

Enhancement in Green Building Technology Including Life Cycle Cost

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Abstract: 11th Malaysian Plan one of the strategic thrusts to meet the needs of the people which is encouraging green growth for resilience and sustainability as to catalyst Malaysia's development. In an urban economy now a days, building is the basic human needs as their living spaces. Building development now a days still practicing the conventional method at construction stage which contributes a lot of emissions and consuming high energy. Green sustainable living not only importance to the government, it also importance to the nation's need as to fulfill the people housing needs. One of the most important and critical to the nation is energy, the highest percentage of energy and resources in countries the more powerful as a key measurement for its power development. In recent years, Malaysia has built some world class green buildings with awarded by green rating tool called as Green Building Index (GBI) system but the idea of green buildings for general masses is in beginning stage. In this research, renewable energy should be implemented to optimize energy use and achieve goals of green building. This research aims at studying the ways to enhance in green building by material selection of house prototype. Literature review indicates that the method of energy conservation can be lowered to two design strategies: passive (architectural) and active (mechanical). The objectives of this research are to investigate the best way in enhancement green building technology, to minimize energy consumption and to pursue green growth for sustainability and to improve the effectiveness of the construction technology in achieving sustainable green building. The result an enhancement in green building prototype evaluate by some calculation which called Return on Investment (ROI), Life Cycle Cost (LCC) or payback.

Key words: Green Building Index (GBI), 11th Malaysia Plan, Return of Investment (ROI), Life Cycle Cost (LCC), conservation, enhancement

INTRODUCTION

Green buildings is referred to the aim of promoting sustainable life with capability in lessening the negative impacts of real estate development and human wellbeing (Dapaah *et al.*, 2009).

High quality in practicing of energy, water and materials during design stage will reduce the building impacts on human health and the environmental over the entire life cycle, thus, increase building efficiency. Building is the one of the largest energy consumers in universe, making up one-quarter for all energy use and an equivalent volume of greenhouse gas emissions. In this century, green building has now become concise of sustainable development (Yigitcanlar and Teriman, 2015). Malaysia target has been set which accomplished in a resilient, low carbon, resource efficient and socially inclusive manner.

As to greener trajectory-green growth which ensure that socio-economic development is hunted more

sustainably, beginning at the planning stage and continuous at every stage of implementation and evaluation. Perception of green growth will be correct at a high cost to a long investment in future are the intention to shift from the conventional methods and materials was mentioned in the 11th Malaysia Plan. Minimize energy consumption, renewable energy resources, ensuring sustainable water supply by improving the processing and treatment of water, implement green construction practices at the workspace and much more are the ways to enhance in green building (EPU., 2015). Government has stated the summary of focus area in Eleventh Malaysia Plan (2016-2020) which shown in Fig. 1.

About green building development, green building design are terms and conditions that need to be which is itself the concept of sustainable development and it emphasizes the adaptation in the circumstances, time and issues (Zhang *et al.*, 2011) (Fig. 2).

During the 10th Malaysia Plan (2011-2015), several development plan is achieved due to going green practice

