

THE NEED FOR RETROFITTING TO ACHIEVE SUSTAINABILITY OF MALAYSIAN BUILDINGS

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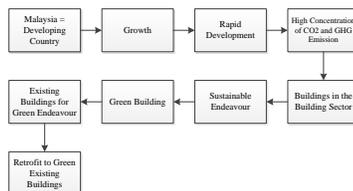
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Graphical abstract



Abstract

Malaysia is a country that is progressively developing that uses energy as the main input for its continuous development. The increasing demand and consumption of energy subsequently led to increase concentration of greenhouse gas emission and resource depletion. To cope with the challenges in mitigating adverse effects and sustaining energy, Malaysia has made efforts in emphasizing on the green building initiatives in the building sector. This has been demonstrated through promulgation of policies (i.e. NTGP, NPCC), impetus in developing 'greenness' (i.e. GTFs, GBI) and government-owned green buildings manifests. Considerable attention on green building initiatives can be seen through the increasing number of new green buildings that are presented in the GBI executive summary. However, the existing building stocks remain with less attention. Furthermore, there is a lack of consideration in retrofitting these existing buildings as a mean to contribute to sustainability. Therefore, this paper presents and reviews the measures that have been taken towards Malaysia's building sector and the emphasis of retrofitting existing buildings to contribute in the sustainability movement.

Keywords: Existing building, retrofit, sustainability

Abstrak

Malaysia adalah sebuah negara yang sedang membangun. Penggunaan tenaga merupakan input utama bagi meneruskan pembangunan di negara ini. Peningkatan dalam permintaan dan penggunaan tenaga telah membawa kepada peningkatan kesan rumah hijau dan penyusutan sumber-sumber. Dalam usaha bagi menanggapi cabaran dalam mengurangkan kesan rumah hijau dan mengekalkan tenaga, Malaysia telah memberi penekanan terhadap inisiatif bangunan hijau di dalam sektor bangunan. Hal ini telah dipamerkan melalui pengisytiharan dasar-dasar (seperti NTGP, NPCC), dorongan dalam membangunkan kehijauan (seperti GTFs, GBI) dan penjelmaan bangunan-bangunan hijau milik kerajaan. Peningkatan dalam jumlah bangunan-bangunan hijau menunjukkan inisiatif bangunan hijau mendapat perhatian sewajarnya. Hal ini dapat dilihat melalui rumusan eksekutif GBI. Namun, bangunan sedia ada masih kurang diberi perhatian. Tambahan lagi, pengubahsuaian terhadap bangunan sedia ada sebagai satu cara untuk menyumbang kepada kelestarian juga kurang mendapat pertimbangan. Oleh itu, kertas kerja ini membentangkan dan mengulas langkah-langkah yang telah diambil terhadap sektor bangunan Malaysia dan penekanan terhadap pengubahsuaian bangunan sedia ada untuk menyumbang kepada gerakan kelestarian.

Kata kunci: Bangunan sedia ada, ubahsuai, lestari

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1.0 INTRODUCTION

Sustainable development is a global consensus. It is considered important due to the result of rising environmental crisis [1]. Malaysia has also recognized the importance of sustainable development and therefore has taken steps in making its own contribution to sustainable development. This effort has ranked Malaysia as 38th among 146 countries worldwide and as second in Asia with regard to environmental sustainability [2].

Throughout Malaysia's development, energy has been used as the main input for growth. This subsequently led to greenhouse gas emission and resources depletion. This has caused the Malaysian government to take serious concern on the environment [3]. This concern is presented through the embedment of sustainable development concept in Malaysia's policies, visions, missions, and plans as a part of Malaysia's initiative towards sustainable development [4].

One of Malaysia's efforts in its sustainable endeavour is the introduction of green building rating tool. In 2009, Green Building Index (GBI) rating tool was introduced [5] as a mean to further encourage the mainstreaming of green building in the building sector.

The GBI executive summary has shown progressive increase in the amount of green buildings in Malaysia. Most of which are new construction of green buildings. Nevertheless, existing buildings should be the centre of green building endeavour in order to achieve optimal sustainability. By implementing retrofitting on existing buildings, the sustainability of Malaysian buildings can be achieved.

Throughout this paper, it will briefly discuss on the background of Malaysian endeavor for sustainability, the endeavor in encouraging green buildings in Malaysia, the current trend of green building in Malaysia, the significance of existing buildings, the significance of retrofitting existing buildings to the sustainability movement and lastly the overall conclusion of the paper. Figure 1 illustrates the overall discussion of this paper.

