

Designing a Legal Framework of Green Environment in Smart Home Project

Asmah Laili Yeon¹, Noor Ashikin Basarudin², Zuryati Mohamed Yusof³ Nuarrual Hilal Md Dahlan⁴
Nazli Mahdzir⁵

School of Law, Universiti Utara Malaysia,

Sintok,, Kedah Malaysia

¹asmah485@uum.edu.my

²noorashikin88@gmail.com

³zuryati@uum.edu.my

⁴nuarrualhilal@uum.edu.my

⁵mnazli@uum.edu.my

Abstract—Smart home concept in Malaysia is still in the early stage. There is no comprehensive and specific law and rules which governs the smart home project. The installation of smart home gadgets and facilities is on the choice of the home proprietors themselves. The question arise is to what extend the law and policy in Malaysia can accommodate the development of smart home project which gives priority to preserve green environment. Therefore, the objective of the paper is to highlights amendments to the law and policy in ensuring the success of the smart home project and preservation of green environment. This paper is based on a legal doctrinal research and qualitative research. Mixed method was used in analysing the data. Legal doctrinal analysis was performed based on the statutory provisions of housing statutes, codes, and guidelines. Qualitative data were collected by way of interview with 13 experts of smart home and green environment. It is suggested that the Government of Malaysia to recognise the environmental potential of smart features, to commission and support research in establishing a robust evidence base. Some amendments to the existing law and new policy of smart home and green technology should be established to support both agenda.

Keywords— *Designing, Green Environment, Smart Home, Legal Framework, Sustainable*

1. Introduction

Malaysia have a comprehensive National Policy on Biological Diversity in safeguarding its heritage and rich flora and fauna. The policy aims to provide the direction for the nation to implement strategies, action plans and programmes on bio diversity for the conservation and sustainable utilization of its resources.

According to the New Economic Model, Malaysia should embrace a leadership role in green technology and become a strategic niche player in high value green industries and services that play to our competitive advantage. As of 2013, Malaysia have managed to reduce carbon intensity by more than 33% which is in line with the target of 40% carbon intensity reduction in 2020. Green technology has been identified as a driver of the future economy for the nation that would contribute to overall green growth and sustainable development.

The policies and regulation of green technology in Malaysia are several. The National Renewable Energy Policy and Action Plan is the main policy and it is codified in the Renewable Energy Act. The National Climate Change Policy and National Automotive Policy also play an important role to maintain the green environment in Malaysia. Other effort by the government to enhance green technology programme are implementation of Eco labelling, MyHIJAU Mark, Energy Efficient Rating and Labelling Scheme and Water Efficient Product Labelling Scheme.

As for smart city project, in Malaysia the plan for future city involves smart mobility and connectivity by focusing on public transport instead of building more roads, and improving strategic ICT infrastructure to ease the process of doing business as well as for an easier lifestyle without actual movement on the roads. The ICT improvements would also provide new economic opportunity for people living in city as well as in rural areas. Further, this programme can produce smart people and mind set by taking on the grassroots and younger generation, providing training and events to promote harmony-living, and job opportunities and reach-out programmes. It also provides quality

living in a smart way, by having and promoting shared responsibilities between the police, business communities and the people to ensure agenda a safe and secure Iskandar Malaysia, via the Safe CAM project and Rakan Cop. Smart Home is one of the project under Smart City Agenda. However, smart home is just concentrate on facilities in a house which has sensor control such as CCTV, light control etc. According to Yeon et al. (2017), smart home focusing on safety, security and comfort to its users with modern technology integrated in it. By converting ordinary homes into smart home using advance and complete technologies, life becomes easier, convenient and simpler, particularly to the high-tech lovers, medium and upper-class families, people with hectic lifestyles, pro-technology, developers, suppliers and teenagers [1].

Further according to Iskandar Regional Development Authority (IRDA), Dato' Ismail Ibrahim, countries like South Korea and Japan also promote the same concepts for their smart cities but their focus is more on ICT. Their concept is not in line with Iskandar Malaysia vision of a sustainable metropolis of international standing which focuses on economic growth, balance with the environment, and social sustainability [2]. Therefore, Iskandar Malaysia approach is similar to that of European countries.