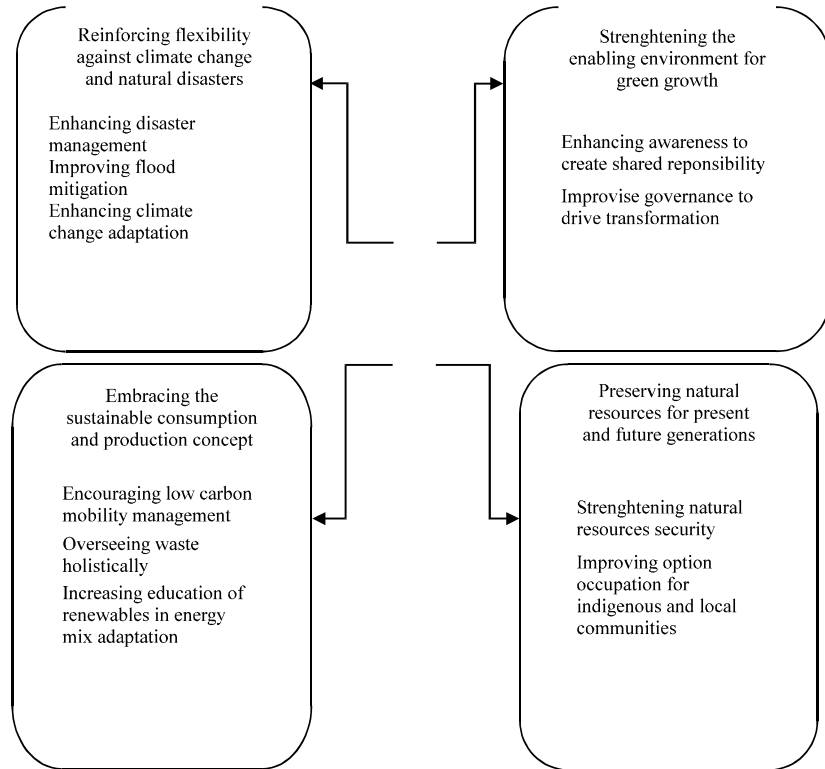


Fig. 1: Summary of focus areas 11th Malaysia Plan



Fig. 2: Highlights 10th Malaysia Plan (2011-2015)-achieved

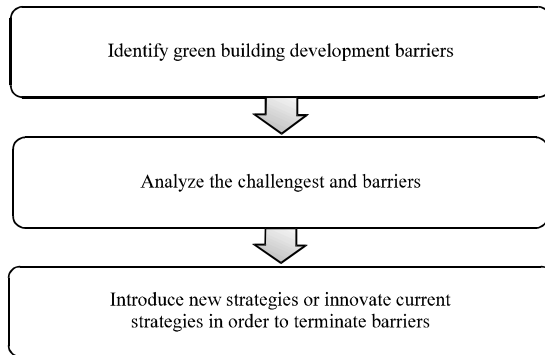


Fig. 3: Government steps as to achieve green building development

in Malaysia. Figure 2 indicated the 10th Malaysia Plan (RMK-10) achievements in going green and sustainable development.

Green Building Index (GBI) was used in the industry in Malaysia to promote sustainability recognized environment and height built between designers, engineers, developers, architects, contractors, planners and the general public about the problems of the environment and our responsibility to future generations (Kibert, 2016).

Savings in water and energy, healthful indoor environment, improved connectivity to common transport and the implementation of recycling and greenery for their projects and decrease our influence on the environment can be offered by the GBI rating tool for the developer and the owner of the structure to plan and build green (Liew, 2012).

In Malaysia, they use Leadership and Environmental Design (LEED) as a sustainable guidance in enhancing green building technology and as a mark of quality and achievement in green buildings. As mention in master plan and 10th Malaysia Plan, government has to introduce green lifestyle in order to preserve natural resources and enhance green concept in construction industry, thus, urban life quality for resident improved (Samari *et al.*, 2013). Figure 3 identify three steps that can be used by the government and practices to develop a green lifestyle in the construction industry.

During this study, the sustainable development with its concept and goals of green building will be explore. Further, this study review the application of green building barriers.

MATERIALS AND METHODS

Sustainable development: Tan (2009) said Malaysia Government has always encouraged specialists to

develop green structures has an agreement overall focus points. Energy, green technology and water Deputy Minister Datuk Seri Mahdzir Khalid said such attempts would continue disregarding of troubles in directions identifying with the building outlines.

With applied green office building as a lifestyle, the productivity of workers increases and the organization would benefit with an increase of production (Kats *et al.*, 2003).

Until now, water can be reused to be devoured for various purposes when several building and industries have been integrated the technology in air circulation and cooling systems and water maintenance outlines for toilets (Lambe and Chougule, 2012).

An experts Atsusaka (2003) agree with the role of governments in enforcing and promoting green as a lifestyle which is effective.

Concepts of Energy Efficiency (EE): As in the 9th Malaysia Plan (9th MP), patterns of energy consumption vary between different industries, buildings and sites. It depends on the duration and nature of the period of occupation which affects the energy consumption. In energy management there are two common ways which are behavioral approach and technology approach (Mahon, 1983).