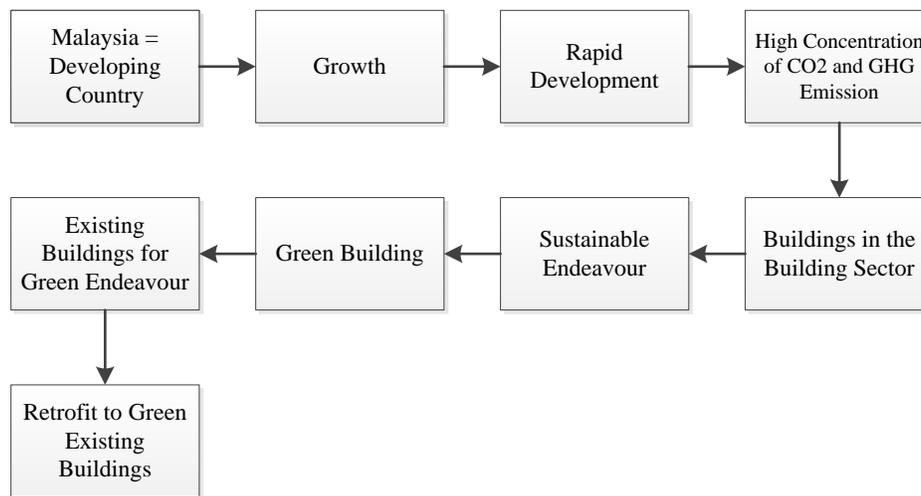


Figure 1 The overall view of the discussion

2.0 BACKGROUND

Malaysia is a developing country [6-7] and the use of energy has strengthened its economic growth and energy demand [8-9]. The increasing energy consumption raises the demand for energy supply. High energy consumption is evidently seen in sectors such as residential, commercial, industrial and transportation throughout Malaysia's development [10].

This has shown that energy is used as the main input for development. Malaysia has experienced a strong economic growth alongside with increasing energy demand from 1990 to 2000 and from 2000 to 2010 [8-9]. With high consumption of energy, it consequently leads to increase concentration of greenhouse gas emissions and depletion of natural resources [8].

In referring to the Department of Energy (DOE) in USA, such situation leads to the contribution of global carbon emission to rise more than 2% annually [9]. In this regard, the Malaysian government has taken actions in setting a sustainable development program to address the challenges of energy demands [10].

Over six decades ago, the government had formulated various energy-related policies to face with the challenges of security and sustainability in energy supply. These policies were gradually developed and revised over time. Subsequently, the past three decades have formulated a much more practical energy policy which took path in the environment-friendly energy development [8].

In 1999, Renewable Energy (RE) was introduced as the fifth fuel to the energy supply mix. RE was further encouraged through the announcement of the 8th

Malaysian Plan (2001-2005). The stipulation of RE utilization under the 8th Malaysian Plan was targeted to meet the 5% target of RE contribution in the energy supply mix.

The stipulation of RE utilization continues to be highlighted under the 9th Malaysian Plan (2006-2010), in which the aim of RE utilization was to further secure sustainability in energy supply for continuous economic growth [8]. Furthermore, the promotion of Energy-Efficiency (EE) program to deal with the nation's energy challenge was intensified [8]. The EE programs aims on reducing energy consumptions by utilizing energy saving features.

Another effort is the introduction of National Green Technology Policy (NGTP). This policy promotes the utilization of green technologies and encourages its adoption to minimize the growth of energy consumption while at the same time enhances the Malaysian economic development [11]. The use of green technologies is a requirement that has been specified to four sectors in Malaysia which are namely [11]:

1. Energy sector
2. Water and waste management sector
3. Transportation sector
4. Building sector

3.0 GREEN BUILDING ENDEAVOUR

Suhaida *et al.* [12] has quoted from one of United Nations Environment Programme (UNEP) expert Dr. Arab Hoballah that "...almost no country in the world can hope to achieve carbon dioxide-reduction targets without including the building sector into their plan of action". This means that the building sector plays a crucial contribution to the overall sustainability target of a country. The buildings in the building sector contribute substantially to the amount of global carbon emission because of their massive consumption of energy [13-14].

In regards to this matter, the Malaysian government has introduced NGTP as an effort to efficiently utilize energy, conserve and minimize the impact to the environment, enhance economic growth, and improve social quality of living [11]. As previously mentioned, green technology has been encouraged in four specified sectors and one of which is the building sector.

