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Malaysia's Rising GHG Emissions and Carbon 'Lock-In' Risk: A Review of Malaysian Building Sector Legislation and Policy

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ABSTRACT
Malaysia has rapidly transformed from an agricultural to an industrialized economy in the last four decades, which attributed to the accelerated 235.6% carbon emissions increase from 1990 to 2005. This carbon emission growth was largely due to an increase in national energy demand of 210.7% (1990 to 2004) and rising number of automobiles and industries. In 2009 Malaysia announced a voluntary commitment to reduce 40% of its greenhouse gases (GHG) emissions by 2020 (from 1990 levels). This commitment has not been greeted with much optimism given the limited support from existing legislation and restrained environmental awareness. Without emissions mitigation and conservation policies, Malaysia is unlikely to meet its emissions reduction targets. Malaysia has yet to include any energy efficiency legislation in its growing building sector, particularly in the Uniform Building By-Laws (UBBL). In the absence of such legislation, the Malaysian building sector is likely to lock-in inefficiency for decades into the future, which leads to further growth of GHG emissions. This paper reviews existing Malaysian policies and legislation in the building sector and recommends implementation of mandatory energy efficiency building codes to curb rising GHG emissions and reduce the carbon 'lock-in' risk.

Keywords: GHG emissions, climate change, energy efficiency, developing country

INTRODUCTION

Malaysia has rapidly transformed from an agricultural to an industrialized economy in the last four decades, with an alarming growth of greenhouse gas (GHG) emissions that are caused by the escalating number of automobiles, factories and power plants. Between 1990 to 2004, Malaysia's carbon emissions grew by 221 percent (+221%) increased energy demand from industrial and transportation sectors, dubbed the fastest growth rate in the world (Al-Jazeera, 2007; Watkins, 2007). By 2009, Malaysia's national energy demand had increased by 210.7% from 1990, which prompted its carbon emissions growth by +235.6% (Energy Commission, 2011; IEA, 2011). Table 1 briefly shows the rapid increase of carbon emission growth from the 1990 levels and its projected levels for 2020.

The International Energy Agency (IEA) reported Malaysia's carbon emission was a total of 194 million tonnes for 2011, which has seen an increase of 290.7% from 1990 levels (IEA, 2013). Research using a long-range energy alternative planning system (LEAP) projected that without any mitigation measures, Malaysia's carbon dioxide (CO_2) emission in 2020 will amount to 285.73 million tonnes; a 68.86% increase compared to year 2000 (Safaai et al., 2010). Figure 1 also illustrates Malaysia's position in comparison with a number of emerging and developed nations, in terms of carbon emissions percentage change between 1990 to 2005 (WWF, 2009).

Table 1: Malaysia's Carbon Emission Growth and Projection

Year	Carbon Emission Growth	Carbon Emission	Reference/Source
1990 – 2004	221 %		Al-Jazeera (2007); Watkins (2007)
1990 – 2009	235.6%		Energy Commission (2011); IEA (2011)
1990 – 2011	290.7%		IEA (2013)
2010		185 million tonnes	IEA (2014)
2011		194 million tonnes	IEA (2013)
2020 (projected)		285.73 million tonnes	Safaai et al. (2010)