The question arise is to what extend the law and policy in Malaysia can accommodate the development of smart city and smart home project which gives priority to preservation of green environment. Due to the complexity of governing the smart home project, it is essential that Malaysia should have a comprehensive legal framework on preserving green environment. The ordinary housing development concept should be transform and it is the aim of the paper to highlights some amendments to the law and policy that needs to be implemented in ensuring the success of the smart home project and smart city at present and in the future.

2. Problem statement

According to Scott, smart home crop up far more in conversations about the latest gadgets than they do when talking about energy saving or environmental benefits. But as well as having a place in the futuristic new homes imagined by science fiction, smart technology may help to lower the environmental impact of the homes that we live

in today [3]. With energy efficiency becoming an increasing preoccupation, smart technology's potential to help will be just as welcome as its ability to make our lives easier. The question is to what extend the law and policy of smart home in Malaysia encourage and stimulate preservation of green environment?

The application of full smart home is still not widespread among home owners in Malaysia. The reason is the cost to fix these products in the house and its complication use due to its advance technological usage. Nonetheless, some partial and quasi-smart home-products are provided to serve special needs of the home occupants. For examples the provisions of home security alarm system to prevent burglary and house breaking and smart home products that can control lighting, temperature, multi-media, security, window and door operations [4].

Smart home in Malaysia is still new. The installation of smart home gadgets and facilities is on the choice of the home proprietors themselves. They will improvise their homes with SH facilities either through hiring contractors fitting the facilities or they install it themselves (DIY). According to research, currently in Malaysia there are only three main standardized technologies having achieved significant deployment as smart home facilities. These technologies are X-10 (a protocol for communication among electronic devices used for home automation), CEBus (short for Consumer Electronics Bus, also known as EIA-600, is a set of electrical standards and communication protocols for electronic devices to transmit commands and data) and LonWorks (a networking platform specifically created to address the needs of control applications), with X-10 being the most widely deployed for home automation (Smart Home Concept, 2003). Many products using smart home technology have been developed in Malaysia. Examples of smart home products in Malaysia are Intel energy saving equipment, Osim automated cleaning equipment, I-Berhad's security and home automation and Hugewin's wireless switch [4].

The next issue is whether by fixing the smart home products and facilities in the housing development projects which are subject to Act 118 would be contrary to the requirements under the Street, Drainage and Building Act 1974 (Act 133) ('SDBA'), Town and Country Planning Act 1976 (Act 172) ('TCPA'), States' Planning Control Rules and the Uniform Building By-laws 1984 ('UBBL')? Otherwise, if by incorporating smart home products into the houses would go against the requirements under the UBBL, SDBA and the approved building plan, Certificate of Completion

and Compliance (CCC) shall not be issued by the qualified persons (Professional Architect, Professional Engineer or building draughtsman), as the house is not safe and fit for human habitation and occupation (sections 20 and 21 of the SDBA) [5]. It follows that if by incorporating smart home products and facilities into the house would contrary to the requirements under the UBBL or that it does not comply with the approved building plan or that it may cause the house unsafe and unfit for human habitation and occupation, the purported smart home products and facilities shall not be provided for otherwise, CCC may not be issued.

Additionally, the question regarding to what extend the law such as SDBA, TCPA and UBBL can assist preservation of green environment agenda and smart home project? Even though Malaysia have a comprehensive policy in relation to biological diversity and preservation of green environment, it may defeat the mission and objective of the policy if it is not supported by the law and regulation [6] (Ministry of Green Technology, 2017) Therefore, the aim of the paper is to discuss improvements of law and policy in relation to smart home and preservation of green environment in Malaysia.

2.2 Literature review

Initiating smart home other than making life easier and convenience will be due to the needs on reducing energy consumption [7], maximizing energy efficiency, minimizing resource consumption [8], promoting 'green' through technology [9], and to help for the conservation of environment at large [10]. Rising global energy demands, increasing costs and limitations on natural resources is among the cause that have elevated concerns about resource conservation. Thus, ways on solving it should be addressed either through management of energy and creating awareness to the consumers will help in making the target achieve [10].

The current billing system and electricity meters is lacking in providing information on the usage of domestic electricity to create energy awareness to the consumer. Due to that, smart home system is expected to provide such information through the integrated technological devices to promote the energy efficiency environment. Apart from that, it is due to the needs on reducing the household energy consumption which is also among the important of raising of cost factor. In achieving the target, an embedded smart home system which capable of react to the environment itself must also able to be monitored by the users in private household to help in controlling the energy usage

other than solely depend on the energy suppliers or device manufacturers [7].

