LOW-COST HOUSING IN MALAYSIA: A CONTRIBUTION TO SUSTAINABLE DEVELOPMENT?

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Abstract: Rapid urbanization and the scale of new buildings constructed in Malaysia demonstrate an urgent need for change in policy and mode of operation. National energy demand increased by 54% since 1994, which subsequently amplified carbon emissions growth by 221% (per head of population), dubbed highest in the world. Malaysia ranked 66th in the 2009 Human Development Index (HDI); and 54th on the Environmental Performance Index (EPI) in 2010, dropping 27 places from 2008. This indicates that Malaysia's economy and quality of life is improving, but at the cost of the environment. Presently, there is no Malaysian operational definition of sustainable performance in the construction industry, and therefore no consistent framework for assessing building greenhouse gas emissions. It is anticipated that an environmental assessment will prevent further locking in of the country into an unsustainable future. Low-cost housing in Malaysia represents 23.3% of housing targets for 2010, which presents affordable housing in urban areas. The subject of low-cost sustainable housing is still uncharted territory in Malaysia. While low-cost housing contributes to economical and social sustainability, the environmental impact of low-cost housing has yet to be assessed. This paper presents a brief overview to how low-cost housing can contribute to sustainable development's triple-bottom-line.

Key words: sustainable development, low-cost housing, developing country.

1 INTRODUCTION

Evidence and research within the last few decades concurs that human activity is contributing to climate change, linked directly and indirectly with the by-products of human activities (Intergovernmental Panel on Climate Change [IPCC], 2007a; United Nations Environment Programme [UNEP], 2007). The city landscape covers about 2% of the Earth's surface but its inhabitants consume approximately 75% of the planet's natural resources (United Nations Environment Programme & United Nations Human Settlements Programme [UNEP/UNHSP], 2005). This has consequently placed the world's current footprint is at an overshoot, humanity currently uses equivalent of 1.5 planets to supply the demand on nature, and that exceeds the biosphere's supply or regenerative capacity (Global Footprint Network [GFN], 2010). It is estimated Earth requires one year and six months regenerating what we consume within a year, excluding the non-renewable (GFN, 2010).

Rapid urbanization and scale of new buildings constructed in developing countries calls for an urgent need for change in mode of operation in the construction industry (International Council for Research and Innovation in Building and Construction [CIB], 1997; du Plessis, 2002; World Business Council for Sustainable Development [WBCSD], 2009). According to the Asian Business Council, Asian cities account to majority of the world's total new construction; more than 50% of new buildings will be in China and India alone, with an expansion of 2 billion square meters of buildings added each year (Hong, Chiang, Shapiro, & Clifford, 2007; WBCSD, 2008).

The substantial amount of new construction will lead to higher increase in energy demand, which subsequently increases level of carbon emissions. In 2007, China alone accounts for 18.7% of total carbon dioxide (CO_2) global emissions (IPCC, 2007b), and this increasing trend is expected to continue with the construction of two new coal-fired plants every week to meet high electricity demands (Hong et al., 2007, p. 2). India's gross built-up area is expanding fast, with a rate of 10% per annum, since the last decade (United Nations Sustainable Buildings and Climate Initiative [UNEP-SBCI], 2010b). The rising trend of CO_2 emissions from Asia is replicated from the striking rate of economic development and expansion of international market forces (International Energy Agency [IEA], 2009).

1.1 Sustainability and the Built Environment

The built environment therefore holds a critical role in sustainable development; it not only provides infrastructure, economic exchanges, engages 10% of global employment directly and indirectly (CIB, 1997; du Plessis, 2002; WBCSD, 2009). It also simultaneously pollutes the environment with its economic activities and by-products. The built environment globally accounts for more than 40% of energy consumption, generates approximately 40% wastes, consumes 16% of water for construction (United Nations Conference on Environment and Development [UNCED], 1992; du Plessis, 2002; WBCSD, 2009).