Al-Mofleh *et al.* (2009) describes both methods of electric energy conservation in Malaysia by the integration of three steps: the efficient use of electrical appliances, the use of passive energy technologies such as building insulation, evaporating cooling, ventilation and solar heating and supports such as awareness, energy codes, regulations, energy information and database. In addition, two design strategies used as development practice in Malaysia which is passive design and active design. Passive design strategies covered the architectural elements such as air well ventilation, daylight harvesting, skylight design, wall insulation and many more. Meanwhile, active design strategies covered the mechanical elements in building such as lighting power density, HVAC sizing design, heat recovery, chiller efficiency, cooling tower efficiency, AHU efficiency, lighting control and many more. Application of higher energy efficiency at the enterprise or company level will reduce operating costs, thus, increased profitability (UNIDO., 2017).

Enhancing energy efficiency is the responsible by government agencies as the main bodies whose responsible on enacting legislation relating to energy efficiency, promote energy awareness and circulate utilizable information on energy efficiency measures, appropriate budget and carry out energy efficiency

programmes in cognation to government-owned assets, e.g., government buildings, vehicle fleets (UNIDO., 2017). The numerous green building projects being developed around the world by technological and other solution exist to improve building energy efficiency. Human educating, disseminating and decided to use existing solutions is the biggest challenge in improving energy efficiency.

Everyone who is involved in building should make underpin decision with looking at total costs over the life cycle of structure. Quick payback on investments for building developers and their tenants promised due to the powerful economies (Hong *et al.*, 2007).

The authoritative intergovernmental panel on climate change in its most recent report noted: “invest in end-use energy efficiency improvement is often more cost effective than in increasing energy supply to satisfy the demand for energy services. Positive effect on energy security, local and regional air pollution abatement and employment with efficiency improvement”.

Four of the five most cost effective measures taken to reduce greenhouse gas emissions involve building efficiency by the McKinsey Global Institute which has reviewed this issue on the basis of worldwide. Building insulation, lighting systems, air conditioning and water heating are the measures taken. Incredibly, these measures result in net savings for building owners and their tenants because their cost is so, cheap compared to the savings.

Indeed, build a new power plant is more expensive than some utilities actually consumers to use energy more efficiently because it is cheaper for the utility (Hong *et al.*, 2007).

Ways to enhance green building technology: Action from people that engaged in constructing and maintaining the building structure is requires for sustainable construction (Atkins, 2001).

Prime Minister of Malaysia, Dato Sri Mohamad Najib Tun Haji Abdul Razak declared Malaysia’s commitment in Congress climate change United Nations 2009 (COP 15) in Copenhagen on December 17, 2009 that up to 40% carbon emission will reduce during 2020 from the present rate on 2005. Green building project in Malaysia implemented when effective and positively dealing with the challenges. Increasing public awareness give a lots impact in implemented green building which results in the increase on demand for sustainable building. Education and exposing on an important effect of green building projects towards environment could enhance stakeholders interest in the application of green building projects in Malaysia.

Miller *et al.* (2009) stated that green buildings practices in good ventilation, inherent natural lighting, healthier and happier workers when the absence of organic compounds as well as the existence of locally appropriate temperature control.

Project manager plays the main role in a project team to creates positive impact to the implementation of green building projects in Malaysia. Return of Investment (ROI) education provided for stakeholders and public as to convince the savings in electrical consumption and water usage in the future investment (Sharif *et al.*, 2013).

The main key player in encouraging green building construction is the government by variety methods and instruments (Benbear and Coglianese, 2004).

Minimize energy consumption: Use less energy for cooling, heating and lighting without interrupt and affect the comfort of the individuals who live in the building is defined as minimize the energy consumption (Hong *et al.*, 2007).

Green buildings are not only the methods of construction to minimize the impact on the environment, it is constructed to decrease the amount of used water which liberated into the environment through recycling method of about 35-40% annually (Alias *et al.*, 2010).

Energy consumption can be expressed in various units (kWh, joule, tonnes of oil proportionate and so on). Energy consumption can be reduced by using more services for the same energy input or an input serves less energy. For instance, when a Compact Fluorescent Light bulb (CFL) utilizes less vitality than an Incandescent bulb to deliver a similar measure of light, the CFL is more energy efficient thus minimize the energy consumption by using less wattage of CFL (IEA., 2014).

Energy conservation in the dictionary of energy, any action made to reduce energy consumption such as avoiding use find alternatives uses which require less energy, developing more efficient energy using technology and process (Cleveland and Morris, 2014).

