

## THE GREEN HOME CONCEPT – ACCEPTABILITY AND DEVELOPMENT PROBLEMS

A. Alias\*, T.K. Sin, W.N.A.W.A. Aziz

Centre for Studies of Urban and Regional Real Estate (SURE)

Faculty of Built Environment, University of Malaya

50603 Kuala Lumpur, Malaysia

\*Corresponding author: [raunnor@gmail.com](mailto:raunnor@gmail.com)

### Abstract

People nowadays are more concerned about the environment since they know the effect of pollution to the environment and to human's health. The conventional homes used up large amounts of power and produced large amount of carbon dioxides annually. Therefore, conventional homes are one of the sources of global warming. Conventional homes also polluted the environment. Green Home Concept is an effort made to reduce the impacts of conventional homes. Green home is a concept whereby a home is created to use less energy, water and natural resources, to provide good air quality and comfort, to generate less wastage, and can be considered as a sustainable development that improve the homeowners' lifestyle. It is still a new trend in Malaysia housing development scene. This research focuses on the people's acceptability and development problems that occur when developing green home by adopting case study and structural interviews methods. Questionnaire has also been applied to ascertain the Malaysian homeowners' acceptability towards this new development concept. This research has also highlighted the concept and designs of green home in Malaysia. The findings reveal that uncertainty on people acceptability towards green home and the price are the biggest problems faced by developers when developing green home.

**Keywords:** Conventional home, Green home development, Housing developers, Home Owners.

### Introduction

Green Home is a space and energy efficient home which can offer cosiness and healthy living environment to its residents. Green Home operates by using sustainable resources. It is considered as a sustainable resources in the sense that it can maximize our resources by taking its resources from the natural environment and produce less effect on the environment. Green Home concept has to be applied from its building materials to its insulation and lightings. Green Home can fill up the homeowner's life with lavishness and style and is considered as a new positive feature to the community. There are two types of Green Homes which are Healthy Green Homes and Affordable Green Homes. Healthy Green Home emphasizes on controlling a home's resources which can pollute the environment for both the builder and homeowner. For the Affordable Green Home, the energy-saving features must be able to estimate cost efficiently (Yuldelson, 2007). Therefore, Green Home can be considered as a lifetime home.

Nowadays, the world's population is getting more and more concerned about the activities which can lead to global warming and cause pollution to the environment. Earth is excessively being exposed to all kind of pollutant resources. Every individual have to play their roles in protecting the Earth. Green technologies can be used to protect the earth and change our environment. The United Nations Environment Programme (UNEP) announced the environmental problems of water shortages and global warming are two major issues that the world faced. UNEP stated that all of these environmental issues will endanger the humans besides endanger the earth (Harris, 2007). Home owners used up large amounts of power and become a major source of the global warming since it produced between 10 and 30 tons of carbon dioxides annually. Some 1.8 billion tons or more carbon dioxides could be saved by applying green development (Harris, 2007).

Thus, sustainable development and green development play a big role to reduce the pollution of the Earth. Green Home Concept is one of the efforts made to reduce the

impacts homeowners and builders caused to the environment. Although Green Homes have been around for centuries but they are only practiced mostly in the Western countries. Architects started to design homes which used less electricity. They introduced the use of solar energy in 1970s when the first major global energy shortage took place (Harris, 2007). Although Green Homes have exist for such a long time but there are still not many experts and experienced green building developers availabler, even in the western countries. This concept has just set its foot in Malaysia in year 2007 through the development of the luxury Green Homes at Taman Tun Dr Ismail (TTDI), Ampang, Selangor (Andrew, 2007). This means that the Malaysians have started to realize the importance of maintaining the environment which is being seriously polluted, evidenced by a global warming phenomenon. Malaysians should put more effort of protecting the environment starting from their house as homeowners. Green development has begun to be emphasized in construction these days by local developers. Thus, this research focuses on the people's acceptability and development problems when developing Green Home.