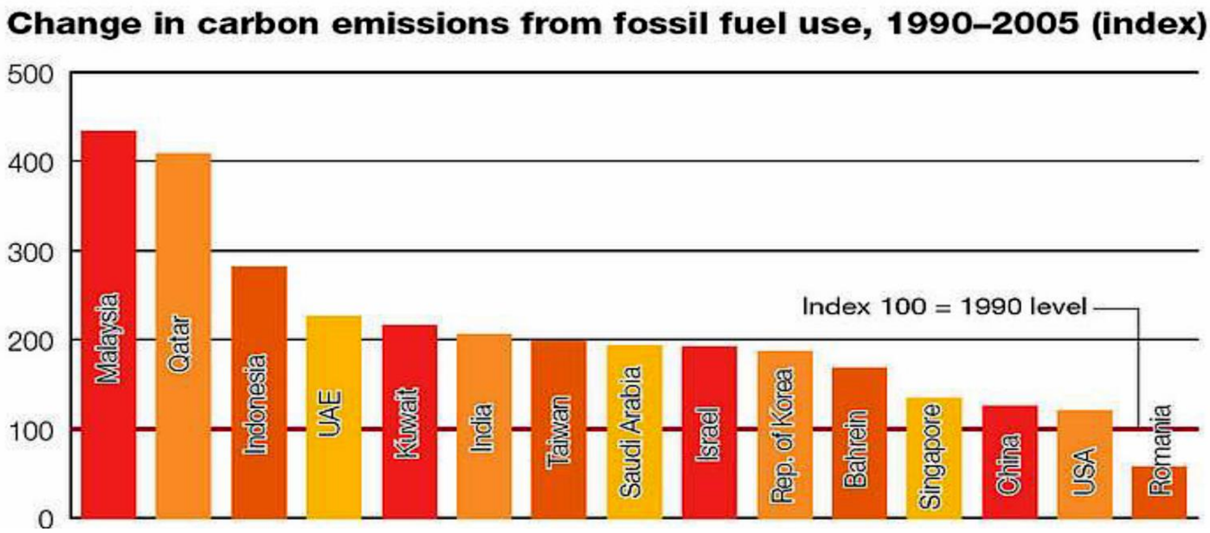

Figure 1: Percentage change in carbon emissions from fossil fuel use (1990 to 2005)
Source: (WWF, 2009)

However in 2009, Malaysia announced at the 2009 United Nations Climate Change Conference in Copenhagen (COP-15) avoluntarily commitment to reduce 40% of its greenhouse gas (GHG) emissions (from 1990 levels) by year 2020 (Department of Environment, 2010). Nonetheless, this commitment has not been greeted with much optimism given limited support from existing legislation and restrained environmental awareness (Department of Environment, 2010). For example, there are no legislation that holds environmental sustainability mandatory for major GHG emitting sectors such as energy, transportation, and oil and gas (Department of Environment, 2010).

The global building sector's primary contribution of GHG emissions is the result of fossil fuels being used to generate electricity or used directly for building operations in the form of fuel combustions, which represents approximately 40% of global GHG emissions (IEA, 2011; UNEP-SBCI, 2009, 2010a). The building sector also produces 40% of global wastes and consumes approximately 16% of water sources (du Plessis, 2002; Sisson et al., 2009; UNEP-SBCI, 2010b). Residential buildings represent 65% of the global total sectoral emissions and 35% for commercial buildings (Baumert et al., 2005). Only 10-20% of building energy is consumed for pre-production and demolition or deconstruction, and similarly for its GHG emissions (Sisson et al., 2009; Urge-Vorsatz et al., 2012).

Table 2: Building sector's global contribution to climate change

<table>
<tr><th colspan="5">Building Sector Account for:</th></tr>
<tr><td rowspan="3">40%
Of Global Energy Use and GHG emissions</td><td rowspan="3">60 %
Of Global Electricity</td><td rowspan="2">65%
from Residential Buildings</td><td rowspan="2">80-90%
Energy used and GHG emitted during Operational Phase</td><td>50%
Used for space heating and/or cooling</td></tr>
<tr><td>10-20%
Used for water heating</td></tr>
<tr><td>35%
from Commercial Buildings</td><td colspan="2">10-20%
Energy used and GHG emitted during pre-production and demolition/deconstruction</td></tr>
</table>

(Source: Comstock et al., 2012; Levine et al., 2012; Urge-Vorsatz et al., 2012)

The bulk of GHG emissions from the building sector are largely produced in the operational phase (80-90%) from energy consumption mainly for space heating and cooling purposes (50%) and approximately 10% to 20% is used for water heating (Sisson et al., 2009; Urge-Vorsatz et al., 2012). Furthermore, the bulk of the building sector's GHG emission comes from residential buildings, accounting for approximately 65% of the global total, while commercial buildings account for the balance of 35% (in 2000[1]) (Baumert et al., 2005). Studies suggest that without any action, the building sector‘s energy use is expected to grow from 60% to 90% between 2005 to 2050 (Urge-Vorsatz et al., 2012), thus increasing its GHG emissions. The building sector's contribution to climate change can be summarized and tabulated as Table 2.