Other than smart meter function to gather and record information on the electricity usage, another method of promoting green technology in smart home is also depending on the appliances that is transformed to be energy efficient equipment which is determined to be the minimum standards than suggested by the government. Green technological devices are possible for energy saving and to reduce a great deal of wasted energy as well as to mitigate the effects of human activity on the environment.

The integration of devices in a home works on automation based in which thermostat would be the center controller to adjust the temperature according to the day, time, season, weather, and the number of people in the home. The home automation system will also adjust the window blinds and curtain based on the time of the day allow maximum penetration of the sunlight and to absorb solar heats or block it depending on the temperature needs. As the system of smart home is adjusted to respond to the needs of the environment in making decision [11], smart home devices will be able to run energy-heavy appliances during off-peak hours to reduce the cost charged during the peak-hours [12].

Concept of green and technology would bring two strategies; first, greening of Internet Technology (IT) itself which means reduction of energy and CO₂ emission from IT products or second, greening by IT by utilizing IT for greening purposes. Different actions and solutions were used in enhancing green through the technology advancement whereby in the 'smart buildings', sensors and controls in buildings should be used to improve efficiency and tailor energy use to energy needs. While for 'smart appliances', IT components will be utilized within appliances to improve efficiency and tailor appliances use with actual needs. However, since most countries implement green IT and clean technology strategies at the national level, they are no standardization and may affect the advancement and competitiveness in greening of these countries differently. Small, indirect, private and uncoordinated incentives are not sufficient to effectively manage high capital cost, significant uncertainty, and lack of infrastructure for green technology. In short, viability in employing a smart green home concept and in supporting the green initiatives rely on the public investments and strict regulations by government [13].

Energy efficiency has been extensively studied in Malaysia but the implementation is very slow. One of the main barriers to Malaysia's energy efficiency efforts is the Government's policy on giving subsidies on energy prices for the power and non-power sectors. That's why Energy Efficiency in Malaysia is still a long way to go in achieving more efficient utilization of our energy resources. Initiatives on energy efficiency have been carried out but on a fragmented basis. If the same outputs can be achieved using less energy, then the costs of energy infrastructure development will be reduced and benefit the society [14].

Local authorities and government hold major influence over the effort of reducing environmental impact caused by construction project. By imposing laws and requirements, all related construction practitioner including housing developer would abide by the standard and minimum requirement set by the law. Therefore, as laws and regulations play important role in promoting green concept in a home, improvement and process of revisiting the laws must be addressed to enable the enforcement which is considered as an effort on promoting green home [15].

Although promotion and awareness on green initiatives have been widely spread, but it goes back to the readiness of homeowner to willingly spend sum amounts for employment of green technology appliances. Yean and Gunawansa (2011) in their project concluded that there are many other green features that homeowners may not be willing to pay more for. These includes features which able to help in reducing emission of carbon dioxide such as energy saving devices, energy efficient materials and use of renewable energy, features for the management of waste disposal, better indoor environment and public transport accessibility. Thus, support of government in terms of financial and funds should be looked into such as by providing affordable low interest loans to end-users so that they can pay for green features by themselves and payoff the loans from the savings achieved from the green features used in the building [16].

Although the advanced idea of promoting green and highly efficient appliances will benefit the smart home user for the future saving, there is still challenges especially in educating consumer on the long-term benefit than only focus on the present cost. Besides, due to uncertainty of the devices about the resulting energy savings will also be the

cause of dragging them away [17]. Study conducted also suggested that adoption of energy saving appliances in private individual home should be discounted and government agencies and energy utilities' must provide incentive or subsidy programs which can improve the adoption rates [12].

Introducing the interaction of human-environment technological system in a house requires holistic approach in terms of risk, its potential benefit in adopting new home system, operation of such technologies and its practices, the needs of expertise in solving it, as well as the flexibility of legislation, rules, standards, and codes and governance to ensure its safety [9]. However, it is argued that, promoting home technology for the purpose of improving green or sustainable will not be extremely impressed the way 'smart' has shown its impact [18]. Thus, justifying sustainable or green in terms of smart technology usage is needed to encourage the public to have in their mind the readiness of accepting the importance of green technology concept [9]. Besides, it is developer's responsibility to promote its real concept of smart for sustainable outcomes.