Furthermore, given the long life-spans of buildings, it has the potential to impact the natural environment and ecology well into the future, locally and globally (CIB, 1998; du Plessis, 2002; IPCC, 2009). The building sector comprised of residential and commercial buildings, contribute to 7.9% of total global CO_2 emissions (IPCC, 2007a, p. 36). Its primary contribution to climate change is through the causal effect of using fossil fuels in building operations, more than its actual construction (UNEP-SBCI, 2010a; Huovila et al., 2009). Studies suggest over 80% of the greenhouse gas (GHG) emission from buildings is produced during operation, for heating, ventilation, air-conditioning, and electrical purposes (UNEP-SBCI, 2010; Huovila et al., 2009; WBCSD, 2009).

Nonetheless, research on GHG mitigation suggests the building sector has the largest potential to significantly reduce GHG as compared to other major emitting sectors (IPCC, 2007a; Huovila et al., 2009; UNEP-SBCI, 2010a). It is estimated that both new and existing buildings have the potential to reduce its energy consumption by 30% to 80% using proven and commercially available technologies, with potential net profit during its lifespan (IPCC, 2007a; Levine et al., 2007; Huovila et al., 2009). According to the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (2007a), measures in reducing GHG emissions from buildings can be considered in any of these three categories (Levine et al., 2007, p. 389):

4. Reducing energy consumption and embodied energy in buildings;

5. Switching to low-carbon fuels including a higher share of renewable energy; or

6. Controlling the emissions of non-CO_2 GHG gases.

The building sector holds tremendous potential in addressing the challenge of carbon mitigation through its lifespan. Mitigation of GHG emissions and assessing actual building performance during its operational phase is more likely to have a positive impact on the environment. Actual building performance depends of the quality construction, design, operation and maintenance systems (Levine et al., 2007). Measuring energy performance of buildings will play a large role in contribution to sustainable building performance, as carbon emission is recognized as the largest building pollutant to climate change.

The operational stage in buildings account for 80-90% of total carbon emissions from energy use (UNEP-SBCI, 2010a), which justifies the need to measure actual operating building performance. Monitoring the performance level of buildings will also facilitate its operating efficiency (Levine et al., 2007). The construction industry can play major contributor role towards sustainable development, locally and globally; and in accordance with the 20% CO_2 emissions reduction by the year 2050 as set by the Intergovernmental Panel on Climate Change (United Nations Development Programme [UNDP] Communication Office, 2007). Therefore, measuring the sustainable performance of buildings will guide not only the industry forward for a more sustainable future, but improve the quality of the built and natural environments. This paper presents the benefits of low-cost housing and its contribution to sustainable development; through the triple-bottom-line features of social, economic and environmental sustainability. The social and economic value of low-cost housing are clear, however its environmental performance requires more attention for improvement. It is hoped with the recommendations presented in this paper, particularly investigating the building stock's environmental performance using UNEP-SBCI's Common Carbon Metric, will act as a catalyst in reducing energy consumption during building operation.

2 MALAYSIA AND SUSTAINABLE DEVELOPMENT

Sustainable development is still at its earlier stages in Malaysia (Hezri, 2005), and although Malaysia started its environmental policy movement much earlier than many developing countries, the sustainability agenda is a relative newcomer to the Malaysian policy landscape. This is further supported by Hezri and Hasan (2006) in concluding that:

> *"…neither prominent structures and processes such as a National Council for Sustainable Development, nor statutory review were introduced as meta-policy responses to equip the policy system in addressing the challenge of sustainable development,"* (Hezri & Hasan, 2006, p. 578).

Malaysia rapidly transformed from an agricultural economy to an industrialized one in the last four decades, which subsequently positioned as 26th largest emitter of greenhouse gases in the world (Al-Jazeera, 2007). Energy demand in Malaysia increased by 54% since 1994, which subsequently amplified growth in carbon emissions (Al-Jazeera, 2007; UNDP Communication Office, 2007; World Wide Fund for Nature [WWF], 2009). The alarming growth of 221% in carbon emission (+221% per head of population) has been dubbed highest in the world caused by the escalating number of automobiles, factories and power plants (UNDP Communication Office, 2007; WWF, 2009) (refer Figure 01).