MALAYSIA GHG EMISSION GROWTH AND RISK OF CARBON LOCK-IN

According to latest data accessible from the World Bank (2015), the world average GHG emissions in 2010 is approximately 4.6 metric tons per capita (World Bank, 2015) and in comparison to Malaysia's 2010 emissions at 7.7 metric tons per capita, which is approximately 40% more than the world average (refer Table 3). Table 3 also presents a contemporary comparison of Malaysia's steady increase of carbon emissions (metric tons per capita) to other developing countries in Asia such as Indonesia, China and India, while comparing Malaysia's emission with its neighbouring Singapore where there has been a steady decrease in emissions (World Bank, 2015).

Table 3: GHG Emissions (metric tons per capita) 1980 – 2010

Year	GHG Emissions (metric tons per capita)					
	World Average	China	India	Indonesia	Singapore	Malaysia
1980	3.6	1.5	0.5	0.7	13.0	2.0
1985	3.1	1.9	0.6	0.7	12.2	2.3
1990	3.4	2.2	0.8	0.8	15.4	3.1
1995	4.2	2.8	1.0	1.2	13.4	5.8
2000	4.3	2.7	1.1	1.3	12.2	5.4
2005	4.5	4.4	1.3	1.5	7.1	6.9
2010	4.6	6.2	1.7	1.8	2.7	7.7

(Source: World Bank, 2015)

[1] Absolute emissions by the building sector in 2000 is approximately 6,418 $MtCO_2e$.

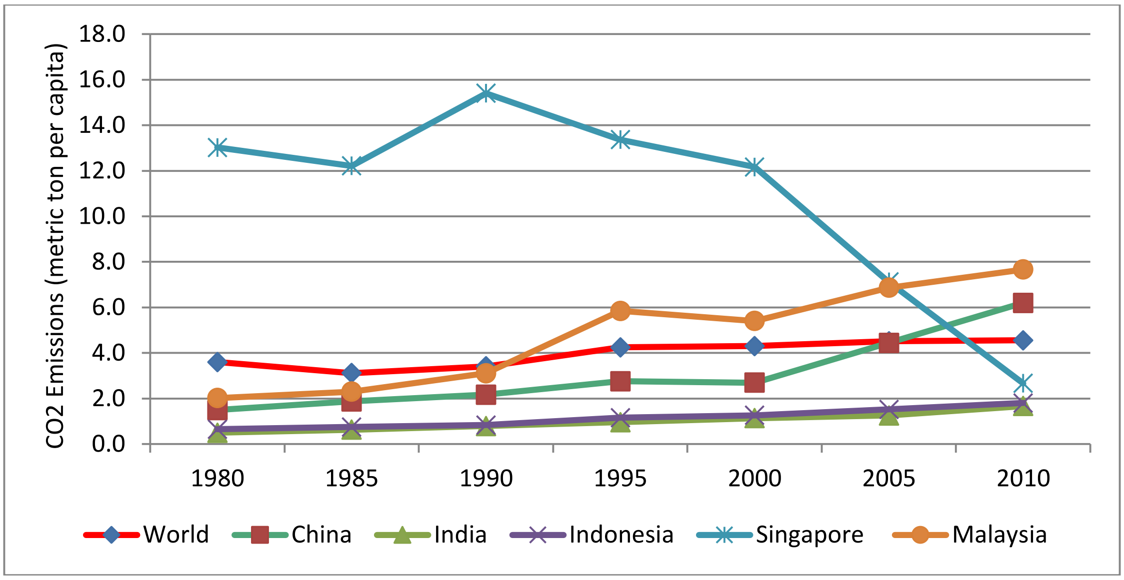

Figure 2**:** Carbon Emissions in Metric Tons per Capita (2003-2010)
(Source: World Bank, 2015)