According to Mizuta (2003), Carbon dioxide (CO²) emission which had reduced by energy conservation lead to savings in expenditure on energy. Certainly, an ideal approach to take care of the elevating demand for energy is not to supply constantly or exclusively depending on the technology fixed. The least sumptuous, most expeditious and cleanest energy by a wide margin is through energy conservation (Choong *et al.*, 2011).

Myhrman and MacDonald (1997) said that use of local material to support natural building is one of the ways to enhance green building. Straw bale is the material that can be renewable, some bamboo and timber is sustainably harvested or stone, sand and clay is literally

under our feet. Some innovation of these materials can be made through various mixtures of straw and Earth (Alias *et al.*, 2015; Mohamed *et al.*, 2015 and Ibrahim *et al.*, 2015).

Improvement of construction technology: According to the National Research Council United State, five findings to increment the efficiency and productivity of the construction industry; “Better use pre-fabricated basis, preassembly, modularization and external manufacturing techniques and processes”. With the use of technology in construction method can increase quality and construction method become easier. Building efficiency is depends on the material use in construction stage. Focus and arrange development from early stage in term of the ways that new technologies, materials and processes will improve the life cycle performance of buildings. Majority in industry still applied the traditional ways in construction, so that, it is been slow at technology development. In this decade, most of industry discovered more efficient methods of cooling, heating and lighting in construction. Most of industries used off-grid or distributed power sources such as geothermal energy, wind power and solar panels on roofs (WEF., 2017a, b).

RESULTS AND DISCUSSION

Internal challenges in industry: Innovation adoption in industry has been very slow even some new technologies and tools have been emerged. Many causes underlying and varied in obtaining the effective construction result (WEF., 2017a, b).

Some problems and challenges in appeal for green building while moving towards sustainable construction development will be faced by commercial and residential (Aliagha *et al.*, 2013).

Lack of interest by clients: Landman (1999) stated that lack of interest or demand by the clients, lack of education and knowledge, lack of life cycle cost knowledge are the main challenges in the development in sustainable buildings.

Informal processes or insufficient rigour and consistency in process execution: Construction company with lack maturity typically adopted this informal processes which often seem to put greater emphasis on defining end of product than on planning the actual construction process. Lack of integrated design, low knowledge of education, greening existing buildings (Bilau, 2008).

Unfavourable demand as well as higher final price: Most client and user only look to the lowest price in market. It is because they lack of education and demonstration about the life cycle cost. The alternative to remove this barrier are introduce the benefits of green building and long term investment educations to show them the advantages of green building (Samari *et al.*, 2013).

Lack of credit resources to invest early cost: Statement mention for the beginner construction company which does not have a stable financial. They afraid to take a risk in higher investment (Samari *et al.*, 2013).

Weak project monitoring: Freidi (2014) said in organization is need the reasonable level of project management maturity to enable the program management framework to be efficiently applied. Projects should be monitored from early stage. This to avoid from something goes wrong for instance, the root causes can quickly identify and implement remedies immediately and efficiently.

Moreover, other reasons behind implementing sustainable development is the shortage of professionals project manager with proper experience, qualification and skills (Wai *et al.*, 2012).

Decissions pertaining to the company’s planning, reporting structures, controlling and coordinating systems are involved in organization management (Barney, 1991).

Conservative company culture: Majority of construction industry generally, retains a conservative corporate culture. Most of them still think that the cost needed for green building are always more higher than conventional building method. Developers always highlight and focus the instant payback rather than the life cycle cost.

As John M. Beck, Executive Chairman Aeon Group, Canada said “there is not much difference in carrying out construction work compared to 50 years ago with the construction of the day”.

CONCLUSION

Green building is encouraged by the government today and most generally, utilized structure of structural building. Going nature is the slogan that was adopted in the Malaysian society now a days.

From this review, barriers and challenges in obtaining going nature can be overcome by the positive reception of the community and extensive exposure on the life cycle cost. This shows that a lot still need to be done by local authority as to obtain the objective.

In other word, green as lifestyle rewards us in long term and life cycle of the building. Malaysia has been lagging behind in terms of technology and environment issues compared to many countries.

In response to the call by the government to save energy, it is a challenge for young researchers in finding the best way to achieve the objective.

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