Technology is expected to bring solution to the environmental sustainability, management of electricity consumption and to cater the growing of energy demand in residential sectors. In a private domestic home, energy usage is possibly controlled by the smart meter which records the consumption of electric energy in intervals of an hour or less and communicates that information at least daily back to the utility for monitoring and billing. Yet, it is argued that, although awareness and motivation to save energy are nowadays typically existent among home owners, however, adequate technological support for the users is greatly lacking [11].

Bringing technology within domestic home parameters do not always meet the emotional and functional needs of the users. Values and acceptance of technology is measured through its solving character, simple and convenient. Methods of creating awareness is challenging in the situation whereby householders do not have any idea on how much the costs of production and the units of consumption of energy, electricity and water if not being made clear. Thus, designing for resource consumption visibility will possibly educating consumer on visual systems that compare the resource usage with units of production, for example, buckets of water, bags of coal, stacks of wood, as well as a monetary amount. Users' awareness on the units' production and

consumption will easily lead to the changes of behaviour of individual to support and appreciate the technology adoption in a house to support green and sustainability. Apart from that, rather than create a divide between those who can afford to conserve and those who cannot, we should ensure that the technologies we design for resource consumption management are economically viable for majority of households [10].

In other part of the country such as Germany depends on the usage of renewable resources such as sun and wind to cater the high demand of electricity. The system includes the operation of the controlling of grid power generation that able to measure the actual consumption and shifting loads so that consumption of electricity matches the supply or it will also adapt to the demand of actual supply instead of surplus in supply. Thus, the metering system is the smart way of introducing sustainable electricity usage which is built for energy efficiency and sharing the renewable energy. However, the obstacle in introducing sustainable use of electricity will involve the changes of routine and behaviour of the user to adapt to the different time of doing household activity. Apart from that, the measurement of electricity is highly depending on the combination of electricity tariff, smart meter, smart appliances and home automation which based on the study conducted have caused difficulties in understanding the interconnection between the elements. Moreover, because of nobody has knowledge about their electricity consumption patterns and nobody was familiar with any of the technologies presented will draw them away from the purpose of adopting green technology in a home [17].

Green concept has raised up to another level in which its implementation is engrossed in every aspect of Internet of Things (IoT) from different angle including the design, production, and utilization until the process of disposal or recycling of the invention of hardware and software. The main objective of green IoT is focusing on reducing the energy consumption of IoT in realising the smart world with sustainability [19]. The effort of limiting the energy consumption might be seen in the radio-frequency identification (RFID), machine to machine (M2M), cloud computing (cloud computing) [20] and data center (data center) [21]. For examples RFID that function for information storage, operate by a small microchip attached to a radio a will transmit an enquiry signal to the nearby RFID tags at certain either low or ultrahigh frequencies. Thus, to perform a green RFID [22], reducing the sizes of RFID tags should be considered to decrease the amount of

nondegradable material because it is unrecyclable in nature. While in terms of performing energy efficiency, the process of developing such operation should adjust the transmission power, avoid overheating, and avoid tag collision with other tag reader.

The initiative of sustainable smart home depends on the idea of making home 'smart' and 'sustainable'. The combination of the both phrases represent the adoption of Information and Communication Technology (ICT) and electronic equipment in a home for the reason of leveraging the usage of renewable materials to develop a resource-efficient houses. The concept of sustainable home is discussed in two perspectives either making sustainable home smart in the sense that technology will be employed to improve sustainability or making smart homes sustainable by improving the sustainability of the technology itself. In the aspect of computing in which work is done to improve the technology devices, sustainability indicates the working system of every devices or appliances to achieve few times better energy efficiency such as through improvement of the heterogeneous chip multiprocessors and programming work for a modification of cell processor. Thus, in ensuring the sustainable smart home, process of making a longer lifespan of every devices that only lasts for few years is needed because the home lasts for decades or centuries [23].

Study has shown that, the monitoring of consumption of the usage of water, energy, air and waste has the potential to create awareness of the users on the details of their behaviour towards the energy consumption at home. Several systems have been introduced to enable the users to optimize the process to ensure its efficiency and capability on managing the consumption based on the measured system scale. The technology system is expected to provide solutions that enable us to 'see' our consumption and could provide the means for optimizing systems and processes to make them more efficient [24].