Malaysia's GHG emission in 1980 was lower than the world average at only 2.0 metric tons per capita, and has steadily increased to surpass the world average in 1995 with 5.8 metric tons per capita and at 7.7 metric tons per capita in 2010 (World Bank, 2015). In total, Malaysia's GHG emission growth from 1980 to 2010 is approximately 250% from 2.0 to 7.7 metric tons per capita. The opposite can be seen in comparison to our neighbouring country Singapore, where in 1980 it emitted approximately 261% more than the world average at 13 metric tons per capita, and has reduced drastically to only 2.7 metric tons per capita in 2010 (World Bank, 2015). In comparison, Singapore total GHG reduction is approximately 79% from 1980 to 2010, from 13.0 to 2.7 metric tons per capita. Figure 3 illustrates Malaysia's steady increase and Singapore's stark decrease of GHG emissions from 1980 to 2010 (World Bank, 2013).

The unparalleled carbon emission growth, coupled with business-as-usual practices will potentially lock Malaysia in for an unsustainable path of development. Malaysia should be strategic in implementing policies that support mainstream implementation of new technological advances to avoid or minimize the lock-in effect. As developing countries prepare for a growing demand for construction, it is important to invest in more energy efficient buildings and prevent the 'carbon lock-in' effect. Industrialized countries' significant contribution to climate change is predominantly a result of meeting consumer's demands for goods and services such as transportation, electricity, industrial and commercial buildings, through carbon-based energy technologies and systems (IPCC, 2007; Unruh, 2000). A 'carbon lock-in' condition is manifested through "a combination of systematic forces that perpetuate fossil fuel-based infrastructure in spite of their known environmental externalities and the apparent existence of cost-neutral, or even cost-effective, remedies" (Unruh, 2000, p. 817).

According to the World Bank, in China alone it is estimated that every year lost in failure to build efficient buildings locks in approximately 800 million square meters of urban built space of inefficient energy use for decades into the future (World Bank, 2001). Inefficient sectors and infrastructure prolong the operation of obsolete technologies that are highly energy dependent, which causes large-scale 'carbon lock-in' (Brown et al., 2007). The danger of lock-in pattern is highly relevant to climate change and environmental policies, as high GHG emissions become more difficult to reverse (Anas & Timilsina, 2009).

The challenge now is to absorb rapidly and on a large-scale, low-carbon technology into the economy and move beyond research and development (R&D) strategies into operation (Brown et al., 2007). The inertia to change and reduce energy-dependency manifests itself as market and policy failure that is systematically ignored, or aggravated institutionally (Unruh, 2000, 2002). Environmental policy makers need to develop policies in mainstreaming energy efficient strategies, which are based on best practice and case study energy performance. Nevertheless, carbon lock-in is not a permanent condition, rather a persistent state that raises market and policy barriers to alternatives (Unruh, 2000).

Notwithstanding its environmental impacts, the building sector has been identified by the IPCC as the sector with largest mitigation potential (IPCC, 2007). Many projects have therefore emerged in the building sector to reduce energy consumption**.** It is estimated that consumption in both new and existing buildings could be reduced significantly by applying existing technologies, design, equipment, management systems and alternative solutions (Levine et al., 2007). The Intergovernmental Panel on Climate Change (IPCC) predicts a reduction of 75% in energy consumption for new buildings, through incorporating energy efficiency strategies in designing and operating buildings systematically (Levine et al., 2007). Holistic and systematic approaches to building systems, rather than improving individual component efficiency, is predicted to achieve significant energy reduction (Urge-Vorsatz et al., 2012). Table 4 summarizes the building sector's potential reduction in terms of energy consumption, GHG emissions, water consumption and waste production.