The National Policy on Climate Change (NPCC) 2009 was formulated in tandem with introduction of NTGP. It aims to stipulate efficient management of resources and enhance the environmental conservation. NPCC was rationalized due to the concern of rising energy consumption which brought negative effects on the environment. Additionally, RE and EE measures were also specified under the 5th Strategic Thrust of NPCC. Under the 22nd Key Actions of NPCC, it promotes the construction of green buildings which also includes the promoting of retrofitting existing buildings.

Malaysian Building Integrated Photovoltaic Technology (MBIPV) Project is one of the first projects

in the green building initiative that the Malaysian government has engaged in. The launch of this project was aimed at encouraging the long term cost reduction of non-emitting greenhouse gas technologies by integrating energy generating photovoltaic technology into building designs and envelopes [8].

There are several demonstration of government owned green building in Malaysia and these are the Pusat Tenaga Malaysia (PTM) Green Energy Office (GEO) Building, Kementerian Tenaga, Teknologi Hijau & Air (KeTTHA) Low Energy Office (LEO) Building and Suruhanjaya Tenaga Malaysia Diamond Building [8-12-15].

The Malaysian government had also introduced the Green Technology Financing Scheme (GTFS) to further encourage the green building endeavor in Malaysia. The aim of introducing GTFS is to provide monetary access to further enable the adoption of green technologies through RE and EE applications in building envelopes.

The introduction of Green Building Index (GBI) presents another step forward in the green building initiatives in Malaysia. GBI is Malaysia's own green building rating system. GBI was launched by Malaysia Architect Association (PAM) and the Association of Consulting Engineers Malaysia (ACEM) [6-12-16]. GBI assess the buildings' impact on its environment and awards them with GBI Certification according to different ranks of 'greenness'. GBI's rating tool measures six criteria which are [8]:

1. Energy efficiency
2. Indoor environment quality
3. Sustainable site and management
4. Materials and resources
5. Water efficiency
6. Innovation

4.0 THE CURRENT TREND

The Green Building Index (GBI) was launched in 2009 and since then, many private and public projects have been involved and awarded with GBI certifications. GBI awards the green certification for both new constructions of green buildings and also green existing buildings. The total number of GBI certified green building can be evidently seen in the GBI Executive Summary.

The GBI Executive Summary summarizes the number of projects applied for GBI green building certification. These projects are categorized according to their type of project category, projects from which state or territory, total gross floor area (GFA) of the projects, their awarded categories, number of projects yearly or quarterly, and total reduction in carbon dioxide (CO₂) emission of GBI certified project.

GBI Executive Summary is issued every month. As evidenced from its monthly issue, the number of projects applied for GBI certification have increased steadily with majority of them are of new construction

of green buildings. Despite this positive participation in the green building endeavour has indicated, only a small number of projects have taken up the retrofitting strategy.

Similar scenario is also evident in the list of projects funded by GTFS. Majority of the projects funded with GTFS are of new construction of green buildings. GTFS has been specified to be applicable for both new construction projects and retrofit projects; however, not many retrofit projects are listed under the funding of GTFS.

According to Jamilus *et al.* [6], government policies have been acknowledged as the mechanism in driving the market for greening buildings. NGTP and NPCC are two of the many policies that drive the current market in green buildings. These policies have contributed much to the endeavour of green buildings in Malaysia. However, NTGP policy presents general description of green buildings. While the NPCC policy, retrofit building has been mentioned as another method of greening buildings and to date, this policy have not given the adequate urge for driving the market of retrofitting existing buildings. The emphasis is still much focused on developing new green buildings.

At the moment, the closest mandate for greening buildings is the MS1525:2007; Code of Practice on EE and Use of RE for Non-Residential Buildings [6]. MS1525:2007 comprises of elemental clauses for non-residential buildings to achieve energy efficiency. MS1525:2007 applies to buildings that are newly constructed and to buildings that have existed. Buildings that aim to achieve energy efficiency through retrofitting needs to comply with MS1525:2007. However, the descriptions on the code of practice for retrofitting existing buildings need to be comprehensively detailed. This is because retrofitting existing building requires considering various factors and aspect of complexities in retrofitting.

Although there are available support (i.e. GBI certification for existing building, NPCC policy, GTFS for retrofitting, and MS1525:2007) to encourage existing building retrofit in Malaysia, not many clients had taken the extra mile to take the opportunity [15] and experience the benefits of retrofitting. This is due to the lack of awareness that results in the slow progress and reluctance in retrofitting [15].

5.0 THE EXISTING BUILDING

The new construction of green buildings represents only a small percentage of the overall building stock in Malaysia. Their impact to the overall sustainability of Malaysian buildings is significantly small [17]. Consequently, the number of buildings in the green building endeavour only increases slowly [17].