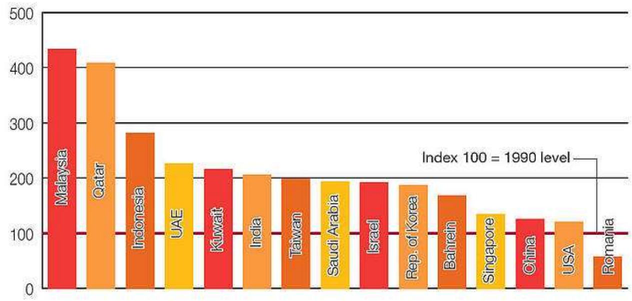

FIGURE 01: Change in Carbon Emissions from Fossil Fuel Use (1990-2005) (per head of population) Source: (WWF, 2009)

Malaysia also ranked 66^{th} in the 2009 Human Development Index (HDI) with an annual growth of approximately 0.81% annually (UNDP, 2009), and ranked 54^{th} on the Environmental Performance Index (EPI) in 2010[1], plummeting from number 27^{th} in 2008 (Yale Center for Environmental law and Policy & Center for International Earth Science Information, 2010). Malaysia accounts for only 0.4% of the world's population but emits 0.6% of the total global emissions, averaging 7.5 tonnes of CO_2 per person (UNDP Communication Office, 2007). Together with the HDI and EPI rankings, it is evident that Malaysia's quality of life and economic is steadily improving, but at the cost of the environment. The extensive increase in energy demand and carbon emissions is clearly an unsustainable path of development. Malaysia has to make significant and urgent changes in its policy, economy, industries and lifestyle if it is to reduce its contribution to climate change.

2.1 **Housing in Malaysia**

The Malaysian housing industry falls under jurisdiction of various regulations such as Housing Development (Control and Licensing) Act 1976; Street, Drainage and Building Act 1976; Town and Country Planning Act 1976; and the Uniform Buildings By-Laws 1984 (Sufian, 2007; Aziz, 2007). These various legislation are in place to ensure quality and cohesion of development practice in theory, but enforcement of all the various legislative procedure falls under the responsibility of local authorities (Aziz, 2007).

Housing has historically played an important role in policy development in Malaysia, and providing affordable housing started prior to Malaysia's independence during the British colonial period, in the First Malaya Plan (1956-1960) (Aziz, 2007). Housing serves as part of the government's political strategy to achieve both social and economic goals (Aziz, 2007).

City Hall of Kuala Lumpur and Ministry of Housing and Local Government have also claimed to include Agenda 21 and Habitat Agenda objectives into their policies (City Hall of Kuala Lumpur [CHKL], 2000; Ministry of Housing and Local Government [MHLG], 2001). However level of integration between these two major principles in housing policy is questionable in the absence of a specific framework that measures its progress. This disposition has lead to confusion about sustainability goals and indicators for measurement of sustainable performance of housing projects (Hasan & Hezri, 2001).

Calculating carbon emission through building operational phase present clear indicators for assessment and provide invaluable insight to the existing building stock's environmental performance. The UNEP-SBCI's Common Carbon Metric provides a protocol

[1] The HDI provides a measure of human progress through the relationship between income and well-being on accounts of life expectancy, literacy, enrolment in education, purchasing power parity (PPP) and income. The EPI ranks countries based on 25 performance indicators across policy categories covering environmental health and ecosystem vitality.

for measuring energy use and reporting GHG emissions from building operations (UNEP-SBCI, 2010). Investigating GHG emission from the existing building stock consequently provides a performance baseline for policy development in reducing the industry's emission (UNEP-SBCI, 2010).