It is estimated that both new and existing buildings have the potential to reduce energy consumption up to 80% using proven and commercially available technologies and with net profit during their lifespan (IPCC, 2007; UNEP, 2009). Enforcing energy performance requirements in building codes has been argued to be the most cost-effective strategy in reducing GHG emissions from both existing and new buildings (UNEP, 2009). In 2007, GHG emissions from Malaysian buildings accounted for approximately 4% of national emissions related to energy, at 3,947 Gigagram of carbon dioxide ($GgCO_2$) or approximately 0.004 Giga-tonnes of carbon dioxide ($GtCO_2$) (Malaysia Energy Centre, 2007). The average energy consumption and GHG emissions for the Malaysian building sector[2] is expected to grow approximately at 6% rate annually (UNDP, 2011). Zain-Ahmed estimated that the average Malaysian office building consumes energy at approximately 269 kilowatt per meter square per year ($kWh/m^2/year$) (2008b).

Table 4: Building Sector's Reduction Potential

Building Sector Reduction Potential:	
75%	Reduction in energy consumption
35%	Reduction in GHG emissions
40%	Reduction in water consumption
70%	Reduction in waste production

(Source: Comstock et al., 2012; Levine et al., 2012; Urge-Vorsatz et al., 2012)

[2] "The building sector in Malaysia consist predominantly of commercial, government and residential buildings (high-rise, as well as terraced and single dwellings). Industrial facilities obviously also have buildings, but energy use in industry is dominated by processing and building energy use is therefore a minor constituent" (UNDP, 2011 p.5).

BUILDING SECTOR CONTRIBUTION TO GROWING NATIONAL GHG EMISSIONS

Most environmental problems in Malaysia are caused by "lack of environmental considerations in the exploitation, development and management of resources as well as lack of control of pollution resources" (Hussein & Hamid, 2008, p. 4). The Malaysian building sector and construction industry is yet to streamline and upgrade its conventional approach to innovative building systems and energy efficiency (EE) (Hamid & Kamar, 2010). For example, the Construction Industry Development Board (CIDB) missed an opportunity to promote energy efficiency in the Construction Industry Master Plan (2006-2015), which was launched in 2007 (Construction Industry Development Board, 2007). Poor quality of construction, maintenance and performance of contractors remain the central challenges affecting the industry (EPU, 2010; Hamid & Kamar, 2010).

EE performance standards would help reduce total GHG emissions from electricity consumed by the building sector. It is also crucial for stakeholders in the building industry to promote existing guidelines to reduce its overall environmental impact. Additionally, the industry must be able to change and expand innovatively, in order to meet shifting demands and growing international standards (Abdulllah et al., 2004; Hamid & Kamar, 2010). At present, a similar EE guideline for the residential sector does not exist. Therefore neither the mandatory or voluntary standards consider the impact of building energy use on climate change

According to United Nations Development Programme (UNDP) report on Malaysia's Building Sector Energy Efficiency Project (BSEEP)[3], in 2008, Malaysia's building sector consumed approximately 7,750 GWh of electricity and emitted 5,301 ktoe[4] of GHG (UNDP, 2011). By 2009, the sector's energy consumption increased to 8,315 GWh and its GHG emissions to 5,688 ktoe (UNDP, 2011). The increase between 2008 and 2009 was higher than expected, at a rate of approximately 7.3% for both the sector's energy consumption and GHG emissions. The forecast predicts an increase of GHG emissions to 8,088 ktoe and energy consumption to 11,824 GWh by 2014 (refer Figure 3).