### **Research Objectives**

The followings are the objectives of this research:-

- i. To explore the concept and designs of green home in Malaysia.
- ii. To identify the problem faced by the developers when developing green home.
- iii. To investigate the people's acceptability towards green home development.

### **Research Methodology**

This research has been conducted using both quantitative and qualitative approaches. The quantitative approach is applied to study and analyse the understanding of green home concept of the homeowners in Malaysia and determining which problems affecting most to the development. The qualitative approach is carried out to explain about the green home concepts and the problems which may encounter by the developers. Interviews with the developers in Klang Valley and Penang have been conducted to get the first hand information on the green home concept and problems in Malaysia.

For the quantitative approach, 150 questionnaires have been distributed to the homeowners to determine their level of awareness and understanding on green home concept in Malaysia. The homeowners from Klang Valley and Penang were selected as the survey's target due to the existence of this type of development in these areas.

### **Analysis of Findings and Discussions**

#### **Structural Interviews**

At least three series of interviews were conducted with a developer (YTL Land and Development Berhad (YTL)) in March 2010. All matters pertaining to development of Green Home were discussed and a special reference was made to development of the 'Bird Island Project' during the interview sessions. The following paragraphs reported the interview outcomes.

#### **The Concept of Green Home**

Based on the interviews, the concept of green home used by YTL to develop the Bird Island Project is the Zero Home Energy Concept. The aim of Zero Home Energy concept is to achieve zero energy cost. The company adopted this concept because the company's mission is "Seeking Zero". The mission is considered as a starting point for the Malaysian to take their responsibility starting from their lifestyle to protect the environment and to build up a sustainable society. The aim of the concept suits the mission of YTL perfectly. The green home of the Bird Island Project is provided with energy-efficiency appliances. It uses renewable energy as its power source. The green

home of the project produces its own energy by sending some of the energy back to the utility. At night or during the day without sunshine, the power stored during sunny days is being used as the power source of the house.

### **Differences in Designs between Conventional Home and Green Home**

The main difference between a conventional home and a green home is that the conventional home used up 30% more energy compare to green home. Green home which was developed by YTL is situated at an environmentally friendly place which is at the Maple of West Sentul, where it is surrounded by the greenery. This allows for the green home to maximise its exposure to the sunlight to generate the required energy. Conventional home can be built anywhere. The trees and shrubs surrounding green home can act as the natural shades to cool down the house.

Day lighting can be used to lessen the usage of electricity. It is the natural light to come through the windows and openings of the house. It also provides heating and cooling purposes to the house besides lighting up the interior of the house. Day lighting allows the sunlight to fall evenly on the green home. Day lighting design can help to maximise the usage of solar energy in green home. Day lighting is very useful in Malaysia because Malaysia has exposure to sunlight all year long since it is located at the equator line. Glass doors and windows are being used in designing green home to allow the daylight to enter the house. Windows must be placed at the right place of the house to serve their function as ventilators. Light tube is also being used to have surface which can reflect the daylight and pass on the light to the home interior. Green home at Bird Island used light tube because it has lesser heat transfer compare to skylight. Sustainably-source silicone glass fabric is being used to build the Bird Island's green home. Since this type of glass is very light and flexible, the green home can sway with the breeze. It also allows daylight to enter the house and allow the homeowner to have a glance to the sky whenever the wind blows.

Solar energy is the form of renewable energy used in Malaysia as green home's energy resources. Solar energy can produce heat and electricity. Solar roof shingles is installed to generate solar energy for green home. Solar thermal system captures and stores the heat obtained from the sun and being turn into heat. Backup boiler is being used to generate heat on the cloudy day and cold weather day. By using solar energy, the homeowner can save electricity cost at Bird Island.

### **The Green Home Competition**

To achieve the outstanding and workable designs of its Green Home at Bird Island, YTL had conducted the 'Green Home Competition' and invited entries of expert property developers from other countries. The 'Green Home Competition' held by YTL was considered as a successful competition. Six countries participated in this competition. Among them are Atelier Ten, Grant Associates and Plasma Studio which are from United Kingdom. Germany was represented by the GRAFT, while Zoka Zola represented the United State. Innovarchi from Australia, KplusK Associates from Hong Kong, and MAD from China also took part in this green home competition. These firms are the firms which have the expertise and experiences in designing and developing green home in their countries.