Erol-Kantarci & Mouftah (2011) in their project proposed that, in educating consumer to reduce energy consumption in a house should not be done by defining a maximum value for consumption, in other word by limiting the usage of energy-consumed devices in a house. This practice will complicate the consumer in every day's setting and may result in discomfort of the inhabitants. In managing energy consumption, it is proposed through the implementation of Time of Use (TOU)-aware Appliance Coordination Scheme (ACS). Consumers are supplied with a suggested time

when they wish to turn on their appliances. The suggested time is calculated based on TOU rates, generation capacity, stored energy, and concurrent demands [25].

The current situation of electricity usage without noticing it, customers pay rates based on the electricity cost although the cost of electricity is varied over time. Thus, the adoption of time-based rate control system is necessary for the users monitoring purpose on the consumption of the devices together with the chances of utilising the off-peak time to minimize the cost of electricity [26]. The existing concept of smart home concerned on the adopting of energy efficiency devices and offer comfort instead of taking into accounts the load forecast or pricing for the scheduling of the high-energy appliances. The introducing of time-based cost is believed will be able to encourage the change of their pattern in reflect of the different prices of electricity offered. However, existing home energy management systems are primarily designed to improve the energy efficiency and comfort within single residential home. They often do not take into accounts the utility data (such as load forecasts or TOU pricing) for the scheduling of appliances [26]. Thus, educating consumer that is considered as the end-user is matter in changing their normal consumption pattern to a change in the price of electricity over time [27].

Some of the assets in smart home can participate in the efficient use of electric energy by intelligently controlling their behaviour in either a reactive or a coordinated manner, these assets can provide leverage for energy and cost savings. Thermal loads electric energy such as air conditioning, electric space heating, and water heating, can be controlled by “intelligent” thermostats. Unlike the traditional thermostats, an advanced thermostat is equipped with learning capability that can learn from pattern behaviour of the users. Upon the information received, thermostat will adjust to the room temperature by scheduling the heat and coldness according to the number of people in the house, outside temperature and others factor. These strategies can help reduce energy consumption, especially when traditional or programmable thermostats are not configured properly, or cannot detect that users are away [28].

In relation to acceptability of consumers, in France, according to a study conducted by OVUM in May 2011, only 17% of homes eligible to smart energy offers (with an electronic meter), showed an interest in this kind of service. Germany (29%),

the United Kingdom (28%), and the USA (26%) today seem more interested in this type of offer but consumer interest remains limited overall [29].

3. Purpose of the study

The objective of the paper is to discuss and highlights some amendments to the law and policy that needs to be performed to cater smart home project and preservation of green environment.

4. Research methods

This paper is based on a legal doctrinal research and qualitative research. Mixed method was used in analysing the data where the legal doctrinal analysis is based on the statutory provisions for example Malaysia housing statutes, codes, and guidelines. Data of thematic analysis is gathered from the interview with the experts in smart home. The experts are officers and professionals from different organization public and private sector as shown in Table 1 below.

Table 1. List of Respondents

No	Department	Date of Interview
R1	Ministry of Urban Wellbeing, Housing and Local Government	30th April 2015
R2	Ministry of Energy, Green Technology and Water	27th May 2015
R3	Putrajaya Corporation	27th May 2015
R4	Construction Industry Development Board	15th May 2015
R5	Board of Quantity Surveyor	6th August 2015
R6	Malaysian Communications and Multimedia Commission	30th September 2015
R7	Board of Engineers	5th August 2015
R8	Malaysian Industry-Government High Technology	1st February 2016
R9	Iskandar Regional Development Authority	17th February 2016
R10	Melaka Green Technology Council	24th March 2016
R11	Intelligent Home Systems (MY) Sdn Bhd	13th August 2016
R12	Chairman of Joint Management Body of Symphony Hills (Residential Place)	24th May 2017
R13	Country Garden Sdn Bhd, Developer of Forest City (Smart City Project)	16th February 2017

5. Findings

Smart home project in Malaysia is still in the initial stage. In terms of legal framework in relation to smart home, there is no provision in the statutes covering the aspect of smart home and preservation

of green environment requirements. Even in a Housing Standard Sale and Purchase Agreement, these two aspects were not acknowledged by the housing developer. It is up to the housing developer to determine the characteristic of the smart home. There is no basic or minimum requirement of smart home concept provided by the existing law. The requirement of housing project with green building or using green technology elements in Malaysia is not compulsory according to the law and regulation. The implementation of the initial stage of green building concept in Malaysia is just based on the discretion of the housing developer and it is initiated primarily as their marketing strategy to attract buyers. According to U.S. Environment Protection Agency, green building or sustainable building refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle, from design, construction, operation, maintenance, renovation and demolition [30].