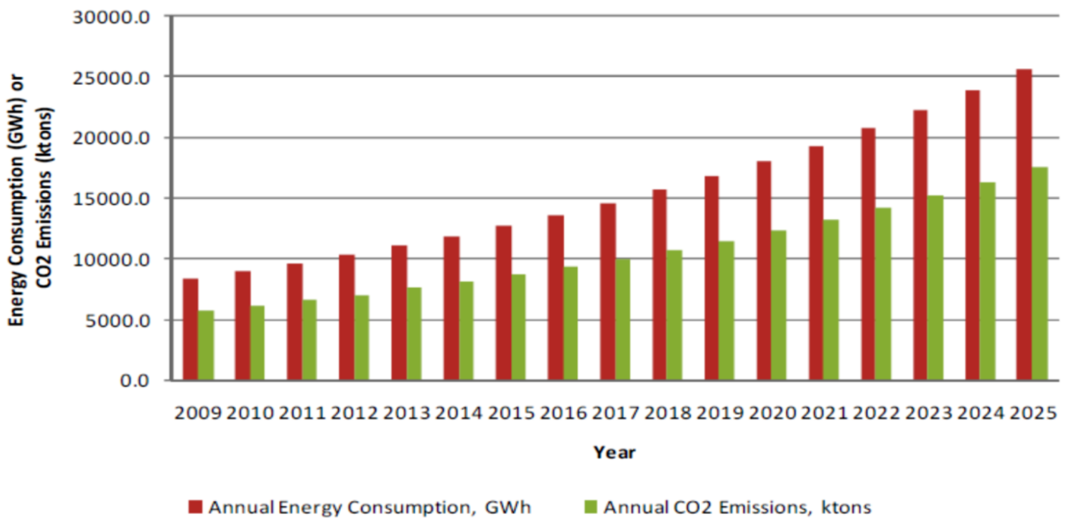

Figure 3: Business-as-usual (BAU) forecast of annual energy consumption and co_2 emissions for Malaysian building sector

Source: UNDP (2011)

[3] The BSEEP is an international partnership project between the Malaysian Public Works Department (PWD) with Global Environment Facility (GEF) and UNDP

[4] ktoe of GHG is defined as kilo tonnes of "emission equivalents from electricity consumption using a grid emission factor of 0.684 ton CO_2/

In Malaysia, construction standards are controlled by the Uniform Building By-Laws 1984 and the Construction Industry Standards, both of which currently impose no energy efficiency requirements. This is a missed opportunity for saving energy and improving thermal comfort and ensuring a minimum energy efficiency and/or energy performance standards for buildings (Zain-Ahmed, 2008a). Even neighbouring countries such as Indonesia, Philippines, Singapore, Thailand and Vietnam have already put in place mandatory EE policies and building codes. Refer Zaid & Graham (2012) for a more extensive comparison of South East Asian EE policies in the building sector. In addition, sectoral baseline data for energy-related GHG emissions in Malaysia is limited or at best underdeveloped (Fong et al., 2009). Presently, there is no consistent framework in Malaysia for assessing GHG emissions from buildings, which limits the development of an emissions baseline for the building sector and therefore building energy performance policies. This is reflected in the existing Malaysian Green Building Index (GBI) rating tool, which exclude any calculation for GHG emissions from buildings.

Energy efficiency for residential buildings in Malaysia is neither regulated nor promoted (UNDP, 2011), which is likely to have significant implications for its energy end-use performance (APEC, 2011). A Malaysian voluntary Standard Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-residential Buildings (MS 1525:2007) was introduced in 2005 (and updated in 2007) (Zain-Ahmed, 2008a), but only covers design specifications for new non-residential buildings and excludes the large typology of existing residential buildings. Buildings in Malaysia should be constructed according its tropical climate classification to reduce cooling loads, as Malaysia experiences a constant hot and humid temperature all year round (except in the highlands such as Cameron Highlands, Genting Highlands and so forth).

Malaysia’s affordable housing demand is also on the rise (Zaid & Graham, 2012), particularly in urban areas, and reflected in the 2015 Federal Government’s budget that allocated approximately RM 644 million to build 26,000 housing units (or more known as Program Perumahan Rakyat – PPR) across the country (The Sun Daily, 2015). This boom in new construction presents a ‘carbon lock-in’ risk as the residential sector is under-regulated for energy efficiency and energy performance. There is a research need to support the development of relevant energy policies for the building sector to avoid this ‘lock-in’ effect. It is this paper’s recommendation for future research to be done in investigating the energy consumption patterns in both commercial and residential buildings, to find effective ways to mitigate rising energy consumption and GHG emissions.