Commercial and residential buildings in Malaysia account for about 13% of energy consumption and 48% of electricity consumption (Al-Mofleh, Taib, Mujeebu, & Salah, 2009; Energy Comission Malaysia, 2008). Malaysia has great potential to apply energy efficient strategies in reducing energy consumption and carbon emission in buildings, particularly its housing sector as the government holds a lead role in providing affordable housing.

2.1.1 Low-Cost Housing in Malaysia

Low-cost housing was officially introduced in the First Malaysia Plan (1966-1970) "to promote the welfare of the lower income population" (Economic Planning Unit [EPU], 1965, p. 182), and implemented through the State with financial assistance from the Federal Government. During the First Malaysia Plan, most of the low-cost housing was constructed to resettle squatter settlements in urban areas, and for renting purposes (Aziz, 2007; EPU, 1965).

The contemporary method of housing delivery in Malaysia is segregated into two sectors; the public and private sectors (Aziz, 2007; EPU, 2010). Within the public sector, there are multiple ministries and federal agencies that implements and coordinates the provision of low-cost housing (EPU, 2010). This has lead to a disarray of responsibilities, and subsequently risks the quality of housing and implementation process. The Federal Government is in the process of rationalizing only one federal agency to hold responsibility for federally funded housing to increase efficiency in implementation (EPU, 2010).

Low-cost housing in Malaysia is also a mandatory section of housing development; abided by housing developers to provide 30% of their total housing development for low-cost housing (Aziz, 2007; Real Estate and Housing Developers' Association Malaysia, [REHDA], 2008). The policy is imposed through administrative procedures that force developers to provide a portion of development for low-cost housing in order to gain development approval by local authorities (Aziz, 2007; REHDA, 2008). This red tape method of delivery challenges the quality of construction, as it is not the primary venture of private developers and merely for approval purposes (Aziz, 2007; REHDA, 2008).

Low-cost housing is also subjected to additional standard guideline for construction i.e. the Construction Industry Standard - CIS 1: 1998 (1-2 storey) and CIS 2: 1998 (high rise flats) (Ismail, 2003; Sufian, 2007). The CIS 1 and 2, produced by the Construction Industry Development Board (CIDB) specifies minimum design and planning requirements for low-cost houses to ensure that "housing estates for low-income dweller are developed to minimum standards suitable for human habitation" (Ismail, 2003, p. 2). The two standards used for low-cost residential construction covers minimum requirements on layout, space and configuration; between four aspects of habitation – safety, adequate infrastructure, physical and mental health, and community (Ismail, 2003). However, the quality of construction relies on strict enforcement, and subjected to each local government's resource and capacity.

As low-cost housing remain to be seen as a government effort, and not seen as lucrative venture, it is unlikely for developers to consider quality and performance towards low-cost housing projects. Most of the initiatives and demonstration projects for sustainable construction were implemented in commercial or office buildings, and private houses. Factors recognized as impeding the implementation of sustainable practices are, foremost, lack of legislation and enforcement; lack of knowledge and awareness; and a passive construction industry culture (Abidin, 2009; Abidin, 2010). Other studies have also concluded that most low-cost housing residence is occupied without regular or scheduled maintenance (Tapsir, 2005). Therefore, the need to bring forth low-cost housing into the context of mainstream sustainable development would be highly beneficial to the country's environmental, economical and social performance.

3 LOW-COST HOUSING AND ITS CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

To date there has been minimal research and development in the field of sustainable low-cost housing in Malaysia. Furthermore, the current Green Building Index (GBI) tool in Malaysia measures 'the greenness' of a building, and is insufficient to determine the environmental performance of buildings through operational carbon emissions. Additionally, the existing GBI's classification of building type only proposes commercial buildings and single private homes; which excludes assessment for low-cost housing projects in urban areas, which are designed in high-rise flats.

A study conducted in 2009 to investigate awareness level of the sustainable construction concept amongst developers in Malaysia concluded that little efforts are made to implement it, despite the rising awareness (Abidin, 2009). The study also deduced that developers, as a majority, perceived sustainability was only about environmental protection without social and economy considerations within the construction industry (Abidin, 2009).