According to Andrew et. al. (2012), there are two approaches to measure the greenness of a building. The first approach is measuring the level of energy consumption and usage per square metre of the building based on the labelling as Low, Zero and Green Energy Buildings. It uses the balance or equation between reducing energy demand for a building with its optimisation of renewable energy resources that could be exported into external grids [31].

Iskandar Malaysia in Johor, Malaysia is the pilot region for a smart city model for Malaysia. The aim of a smart city programme is to enhance the people quality of life, and to achieve a sustainable economic and technological ecosystem that would ultimately create smart, connected and inclusive communities. Iskandar Malaysia in Johor has been chosen as the pilot region for a smart city model for the country as well as the world during the first inter-session meeting of the Global Science and Innovation Advisory Council (GSIAC) in San Jose, California, in July 2012. The GSIAC was formed by the Malaysian government and the New York Academy of Sciences in 2011 to drive Malaysia's efforts to accelerate economic development through science, technology and innovation [2].

According to Iskandar Regional Development Authority (IRDA) Dato' Ismail Ibrahim (2012), *"the Iskandar Malaysia Smart City Framework is based on three main pillars: economy, environment and social aspects. These elements will set the foundation for a city built on the "smart integration of investments in human and social capital, combining hard and soft infrastructure that fuel sustainable economic development, a high quality of life, wise management of natural resources,*

through participatory governance". Based on the statement above, it shows that a comprehensive legal framework is needed in governing the SH project in Malaysia.

According to R1 *"...the government policy at present is green market. If we refer to the green market concept in housing development is referring to normal walling brick wall, however with the new green technology market they use a cold wall application. The material of housing component must have cold elements on house roof, wall etc. Malacca has gazetted a green city project in Hang Tuah Jaya"*. The drawbacks to implement green city project in every state in Malaysia is high maintenance in cost.

Lombart (2009) in his paper suggested the rating of green building must consists of (1) definition of green building index, (2) development of green building calculation tool, (3) setting a threshold value for performance index, (4) definition of the comparison scenario, (5) definition of the scale for green building rating, (6) identification of potential green building measures and (7) gathering information in the certification process [32].

Another project in Malaysia is in Putrajaya where the city implemented LCCF (Low Carbon City Framework). LCCF is been tested not only in Putrajaya but also in Kuching, Johor Bahru and Malacca. Further according R1, *"however, to get the real aspiration is not easy. They come with money and now government cannot afford to pump in the money anymore, so when the government cannot afford to pump in the money, private sector come in, then it is not a social agenda anymore, it is more on profit motive."*

LCCF also covered the issue of smart home by KETTHA. In the latest Malaysian Plan, there are four cities known as competitive cities i.e. Kuala Lumpur, Johore Bharu, Kota Kinabalu and Kuching. However, the problem with the plan is that when there is a change in leadership, the plan will also change according to the new leadership aspiration. This is one of the obstacle in implementing of smart home and city development plan. Further, smart city must be tie up with good infrastructure. This includes green concept in smart city.

The Malaysian LCCF and Assessment System covers four aspects of township i.e. environment, infrastructure, transportation and building. As for low carbon building, there are five criteria which include energy, indoor environment quality, site construction management, material and resources, and water efficiency. The pilot projects in Malaysia situated in Miri City Council, University of

Malaya, Pulau Sahbesar in Kenyir, Port Dickson Municipal Council and Hang Tuah Jaya in Melaka [29].

In the global scenario, the initiative to review the energy mix to reduce dependent on fossil energies and nuclear technology in favour of alternative energy sources (hydro, wind, solar) drives them to develop smart grid and consumption management technologies [29]. People are increasingly aware of the issues of sustainable development and the need to reduce energy consumption for the greater quality of life.