VOLUNTARY ENERGY EFFICIENCY APPROACHES IN MALAYSIAN BUILDING SECTOR

Existing government policies and legislation have been poorly formulated in dealing with energy efficiency in buildings, and efforts to incorporate the MS1525:2007 into the Uniform Building By-Laws (UBBL) have been stalled since 2003 (UNDP, 2011). The MS 1525:2007 stipulates energy efficiency standards and recommendations for renewable energy application for new non-residential buildings and retrofit of existing buildings (SIRIM, 2007). Energy efficiency requirements made in the MS 1525:2007 are such as efficient lighting systems, efficient air-conditioning and mechanical ventilation systems, and designing an energy management system (SIRIM, 2007). The scope of the MS 1525:2007 guideline is divided into seven categories: architectural and passive design strategy, building envelope, lighting, electrical power and distribution, air-conditioning and mechanical ventilation (ACMV) system, an energy management control system, and building energy simulation method (SIRIM, 2007).

The MS 1525:2007 recommends an annual energy consumption rate for non-residential buildings at 135 kWh/m^2/year (Shafii, 2008; SIRIM, 2007; Zain-Ahmed, 2008b). However, similar energy efficiency or energy performance standard for the Malaysian residential sector does not exist (SIRIM, 2004; Zain-Ahmed, 2008a), and the existing MS 1525:2007 is focused on non-residential buildings with air-conditioning systems whereas not all residential buildings would consume high levels of energy for air-condition. Energy efficiency standard for the residential sector should also cater for the different operating time between residential buildings that is mainly occupied during the night, in comparison to a non-residential or commercial building that is highly occupied during the daytime.

As the average non-residential building in Malaysia consumes between 250-300 kWh/m^2/year, it implies that more drastic strategies are needed to comply with the energy efficiency guideline. Localized climatic design strategy can be seen in the architectural and passive design strategy and building envelope categories, which combines architectural, engineering, site planning and landscaping multidisciplinary approach in designing a more energy efficient building (SIRIM, 2007). The architectural and passive design strategies include site planning and orientation, natural day-lighting, natural ventilation, façade design and material, and strategic landscaping (SIRIM, 2007). Building envelope category stipulates minimum standards for Overall Thermal Transfer Value (OTTV) OTTV, shading co-efficiency, day-lighting, maximum thermal transmittance (U-value) for roofs and Roof Thermal Transfer Value (RTTV) for air-conditioned buildings, and air leakages (SIRIM, 2007). A similar code of practice for residential buildings is absent. Notwithstanding the measures and efforts already in place, the most critical gap still lies in the lack of energy efficiency or energy standards for residential buildings in Malaysia. Even more so, there is lack of energy efficiency or conservation measures for existing residential buildings in Malaysia. This is also reflected in the Malaysian Green Building Index (GBI), which excludes existing residential buildings in its assessment.

The GBI currently only applies to non-residential buildings (existing and new), residential buildings (new only), industrial (new and existing), and newly included townships[5] (Greenbuildingindex, 2012). The GBI remains a voluntary tool and has yet to introduce the rating tool for existing residential buildings. This presents an apparent gap in research practice and the need for policy development, particularly for existing residential buildings, in terms of energy efficiency or energy performance standard for building operations. The GBI Residential certification presents a general scorecard based on a point-system calculation that measures the relevant design features. This certification, which is not administrated by the government, does not imply any energy standard nor does it ensure best practice on energy efficiency. The GBI's energy efficient (EE) assessment criteria for new residential buildings are divided into five categories, i.e. minimum energy performance, renewable energy, advanced energy efficiency performance based on OTTV and RTTV, home office and connectivity, and sustainable maintenance. The minimum EE performance criteria is based on OTTV and RTTV that is adopted in the MS 1525:2007, which sets a minimum standard of less than 50 Watts per meter square (OTTV $\leq$ 50 W/m^2) and less than 20 Watts per meter square (RTTV $\leq$ 25 W/m^2, respectively (Greenbuildingindex, 2011).