3.1 **Social Sustainability**

Low-cost housing in Malaysia is aimed specifically to improve the living conditions of low income population. The CIS 1 and 2 not only provides standard guidelines on building specification and safety, but it also provides social parameter guidelines that include public and recreational infrastructure provisions. Amenities provided to "facilitate mental and physical health" are such as local grocer, religious facilities, community hall and child education centres (Construction Industry Development Board, 1998).

Research and survey conducted to investigate residential satisfactory of newly designed public low-cost housing of Sungai Bonus in Kuala Lumpur found that the residents were moderately satisfied with their residential environment (Mohit, Ibrahim, & Rashid, 2010, p. 7). The high percentage of moderate satisfaction were distributed throughout six features; dwelling unit features (76.5%), dwelling unit support service (96.1%), public facilities (92.2%), social environment (62.7%), neighbourhood facilities (99.0%), and overall residential satisfaction (99.0%).

Earlier study of public low-cost residential satisfactory by Sulaiman and Yahaya (1987) concluded that 41% of respondents were dissatisfied with the characteristic of dwelling units, while 79% and 86.5% of respondents were highly satisfied with neighbourhood facilities and CHKL services respectively (Sulaiman & Yahaya, 1987, p. 33). These surveys positively reflect on social sustainability features of public low-cost housing projects in Malaysia, where residents are generally satisfied with their living and social environment. Future improvements could be included in the low-cost housing projects, i.e. providing larger dwelling units for larger families (Mohit et al., 2010, p. 7). The current CIS guideline sets a minimum floor area of 63 m^2, which includes only three bedrooms, a kitchen, a living and dining area, a store room, a bathroom, and a toilet (CIDB, 1998, p.22).

Numerous low-cost housing projects are also located in strategic areas within the city (National Housing Department, 2001), which subsequently integrates other social facility such as employment, public transport and education.

3.2 Economic Sustainability

Under the Ninth Malaysia Plan (2006-2010), affordable housing is categorized as both low-cost and low-medium-cost housing. The Ministry of Housing and Local Government made amendments in 2000 to classify the sale price of low-cost housing units in urban areas, which was previously set in 1982 and was never revised since (MHLG, 2002). It was previously set for households with monthly incomes not exceeding RM 750 (AU$246) (EPU, 2006; Idrus & Ho, 2008; MHLG, 2002).

The previous price of a low-cost housing unit of RM 25,000 (AU$8,186) since 1985 was considered no longer appropriate due to the increase in development costs and cost of living (MHLG, 2002). The revision was made to standardize sale price nationwide according to the market value and location of the property (Idrus & Ho, 2008; MHLG, 2002). The new revised prices are also categorized according to location and housing type; and by household income (MHLG, 2002) (Refer Tab. 01 below).

TABLE 01: Prices of Low-Cost Housing based on value of land, target groups, and typology. Source: MHLG (2002)

PRICE /UNIT (RM)	LOCATION (PRICE OF LAND/SQ FT) (RM)	HOUSEHOLD INCOME OF TARGET GROUPS (RM)	TYPES OF HOUSINGS
42,000	**A** Main cities and urban areas (RM45 and above)	1,200 to 1,500	Apartment (more than 5 storey)
35,000	**B** Big towns and suburban areas (RM15 to RM44)	1,000 to 1,350	Apartment (5 storey)
30,000	**C** Suburban areas and small towns (RM10-RM14)	850 to 1,200	Terrace and cluster
25,000	**D** Rural areas (Below RM10)	750 to 1,000	Terrace and cluster

However, according to the Kuala Lumpur Structure Plan 2020, the term ‘affordable housing’ includes low, low-medium and medium-cost housing with a selling prince between RM 42,000 to RM 150,000 (AU$13,788 to AU$49,246) per unit. Affordable housing in Kuala Lumpur is targeted for the low and medium income population with a monthly household income of RM 1,500 to RM 4,000 (AU$492 to AU$1,313) a month (CHKL, 2000).