The inevitable increase in energy prices combined with current economic difficulties should significantly improve the perceived return of investment from smart home solutions for consumers, overcoming their traditional reluctance. The annual "Energy Info" survey published by the Commission de Regulation de l'Energie (energy regulator in France) shows that 80% of the French public consider energy as an issue of major concern compared to in 2011 only 75% and 70% in 2010. Almost all (97%) of the respondents expect to see energy prices rise in the coming future.

As a comparative analysis, the regulatory initiatives in France in relation to smart home project and preservation of green environment is convincing. In France, construction standards include maximum limits for energy consumption-several recent standards and labels (BBC standard, RT2012 in France) have set strict consumption targets (50kWh/m²/year). The RT2020 is geared towards the development of constructions with positive energy. The France government also wanted to meet their Kyoto Protocol commitments. The Climate and Energy Package of the European declaration sets a target of 20% improvements in energy efficiency and 20% share of renewable energies in energy mix. Therefore, the France government are setting up public aids encouraging owners to equip themselves [33].

In Malaysia, R13 described their smart city project in Johore Bharu as, *"our project will have a location where there are no cars, 100% green grass on the surface of the land and make people happy and easy to manage their daily life. Here, we apply three dimensions urban planning where vehicles and pedestrian will be segregated"*.

According to R7 that there are a few constraints to implement smart home concept in Malaysia such as weaknesses in policy and only a few communities who are affordable to buy the house. Therefore, it is necessary to develop the smart home concept in the public area so that both group, the elite and normal persons can share the facilities.

In relation to the higher cost to develop smart home, there must be a maintenance office to manage the operation of smart home. As what is said by R7, *"there must be a maintenance office and facilities in each area. For examples sports field, parking area, lift facility. Money must be collected and ensure day to day works is smoothly operated."* The local authority should manage the fund appropriately and segregation of fund according to the needs of housing projects in the area. Further, the management must ensure they have enough fund as a reserve. R8 also is of opinion the constraint is from the financial perspective and it is only ties to green concept. Smart home development is not a necessity at present, it just an extra effort and it just *"nice to have"* scenario, however, in terms of liveability, it is a long-term effort.

It is raised by R10 that Malaysia must have the master framework of smart home concept. Based on the master framework it is easier to plan and finalise with the foreign company which are interested to venture into the smart home project in Malaysia. Without the master framework, Malaysia tend to accept various ideas of smart home concept and project with different interpretations and approaches. Some may associate smart home concept with green technology, another investor may introduce it as focusing more on information technology facilities and etc.

In the state of Malacca, R10 explained, *"From the experience of the State of Malacca, with the existence of master framework on the Green Concept it makes the authority is easier to plan and develop the idea and extend it to smart city project."* In his opinion, without the master plan it will open to many interpretation and confusion of smart home concept or any other new development plan by the Malaysian Government in the future.

It is contended by the respondent that smart home is also about incorporation of energy savings provision and it is suggested to improve the Housing Development (Control & Licensing) Act 1966 (Act 118) and its Regulations in relation to SH concept. R7 is of opinion that the Housing Development (Control & Licensing) Act 1966 (Act 118) and its Regulations can improve by introducing on the provision on energy saving and it is in accordance with the global needs and changes. He said, *"we can start the energy saving and security initiative not only for smart home project but to general housing project. Therefore, some amendment to law is needed in housing construction. The law must incorporate the element of energy savings, environmental protection and security specification"*.

The important of energy savings and security is in line with the findings of Robles et al (2010) [17]. Smart home may benefit the owner through its ability to make the life convenient, easier and tranquillity. Robles and others in their writing states that, systems and tools installed within the house will give full enjoyment and peace. The security system is regarded as the most important function in developing a smart home. It holds a monitoring function to ensure the safety of people living in the house and the surroundings. Apart from that, smart home has potential in saving the energy efficiently. The system installed function as an energy reduction medium which able to automatically on or off based on the commands given through actuator or detector. Based on the study conducted, energy saving appliances may help in reducing the cost of electricity bills estimated one third lesser than the actual cost in the same size of a normal house by tracking the energy used and command it to use less.

