulfilled by reducing the energy consumed and producing waste as well as it was realized by the Malaysian construction and building industry (Yang et al., 2017). This also is one of the reasons Malaysia starts to move towards green building and development of sustainability. However, the idea of green building and sustainable is still are infancy and immature, even though some excellent green buildings have been built and some achievements have been made in this field these years in Malaysia (Algburi et al., 2016).

In Malaysia, there are various rating system tools for green building such as GBI, PH JKR, Green PASS, GreenRE and others (CIDB Malaysia, 2018). In 2009, Malaysia had embraced the Green Building Index (GBI) which introduced by the Association of Consulting Engineers Malaysia (ACEM) and the Malaysian Institute of Architects (MIA) (Marhani et al., 2018). The purpose is to study the fundamentals to implement GRI and also to reinforce the implementation of GBI to support and to promote green The goal is to learn the basics of implementing GBI and to strengthen GBI implementation in order to support and promote green construction in Malaysia. concept in Malaysia. However, the GBI is specifically designed from the consideration of the tropical climate in Malaysia, social, infrastructure and the economic development in Malaysia currently (GBI, 2009). The Green Building Index (GBI) is specifically designed from the consideration of the local tropical climate, economic, infrastructure and the social growth in Malaysia currently (GBI, 2009). The Green Building Index (GBI) as a green building rating system tool are the one used in this study for assessment analysis to university academic building. Chew et al., 2016 stated that the Green Building Index (GBI) is the one comprehensive green building rating system in Malaysia with six main criteria for evaluating the environmental design and performance of Malaysian buildings. It developed by the Association of Consulting Engineers Malaysia (ACEM) and the Pertubuhan Arkitek Malaysia (PAM). Greenbuildingindex Sdn Bhd (GSB) encourage to access to Green Building Index for validating environmental initiative to the refurbishment of base building or new constructing during the design phase; or to practice the analyze and improvement to their environmental quality of buildings during construction and procurement phase (GBI, 2009). There may be no fee is needed to pay to the GSB with dependent accredited GBI Certifier in using the Green Building Index in formal certification. However, there are cost need to pay to conduct the

assessment and receive the official certification provided by Greenbuildingindex Sdn Bhd with formal recognition of GBI (GBI, 2009).

1.2 PROBLEM STATEMENT

The building located at Technology Campus used by Universiti Teknikal Malaysia Melaka for Faculty of Mechanical Engineering is a eight-storey building. FKM building has the floor area about 2325 m² and 80% building area covered by glazed facades.

There are many studies that can be found about energy-saving, energy consumption, and energy analysis in Heating, Ventilating, and Air Conditioning (HVAC) in the FKM building. Nonetheless, the research related to the indoor environment quality, material and resources, innovation, water efficiency and the sustainable site planning and management almost cannot be even found. In other words, the study on the energy performance of the building is still lacking.

Moreover, the climate in the Strait of Malacca is hot and humid; northeast monsoon prevailing in winter season and southwest monsoon prevailing in the summer season. The Strait of Malacca is located on the equatorial windless zone, with average high temperature and rain, and the wind is small all year round (Weather and climate, n.d.). This will also damage the building and cause another issue for the indoor environment quality and energy efficiency of the building (Kay, 2018). It can be noticed that there is a frequent issue of air-conditioning system failure causing uncomfortable environment to the student.

Therefore, it is important that for assessment analysis of Green Building Index (GBI) is conduct to FKM building. It will help us to understand the issue of performance of the building

and the improvement that need to take action and help to enhance our awareness about the green building concept.



Figure 1.1: FKM Building UTeM

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Figure 1.2: Lecture room

1.3 OBJECTIVE

The objectives in the project are as below:

1. To conduct an assessment on FKM's building according to Green Building Index criteria.
2. To propose measures for certified Green Building Index compliance of the FKM's building.

1.4 SCOPE OF PROJECT

This project studied in using the GBI-NREB rating tool to do the assessment to the FKM's academic building not included laboratory. In this context, the indoor air quality (IAQ) meter, light intensity meter and sound level meter measurement equipment will be used to obtain physical parameter as well as the measure will be conducted under quiet and unmanned environment. Moreover, the measure of retrofit will focus on energy efficiency, indoor environment quality, and water efficiency.

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