Similarly Singapore's Building Control (Environmental Sustainability) Regulations (BCESR) specifies a minimum standard for residential buildings thermal performance to minimize heat gain and consequently reduce cooling loads (25 W/m2) of permissible residential envelope transmittance value (RETV) (BCA, 2012). Singapore's BCESR also encourages designers to utilizes prevailing winds, provide cross ventilation and orientate window openings to the north and south directions

[5] The GBI's defines sustainable township as "livable places that meet the diverse needs of the community. They are places that are well planned and designed, safe and secure, and enhances the surrounding environment, thus providing a high quality of life for the people who live, work and play there"

(BCA, 2012). The BCESR also requires all new buildings (gross floor area of 2,000 m2 or more), residential and non-residential alike, to comply with a minimum Green Mark score of 50 points (BCA, 2012). A similar policy could be implemented in Malaysia, using the Malaysian Green Building Index (GBI) or the MS1525 as a mandatory requirement. For more South East Asian energy efficiency building code comparative, see (Zaid & Graham, 2012).

DISCUSSION AND CONCLUSIONS

In this review paper we highlighted that without building energy efficiency legislation; the building sector increases its ‘carbon lock-in’ risk and further contributes to the growing GHG emissions in Malaysia. Key barriers in implementing and disseminating EE technology is largely due to the relatively low price of electricity, which is highly subsidized by the government (Mongia et al., 2007; UNDP, 2011). However, the building sector has remarkable potential to reduce GHG emissions during its operational phase with strategies such as low-energy building design, energy efficiency policies and building codes. A missed opportunity for Malaysia is solar energy where it is abundantly available all year long (Kamaruzzaman et al., 2012), yet solar photovoltaic largely remains limited to standalone systems in commercial or industrial sectors and not incorporated within the national electricity grid (Mongia et al., 2007; UNDP, 2011).

Many developed countries in Europe have already progressed towards low-energy or zero-energy building requirements. Countries like France sets energy standards for new housing at 50 kWh/m2/year under the French Low Energy Building Decree, while the European Union Directive on Energy Performance of Buildings and the Norwegian Standard for Residential Passive House that requires new buildings to be nearly zero-energy by the end of 2020 (Sartori et al., 2012; Thiers & Peuportier, 2012). Energy efficient building codes (EEBC) has the potential to regulate energy consumption of entire building portfolios and ensure a minimum level of performance is achieved across the building sector (UNEP, 2009). EEBC can also become an incentive for the private sector to invest in new technologies, in economically adhering to regulatory standards (UNEP, 2009), which in turn leads to greater efficiency with more technological advances that are cost effective (Birner & Martinot, 2005). Therefore Malaysian building legislation should be revised in terms of bio-climatic design and site specific planning to help reduce electricity consumption for cooling purposes, reduce heat transfer and improve natural ventilation. This is vitally important as Malaysia is located in the tropical region and the provision of energy efficient indoor cooling should be listed as a top priority. Neighbouring countries in South East Asia has followed suit and adopted mandatory energy efficiency building codes, but Malaysia is a notable exception. The current Malaysian Uniform Building By-Laws 1984 construction standard imposes no energy efficiency requirements. This is another missed opportunity for saving energy and possible large GHG reductions by the Malaysian building sector, which in turn would help Malaysia reach is voluntary 40% reduction pledge. Without such legislation to reduce the sector’s energy consumption, its GHG emissions growth is inevitable and puts the country at high risk for carbon lock-in with more inefficient buildings constructed. Energy efficiency performance standards would help reduce total GHG emissions from limiting maximum energy performance consumption according to the building typology. Further research in investigating energy consumption patterns for both residential and commercial building typologies is recommended, in determining the most effective approach to reduce energy consumption. Additionally, this paper also encourages more research to integrate non-renewable energy source such as solar photovoltaic (PV) panels into building design and operations. It is high time for Malaysia to implement energy efficiency building codes and further encourage stakeholders to employ green building design and ratings systems, in order to expedite the sector’s energy saving effect and raise the construction industry standards towards sustainability.

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