Based on these definitions, urban low-cost housing in Malaysia can be characterized as housing which is more than 5-storey high, with a minimum floor space $63m^2$, and for a ceiling sale price of RM 42,000. It is estimated between 1990 to 2009; approximately 808,000 units of low-cost housing were constructed to meet the rising demand of affordable housing in Malaysia (EPU, 2006; EPU, 2010). Therefore, low-cost housing contributes to both economical and social development from its affordability and strategic location within urban areas.

3.3 Environmental Sustainability

Malaysia is situated in the South China Sea within the South East Asian sub-region of Asia, and experiences tropical climate all year round (Tourism Malaysia, 2009). The climate ranges between 21°C to 32°C, with an annual rainfall of 2,000mm to 2,500mm, and a monthly mean relative humidity between 70 to 90% (Tourism Malaysia, 2009; Ministry of Science Technology and Innovation, 2009). Building design in the tropical region highly influence the comfort level of occupants (Kubota, Chyee & Ahmad, 2009).

Research done by Kubota et al. (2009) indicated that more than 70% of detached houses, 62% of terrace houses, and 36% of apartments are equipped with air-conditioning (AC) systems (Zain-Ahmed, 2008). This trend of installing AC systems is further expected to grow as it is proportional to the purchasing power of occupants (Zain-Ahmed, 2008). The orientation and height of building impacts heat transfer and indoor thermal conditions (Wong & Li, 2007), and could be most likely the reason for high percentage of AC systems. Given the high rise typology of low-cost housing in urban areas, a more in-depth assessment of the current CIS 2 is needed. There is no reference to building orientation in both CIS 1 and CIS 2. Building design for tropical climate should encourage optimum natural ventilation and provide maximum shelter from extreme temperatures will help reduce the need for AC systems during building operation.

Currently, there is no Malaysian operational definition of sustainable performance that can be used by the construction industry to contribute to sustainable development. Hence, there is no consistent framework for assessing the performance of low-cost housing, in terms GHG emissions. The current ‘green building’ assessment tool applied in Malaysia – the Green Building Index (GBI) does not cater for low-cost residential assessment, therefore little attention is given to promote sustainability in low cost housing. Most research for sustainable building in Malaysia concentrates on technological issues for high performance “green buildings” and energy efficient non-residential buildings.

Therefore, measuring carbon emission of existing government low-cost housing building stock can be used as a potential benchmark for future low-cost housing development. Government low-cost housing is not only the major typology, but it has also the potential to affect policy and change construction guideline as it is wholly controlled by the government. The UNEP-SBCI’s carbon metric offers a way to measure, report and verify carbon emission in a consistent and comparable way. Using the metric to measure the carbon emission of a sample case study, analysed together with the CIS guidelines could provide a generalization of low-cost housing emissions due to the standard design specification. However, a detailed case study is needed to determine the operation pattern of occupant behaviour. Moreover, low-cost housing projects in Malaysia has potential to be credited for Clean Development Mechanism (CDM), based from the Kyoto Protocol, as it not only has social and economical benefits but could also be environmentally valuable.

4 CONCLUSIONS

Malaysia needs to negate itself from locking in for an unsustainable future with detrimental new construction that disregards environmental issues. Sustainable construction and climate based design provides some solution to improve the built environment’s impact on the environment, particularly to reduce the usage of air-conditioning systems and its carbon emission during building operation. Low-cost housing in Malaysia has significant potential to reduce its environmental impact by reassessing the current Construction Industry Standard to include more environmental and climate based design.

Indefinitely, low-cost housing will continue to be a part of the Malaysian housing industry so long as the 30% low-cost housing mandatory development is hold in place. Given the importance of providing affordable housing for the nation and the sheer volume of demand, the need to conduct a performance baseline study of the existing building stock is a matter of urgency. Additionally, investigating actual performance of this section of the built environment will help address sustainability and climate change issues in other industries affected.

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