Thus, as the first step before the government make it compulsory, the new requirements regarding energy saving, environmental protection and security is only highly recommended. Then only in the next level after community have understood and value the new provision, changes to the requirements is necessary and should be amended to compulsory requirement. All the three aspects can be introduced as a criteria or requirements for approval of license and as control mechanism to the housing authority. Malaysia also should introduce scheme of incentive for home user who implement the criteria or requirements as stated above as a motivation for example they can get tax reduction.

R8 recommended the new proposal that is the issuance of building certificate of fitness to the engineer and local authority. According to him, the liability should be equally shared by these two entities. More over the professional should be covered by professional insurance. However, the disadvantage is that may be the professional fee will be higher. It is also suggested by R8 smart home should have common tracheas and utility tunnel and the walkway is flexible and can be opened when it is needed. Thus, some amendment to the Street, Drainage and Building Act 1974 (Act 133) is needed.

An additional amendment to the law is needed in implementing the concept of smart home, the provision of uniform building by law, must be complied by all states. At present, only the selective state had complied with the provision and this is other issue that need to be resolved in terms of implementation because this is the federal law. The current situation is different because it

involved territory or federal level, there is also state level. For that reasons the government must have the strategy to overcome conflicts or problems arise from the said situation. It is highlighted by R7 that UBBL must have a minimum standard which contain provisions on safety, energy saving or gadget. Secondly, regulation on the buyer of this equipment. He suggested that Malaysia should established a centralised Power Commission as a regulatory body to do monitoring and surveillance activities. This is to ensure all electrical goods and smart home gadget have fulfilled the quality standards.

Further, R7 suggested that the quality standards provisions must be added in the UBBL to ascertain international quality standard of the smart home gadget and equipment which is used in Malaysia. It is suggested that the agreement between the supplier and the Power Commission must consists of sufficient guarantee clause and a clear requirement on quality control of the said goods, gadgets and equipment of smart home. The gadgets and equipment must have elements of preservation of green environment.

6. Conclusion

In conclusion it is proposed that the Government of Malaysia to recognise the environmental potential of smart features and to commission and support research to establish a robust evidence base for them. The other consideration is to regulate the building sector and promoting self-regulation. The starting point is to provide a mandate for smart electricity meters requiring all homes and make it compulsory to smart home project to have one. The meter should include clear milestones and require the provision of free real-time display options to all homes to illustrate consumption. As motivation, home owners should be given tax exemption for buying smart electricity meter. Sharing experience with other country, the initiative taken by the European Union where it requires the deployment of smart meters with the target of 80% of European households equipped by 2020 was confirmed by the European Commission which estimates the necessary investments to be around 140 billion euros. Hence, it suggested that government of Malaysia to adopt the same initiative and the housing developer should also innovate with the way that environmental benefits are assessed and be innovative and flexible with policy mechanisms in recognising and incorporating the environmental benefits of smart features.

Therefore, some amendments to the existing law and new policy of smart home should be established to support smart features which includes (a) home information packs (HIPs) - Require homes to achieve certain energy and environmental

performance ratings before they can be sold and recognise smart features in the assessment process as ways to achieve an improved rating; (b) the code for sustainable homes - Proceed with proposals to strengthen the building regulations in line with the code for sustainable homes and ensure that the assessment process recognises the environmental benefits of smart features; (c) building regulations - Apply the energy efficiency aspects of the building regulations to the whole home when extensions are being built or significant refurbishment done [3]. In addition, suppliers should provide training and awareness raising to ensure the availability of dependable installers who understand the technologies and promote their benefits.

For that reason, in brief based on the above findings and discussion, the comprehensive legal framework of smart home in Malaysia is has yet achieved to the satisfactory level neither can it protect the home owner or consumer in full measures. Amendment and improvement in law and regulations is comprehensively needed specifically in the following statutes i.e. the Uniform Building By-Laws 1984, Housing Development (Control and Licensing) Act 1966 and its Regulation, the Street, Drainage and Building Act 1974 (Act 133), the Town and Country Planning Act 1976 (Act 176) and States' Planning Control Rules. The elements of mandatory green environment should be added in the existing law and regulations. Additionally, the quality standards of smart home gadget and equipment must be controlled and monitored by the authority to avoid losses and injury to the user/owner and bystander. A comprehensive legal framework of smart home should include the use of active technologies instead becomes necessary to control and optimise the use of resources for housing.

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