The main objective of this competition is to stimulate new ideas and to promote contemporary architecture with the adoption of sustainable technologies. There are a few criteria that the participants had to fulfil to take part in this competition. The designs of the participants must cover innovation, usage of new approaches to materials and sustainability, and apply contemporary design to create a sustainable community and landscape. The designs also must include new approaches of adopting sustainable technologies, low maintenance resolutions and the ability to meet the target of energy usage. In addition, the designs must be best in terms of its cutting edge design and meet the highest international standards for energy, efficiency and sustainability.

## **Government's Encouragement in Sustainable Development**

The Malaysian government had been encouraging the development of green home since year 2006. The Ninth Malaysian Plan shows that the government of Malaysia had started to emphasise on sustainable development. Based on the interview, it is revealed that in year 2009, the Malaysia Government introduced a new policy which is called the National Green Technology Policy. This policy will lead the country towards energy efficiency and sustainable development and this of course includes the development of green home in Malaysia. The vision of Green Malaysia is stated in this policy. The launch of the Green Technology Policy paves the way to a green and sustainable environment for our future generation. This policy promotes the usage of green technology in development. The Malaysia Government provides incentives for the developers to develop green home in Malaysia. The planning approval of green home is also easier to obtain compared to the planning approval of conventional home.

## **Environmental Features**

Green home uses energy-efficiency appliances in order to lessen the usage of energy. LED lights are being used in green home to replace the fluorescent lamp used in conventional house. The LED lights are energy saving compare to the fluorescent lights used in conventional home. Low-flow water fixtures are being installed in green home to lessen the consumption of water. Low-flow water fixtures can function as good as the normal high-flow water fixtures. Green home in the Bird Island uses low-flow water fixture in order to meet the goal of water efficiency. Grey water recycling system is also being installed at the green home of Bird Island. It can channel the water from shower and sink back to the plumbing. The grey water recycling system can help to save up to 35%-40% of the annual water bill.

Green home is being built by using eco-friendly building materials such as metal and cement tile roof. Lightweight bamboo frame is being used to build green home at Bird Island. The bamboo frame is being wrapped in a tensile, environmentally friendly fabric and being used as the wall of the house. It can reflect sunlight, maintain the coolness of the interior of the house and decrease the needs of air conditioner. Green home gives the homeowner a healthier life since green materials are being used to construct the house. Green materials contain zero volatile organic compounds. Construction materials such as paint contain volatile organic compounds which will cause health problem such as kidney problem to the homeowner. Green home uses low volatile organic compound paint so this means that green home has better indoor air quality compare to conventional home. Green home at Bird Island uses fresh air ventilation system which only used up small amount of power source to provide good indoor air quality.

## **Barriers to Green Home Development**

Developers faced a lot of problems when developing green homes in Malaysia. Thus, YTL also faced the same scenarios and problems. One of the problem the company faced is the lack of green technology in Malaysia. Although the government started to promote sustainable development and green technology in Malaysia, some of the green materials and green technology used to develop green home cannot be obtained in Malaysia. Most of the green materials such as the lightweight bamboo frames are being imported from foreign countries. Besides that, green technology used to build a green home such as the plumbing of the low-flow water system, the grey water recycling system and etc needs to be imported from overseas since Malaysia still does not produce this type of technology. This will lead to the increase in the price of green home compare to conventional home because of the occurrence of the extra costs.

Furthermore, the workers have to be sent to overseas to undergo training courses on the green technology. YTL Corporation sent a lot of its workers to undergo training starting year 2006 so that they have the skills to help the company to develop green home and

green building in Malaysia. A few millions had been spent to train the workers. Even the sales and marketing personals need to be trained in marketing green home.