The current total of existing building represents the majority of the overall building stock in Malaysia [18]. These buildings have existed for years and even decades [18]. Most of these existing buildings were not

constructed with energy efficiency in mind [17-19]. Wood [20] stresses that existing buildings should be addressed to achieve sustainability as their impact to sustainability will be optimal.

In order to improve these existing buildings, it is highly significant to implement retrofit as it enables to successfully attain the targets of sustainability through energy efficiency and environmental performance [13-17-18]. Therefore, the greatest opportunity to reduce primary energy use and improving overall sustainability and efficiency lies within existing building stock [14-17].

6.0 RETROFIT

Previous literatures have mentioned several definitions of retrofit. According to Wood [20], retrofit is described as a building – one adapted to a new use; which reduces the operational energy and maximizes the enduring benefit of the embodied energy that is already incorporated in their 'bricks-and-mortar'. Similarly, Swan *et al.* [19] explains retrofit as upgrades to the fabric or system or physical characteristics of a property that reduces energy use, generate renewable energy and improve environmental performance. Furthermore, the U.S Green Building Council describes retrofitting as any kind of upgrade of an existing building that is wholly or partially occupied to improve its energy efficiency and environmental performance, reduce water use, and improve the comfort and quality of the space in terms of natural light, air quality, and noise, all of which is done in a way that it is financially beneficial to the owner [17]. The definition used by Killien [21] also stated similar characteristics of retrofit. In summary, the definition above clearly states that the goal of retrofit is to improve energy efficiency, environmental performance and overall building performance simultaneously.

There are significant reasons for existing buildings to be retrofitted to a green building. Previous scholars have emphasized that existing buildings should be taken account in the green building endeavour and greening existing buildings through retrofit is highly recommended as it enables to achieve optimal sustainability – thus the value of existing buildings should not be taken for granted [13-14-17-18-20].

It appears that in Malaysia, the construction of new green building have become mainstream. Wood [20] considers this occurrence as wastage. When waste is involved, it is considered not sustainable because the construction of new green buildings requires large amount of resources which at the moment are becoming increasingly rare and therefore wasting a significant amount of embodied energy [14]. Existing buildings should not be under-rated in regards of their contribution to sustainability. Through retrofitting, buildings that have existed can be benefited for sustainability purposes hence lessening the wastage.

The time has come to start focusing on retrofitting existing buildings [13]. Greening existing buildings through retrofit approach can provide both tangible and intangible benefits. One of the benefits of implementing retrofit is that, by comparing to construction of new green buildings, it can avoid associated wastes and conserves the embodied energy. Other benefits of retrofitting existing building is that retrofit is a cost-effect approach to greening buildings; it generates greater investment returns for the client and reduces energy consumption, operation costs and lifecycle costs.

Additionally, greening existing building through retrofitting can provide better indoor environment quality for the occupants. Contrary to the construction of new green buildings, greening existing building through retrofit can be done within a short period of time. Therefore, if the challenge of sustaining energy consumption, generating renewable energy and achieving sustainability to be successfully addressed in the Malaysian building sector, the vast stock of older buildings needs to be retrofitted.

7.0 CONCLUSION

The continuous demand and consumption of energy has made Malaysia realize the significance of sustaining energy and mitigate adverse effect on the environment. This led Malaysia to begin taking efforts in realizing a sustainable concept in the country.

The Malaysian building sector has been set as the focus of sustainability endeavour. The emergence of green buildings in the country has contributed to Malaysia's sustainable development significantly. The number of green certified buildings has increased steadily since the launch of Malaysia's own green building rating system in 2009. This presented a positive and potential mainstreaming of green buildings in Malaysia.

The trend of the green building initiative has focused much on new construction of green buildings in Malaysia. This is presented through the increasing number of new green buildings in GBI executive summary. While on the contrary, the involvement of existing building to the green building endeavour has been disregarded significantly. This strategy at present would not contribute optimally to the sustainability of Malaysian buildings if existing buildings are not well considered.

In order for existing buildings to contribute to achieve sustainability, they need to be retrofitted to be green. Retrofit is a cost-effective approach to turn existing buildings into green buildings. Despite this, not many existing buildings in Malaysia are retrofitted to be green buildings. Retrofitting existing buildings should receive greater attention for the Malaysian building sector to be optimally sustainable. Therefore, further emphasis should be made on retrofitting existing buildings in order to successfully achieve optimal sustainability of the Malaysian buildings.

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