Based on the interview, it was found that the biggest problem faced by the developer is the homeowners' reaction and acceptability level towards green home. Since green home concept is still new to the Malaysian citizens, they do not understand the benefits and concept of green home although the government and developers already started to promote it since year 2007. The demand for green home is low because the homeowners would still prefer to buy conventional home since the price of the conventional home is cheaper. Malaysians are lacking in awareness towards a sustainable development. Most of the homeowners are not willing to pay more to buy green home and this makes the demand of green home low and difficult to sell compare to conventional home.

### **Benefits of Green Home**

Green home can help to preserve the environment since it uses renewable energy as its power source. Bird Island's green home uses solar energy as its energy source. Green home is also water efficiency. YTL green home uses low-flow water fixtures and grey water recycling system to lessen the water usage of the house. Therefore, green home can cut down waste since it uses 50% less amount of water compared to conventional home. Natural resources are being protected since green home is being built by renewable materials such as bamboo frames.

Moreover, green homes can cut down the expenses of the homeowners in the long run. Although the price of green home is more expensive compare to conventional home because of the green materials and green technology it used, but these costs can be deducted in the long run since green home has lower maintenance and operation costs. Since a green home is energy and water efficient, it can reduce the amount of utility bills. This happens because a green home uses low-flow water fixtures, grey water recycling system, solar thermal system and day lighting. Green home allows the homeowner to have a healthier life since the material use to build green home has zero volatile organic compounds. Green materials have lower toxic level of chemical. Thus, the indoor air of green home is fresher and has less pollutant compare to the indoor air of conventional home. Green home has fresh air ventilation system to filter all the mites, dusts and pollutant from the indoor air to provide fresher air to the homeowners.

### **Difference in Price of Green Home and Conventional Home**

The green home of the Bird Island Project is about RM750,000 for each unit but the green home there is not for sale. It is only for rental purposes. However, YTL will develop green home for sale in year 2011. The price of green home which is predicted is around RM250,000 to RM300,000 per unit. It is a little bit expensive compared to the price of conventional home as the materials and technology used is different. YTL tries to lessen the pricing gap between the price of green home and conventional home to attract more homeowners to purchase the green home.

### **Strategies to Increase Demand of Green Home**

Since the demand for green home in Malaysia is not high compared to the conventional home, YTL has made collaboration with the Ministry of Housing and Local Government to spread the awareness of green homes to Malaysia homeowners. The government and company will publish articles about green homes and sustainable development in the local newspapers to increase the awareness of the homeowners in Malaysia. YTL will also promote green home and its benefits in each home exhibition which is held throughout Malaysia. This can help to increase the demand for green home in Malaysia. The company will try to cut down the costs of green home so that it will not have a large gap in price compared to the conventional home. If the price of green home is affordable, more homeowners in Malaysia will purchase green homes instead of conventional

homes. This will boost the demand for green homes in Malaysia and can lead our country towards sustainability development and achieve the Green Malaysia vision.

### **Findings and Analysis of the Questionnaire Survey**

The questionnaire survey was conducted to determine the reaction and level of acceptability of the homeowners in Malaysia. This aspect will be related to the problems of green home. Based on a pilot study conducted in Klang Valley and Penang in February 2010, most of the developers complained that the homeowners' reaction and acceptability towards green home is the main problem of developing green home in Malaysia. Therefore, the questionnaire survey is conducted to prove this fact. From 150 questionnaires distributed, 50 respondents (34%) responded and have given their views based on the questions asked.

### **Awareness of Homeowners towards Existence of Green Homes in Malaysia**

Less than 50% (only 22 out of 50 respondents) know about the existence of green home in Malaysia. This happens because green home is still a new concept in Malaysia and most of the homeowners do not have exposure about green home since the government and the developers have just started to promote this concept of housing in Malaysia.

### **Definition of Green Home**

Most of the respondents answered 'an energy efficient home' as their answer for the definition of Green Home. This is evidenced by 68% respondents answering the question positively. The rest of the respondents answered this question negatively i.e. 'is the same as the *Green House*' and 'home which has lots of plants'. This happens because the respondents do not know what actually a green home is. The exposure to green home is still low in our country. Some of the Malaysian might have heard of green home but they do not have any idea and adequate understanding about green home. This eventually will lead to low demand of green home in Malaysia and then developers who develop green home will face problem to sell this type of houses.

### **Decision to Purchase Green Home if Difference of Price Occur**

The result shows that some 68% of respondents do not want to purchase green home if there is a difference in price between green home and conventional home. It happens because the green home price is a lot higher compared to the conventional home since the green materials and green technology used make green home has high construction cost. The homeowners in Malaysia are not aware of the pollution the conventional home causes to the environment. They lacked of understanding about the concept and benefits of green home since the exposure towards green home to the homeowners of Malaysia is still inadequate.

### **Criteria When Buying a House**

Price of the house is the criterion which has achieved the highest frequency, 40% of respondents think that it is the most important criteria they look at when purchasing a house. The homeowners will buy a house which is cheaper if the features and designs of the house are almost similar. The factor of 'concept of the house' has the lowest frequency whereby only 14% of respondents consider the concept of the house as important when buying a house. They are more concerned about the price and the location of the house they are going to purchase. As a result, it can be concluded that if the price of green home is higher compared to conventional home, the homeowners who do not have adequate understanding about green home will prefer to buy conventional home since it is cheaper.

### **Features which are Important to a House**

Ventilation has the highest mean value which is 4.14 and thus, is the most important feature of a house according to the respondents. Ventilation is important because it is needed to get rid of indecent odour, pollution and water vapour and bring in fresh air for the homeowners. Ventilation is also needed to cool off the interior of the house during hot sunny days. Thus, the design of green home must have better ventilation compared to the conventional home to attract more buyers. Landscape however, has the lowest mean which is only 3.32 which means that the respondents think that it is not as important compared with other features of the house. 30% of the homeowners think that landscape only has an aesthetic value to their house and do not know that landscape such as trees provides natural shades to their house and their house will have better ventilation and indoor air quality if plants and trees are being planted around their house. Table 1 summarized the results of the research.

### **Does Green Home Benefits Homeowners in the Long Run**

According to this question, 75% of the homeowners know that green home provide benefit to homeowners in the long run. They were aware that green home is energy efficient so green home will save up more energy compare to conventional home. Green home uses solar energy as its main energy resources. It also has low-flow water fixtures and grey water recycling system to save up the usage of water. By using all these appliances, green home can cut down the amount of the utility bill. There are 25% of the respondents who think that green home do not benefit the homeowners in the long run. They just think of short term benefit which they can get from purchasing conventional home that is it is cheaper compared to green home.

### **Benefits of Green Home**

The benefit of green home which is to reduce pollution to the environment has the highest frequency whereby 36% of respondents choose this as the benefit of green home. From the result it was found that most of the respondents only have brief understanding about green home. However, small percentage of respondents which is only 4% realized that green home can help to save money in the long run. This benefit has the least frequency because most of the respondents do not have the knowledge that green home can actually help them to save money in the long run. They are not familiar with the features and the contribution these features can make to green home which will help the homeowners save money in the long run. Table 2 summarized the findings.

### **Differences between a Conventional Home and a Green Home**

As depicted in Table 3, the factor of 'green home is energy efficiency' has achieved the highest frequency, where 48% respondents chose it as their answer. This means that this is the only difference known by most of the respondents. This indirectly shows that the Malaysian homeowners only have understanding of green home until the energy efficiency stage. Table 3 summarized the other findings.

### **Price of Green Home whether it is Affordable**

Most of the respondents think that green home's price is not as affordable as the price of conventional home. Some 55% of respondents think that the price of green home is not affordable if the price is set between RM200,000 to RM300,000 per unit for a single storey terrace house. Although some of the homeowners have a certain understanding about green home, but the price of green home that is expensive prevent them from buying it. They still prefer to buy conventional home since it is more affordable. These homeowners do not know whether green home will help them save up more money in the long run. Most of them just think of the short term benefit of buying conventional home that is it is cheaper compared to green home. The understanding and awareness of green home still need to be strengthened among the homeowners in Malaysia.

## Features Needed in Green Home

Fresh air ventilation has the highest mean value which is 4.05 as shown in Table 4. This means that it is the most important feature needed in green home. Fresh air ventilation is very important because it can avoid the outside air from affecting the indoor air quality. It will filter out the dusts and pollutants of the outside air and provide healthy indoor air for the homeowners. Low-flow water fixture has the lowest mean that is 3.82. Most of the respondents do not think that low-flow water fixture is necessary in green home. Some of them think that low-flow water fixture might let them have unpleasant shower experience and think that the flow of water will be low and affect their daily life. They do not know that actually the low-flow water fixture can function as well as the high-flow water fixture and moreover it can help to help the homeowners to save water.

## Decision of Homeowners whether to Purchase Green Home in the Future

Some 59% of the respondents do not want to purchase green home in the future. They still prefer to buy conventional home. This may happen because the price of green home is more expensive compare to conventional home. The price of green home can be said to influence the purchasing power for green home. Moreover, this may happen because the respondents still do not have a clear understanding about the design, features and benefits of green home at this stage. The developers and government must be more proactive when promoting this new development concept to the homeowners in Malaysia to increase and strengthen their understanding towards green home. Thus, people's reaction is the main problem of green home in Malaysia and this happens because of the price of green home.

## Conclusion

Based on the research analysis, conclusion can be drawn that green home concept is still at infancy stage in Malaysia and the homeowners in Malaysia are not really aware of its existence and the level of acceptability is very low.

From the interview conducted with the developer of YTL, it was found out that the company used Zero Energy Home Concept for the Bird Island Project. Green home in Malaysia is being built from green materials such as bamboo frames, sustainably-source silicone glass fabric and etc. Green technology is also being used to build the green homes. The Bird Island green homes have energy and water-efficient appliances. Grey water recycling system and solar thermal system are being installed in the green homes. Green home at Bird Island uses solar roof shingles to generate the energy used by the occupier of the house. This means that it uses renewable energy as its power source. There are a number of problems faced by the developers when developing green home in Malaysia. One of the problems faced by the developers is lack of green technology and green materials in Malaysia. Most of the materials need to be imported from foreign countries making the costs of construction for green home higher than conventional home. Homeowners' reactions towards green home are the biggest problems developers faced when developing green home.

From the questionnaire survey, it is proven that the main problem of green home in Malaysia is the homeowners' low level of acceptability and reactions towards green home. Most of the homeowners in Malaysia are not aware of green home and they lacked understanding towards this new concept which had already set foot in our country since year 2007. This accounts for the low demand of green home in Malaysia. The homeowners lacked understanding about the concept, designs and the benefits of the green home being introduced to them. Moreover, they are not willing to purchase green home because the price is more expensive compared to conventional home. They are not aware that a green home can help them to save money in the long run.

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## Appendix

Table 1: Features which are Important to a House

Features	Mean Value
Ventilation	4.14
Design of house	3.64
Space	3.58
Landscape	3.32

Legend: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree

Table 2: Benefits of Green Home

Benefits	Frequency	(%)
• Reduce pollution to the environment	18	36
• Green home can help to save money in the long run	2	4
• The green home owners will have a healthier	16	32
	14	28

life		
• Green home can save energy		
<b>Total Respondents</b>	<b>50</b>	<b>100%</b>

Table 3: Differences between Conventional Home and Green Home

<b>Factors</b>	<b>Frequency</b>	<b>%</b>
• Green home is energy efficient	24	48
• Green home used solar energy system	11	22
• Green home is built by using high quality and green material	15	30
<b>Total Respondents</b>	<b>50</b>	<b>100%</b>

Table 4: Features Needed in Green Home

<b>Features</b>	<b>Mean Value</b>
Fresh Air Ventilation	4.05
Solar Energy System	3.91
Natural Lighting	3.86
Low-flow Water Fixture	3.82

Legend: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree