SCITECH
RESEARCH ORGANISATION

Volume 4, Issue 2
September 13, 2015

Journal of Research in Business, Economics and Management
www.scitecresearch.com

Preferences on Green Home Attributes among Malaysian Households

ZURONI MD. JUSOH
Sustainable Consumption Research Center of Excellent, Department of Resource Management and Consumer Studies, Faculty of Human Ecology, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia.

Abstract:

Green home concept is an effort made to reduce the impacts of pollution, saving energy and educate Malaysian people with sustainable lifestyle. The aim of this study was to examine consumers' preference on green home attributes in Peninsular Malaysia defined by carbon dioxide (CO_2) emission, rainwater harvesting system, natural air ventilation, and greeneries area. Self-administered questionnaires were used to obtain necessary data from 300 selected households through stratified random sampling in Kajang and Bandar Baru Bangi, Selangor, located in central west of Penisular Malaysia using questionnaires through face to face. The choice model technique was applied to estimate the non market values for this study. The results show that all the attributes are tested significant in generic form, while only three are tested significant in label form. Two attributes are tested insignificant which is rainwater harvesting system and greeneries area in label form. The estimated implicit values for green home attributes based on Multinomial Logit regression shows that natural indoor air ventilation is the most important attribute. This is followed by green areas, carbon dioxide (CO_2) emission and rainwater harvesting system. The findings also reveal that Malaysian society preferred green home as compared to conventional housing based on the attributes. Finally, the study highlighted several recommendations for households, developers and government to stimulate the green home development in Malaysia. Future work should examine the possibility of other attributes effect to Malaysian consumers'.

Keywords: Green Home; Choice Model; Implicit Price.

1. Introduction

In Malaysia, government has announced about "green home concept" since year 2005 towards sustainable development. Basically, green home concept is an effort made to reduce the impacts of pollution, saving energy and educate Malaysian people with sustainable lifestyle. This concept is consistent with the increasing awareness in Malaysian society towards the importance of sustainable development. Sustainable development agenda in developing countries focus on relationship between construction and human development, alleviation of poverty and environment. There are together with the lack of resources and capacities to improve technologies especially on the environmental aspects. Nevertheless, there is the need to balance the environmental conservation with economic development [1].

The concept of green home uses less energy, water, and natural resources; creates less waste; and is healthier and more comfortable for the occupants [2]. Any sustainable housing project requires a careful balancing act between being environmentally responsible, and taking into account the aesthetics of the home, green homes product availability, and budget constraints. However, the common characteristics of sustainable homes include healthy indoor air quality, use of green materials, and water and energy efficiency.

An economic analysis was performed on the household demand for housing improvements in Malaysia, by estimating the implicit prices of housing attributes of *carbon dioxide (CO_2) emission, rainwater harvesting system, natural indoor air* *ventilation* and *greeneries area*. Generally, the objective of this examination is to examine consumers' preference on green home attributes in Peninsular Malaysia. Specifically, the objectives of this study are:

1. To estimate the implicit price for each attribute and the tradeoffs among the attributes.
2. To elicit consumers' willingness to pay (WTP) for different options.
3. To rank the attributes of consumers' preferences on green home attributes.

2. Review of Literature

2.1. Definition of Green Home

Green home development can be defined as 'housing development that meets the housing needs and demands of the present without compromising the ability of future generations to meet their needs and demands' [3]. This green building is an essential way to move housing development in a more direction. Green building uses materials and methods of promoting environmental quality, economic strength and social or cultural improvements through design and development of the built environment, and its continuing maintenance and operations [4.

2.2. Green Home Attributes

2.2.1. Carbon Dioxide Emissions

[5] examine that in Malaysia, there is increasing public awareness and interest in how buildings affect the environment, worker productivity and public health. As a result, both the public and private sector are beginning to demand building that optimize energy use; promote resource efficiency, and improve indoor environmental quality.

Recently, [6] adopts a choice-experiment approach to analyze the willingness to pay (WTP) for energy-saving measures in residential buildings. The results provide the first WTP estimates based on choice experiments in the context of the Swiss housing sector. The analysis includes both renovation cases and new buildings. The decisions are related to purchasing single-family houses as well as renting apartments.

2.2.2. Rainwater Harvesting System

Rainwater harvesting system is a technology used for collecting and storing rainwater from rooftops and land surfaces using simple techniques such as pots or tanks. The greater attraction of a rainwater harvesting system is the low cost, accessibility and easy maintenance at the household level. [7] found that harvested rainwater is a renewable resource of clean water that is ideal for domestic land landscape uses.

Rainwater harvesting has a significant role to play to meet the goal of efficient and appropriate water use. It has been reported that rainwater harvesting can promote significant water saving in residences in different countries. [8] in their study showed the potential of potable water saving in house might vary from 30 percent to 60 percent, depending on the demand and roof area. A study performed by [9] showed the potential water saving by using water harvesting in 62 cities of Brazil ranges from 34 percent to 92 percent, with an average potential for potable saving of 69 percent.

2.2.3. Natural Indoor Air Ventilation

When building or renovating a home, it is important to make good choices to avoid bringing pollutants into homes. Many times the building materials we choose contain the pollutants – in fact, chemically sensitive individuals must be extra careful with their material selections. Some common pollutants found in homes are volatile organic compounds (VOCs), mold, dust (pollen, dust mites, insulation fibers, etc.), carbon monoxide and other combustion products, radon, pesticides, and household chemicals. Given the amount of time individuals spend indoors, indoor air quality for comfort is essential to any green building model due to risk to residents' health [10] estimate individuals born after 1995 will spend over 95 percent of their lives inside. As a result, [11] reports that many green building consultants cite indoor air quality as the most important feature of green homes after energy efficiency.

2.2.4. Green Areas

There are some connections between green areas and consumer behavior. For example, effects to the occupants' psychological. [12] in one post-occupancy evaluation of a high- rise structure found that the primary concern of tenants were the lack of greenery and their sense of disconnection from the outside. [13] also found that occupants rated views of the outside extremely important. A lack of view was related to a feeling of enclosure.

Besides that, the nature views can reduce stress, aggressiveness, mental fatigue, and improve well-being [14]. In additions, [15] found that green homes have potential to improve occupant health by creating more natural environments that help improve air quality inside the building.

2.2.5. House Price

Many private companies simply don't want the added expense of going green with new development projects. One United Kingdom (UK) report suggests that any green development will cost nearly 30 percent more than traditional structures [16].

In United Kingdom recent report released by Smart Money has suggested, an eco home could cost anywhere between 3 to 5 percent more than a conventional home of the same size and amenities regardless of where in the world it is located. However, the same report also says that the price differential used to be 11 to 25 percent more in pricing of eco property.

3. Methodology

3.1. Choice Modelling

The aim of Choice Modelling (CM) was to identify marginal values for green home attributes. This is to allow identification of a desirable green housing plan from the demand side perspective. Typical profile analysis is conducted to provide insights on respondents' socioeconomic, attitudinal, and behavior.

The CM is a class of stated preference technique but has the unique flexibility to evaluate both alternative options and the marginal values of non-market attributes. With CM, it is possible to estimate the value of the individual attributes that make up an environmental good. The CM is also able to derive estimates of the value of changes in the aggregate level of non-market goods quality.

3.2. Overview of CM

The CM has the unique strength in cases where management decisions are concerned with changing attribute levels. The CM is also able to derive estimates of the value of changes in the aggregate level of environmental quality. Therefore it can be used to produce estimates of the total value of multiple services or resource use alternatives. The main weakness of CM is the added cognitive burden it imposes on respondents apart from its complexity in designing it correctly and its econometric estimation.

In CM questionnaires, respondents are given a series of choice sets, where each set contains three or more resource use options. Respondents are asked to choose their preferred option from each choice set. The options in each choice set contain common attributes, which can be at various levels. The combination of attribute levels for each option in each choice set is designed using experimental design techniques. Before the choice sets are presented to the respondents, there is a description of the study site, the research issues, the proposed policy changes and its implications on attributes which are being modeled.

3.3. Model Specification

With reference to the utility theory, the paper models the choice of respondents (home ownerships) for characteristics of house. The underlying assumption is that households evaluate the characteristics of different housing alternatives and then choose the one which leads to the highest utility. By assuming that the utility of living in green home is a function of the price, the housing's attributes (CO_2, rainwater harvesting system, natural indoor air ventilation, green area), household characteristics, and a random component that captures the influence of unobserved factors. The household characteristics can include income, education, environmental consciousness, as well as site-specific characteristics of the household's actual residence. Indeed, according to the random utility theory, the utility of goods or services is considered to depend on observable (deterministic) components, including a vector of attributes (X) and individual characteristics (Z), and a stochastic element *e* [17]. Thus, the utility function of a bundle of characteristics i for individual q at choice task j can be represented as:

$$U_{qij} = V(X_{qij}, Z_q) + e_{qij} \quad (1)$$

where V is the deterministic part and e_{qij} the stochastic element. The deterministic variables that will be used in an empirical model are the housing attributes (X_{qij}) and the respondent's characteristics (Z_q). The probability that individual n will choose option i over other option j is given by:

$$\text{Prob (i/C)} = \text{Prob } \{V_{iq} + e_{iq} > V_{jq} + e_{jq} \,;\, j \in C\} \quad (2)$$

where C is the complete choice set. It is assumed that the error terms of the utility function are independently and identically distributed (IID). A consequence of this assumption is the property of independence of irrelevant alternatives (IIA). The IIA states that the probability of choosing one alternative over the other is entirely dependent on the utility of the respective alternatives. This property may be violated by the presence of close substitutes in the choice sets as well as heterogeneity in preferences.

Assuming an extreme value distribution for the stochastic term e_{qij} in model (1), the probability of choosing alternative i out of a set of available alternatives A={1, 2, …, K} can be written in a logistic form as:

$$P_{qij} = \exp(V_{qij}) / \sum_{k=1}^{K} \exp(V_{qkj}) \qquad (3)$$

Expression (2) is the basic equation of a multinomial logit [18] and [19]. Utility function V is generally assumed to be linear in parameters. In our case, the number of alternatives in each choice task is limited to two possibilities. Thus, the choice set for a given choice task j can be written as A={0, j} with 0 indicating the status quo and j representing the offered alternative. The random utilities of the resulting binary logit model can be written as:

$$U_{qj} = \beta X_{qj} + \alpha Z_q + e_{qj}; U_{q0} = 0 \qquad (4)$$

where Z_q represent the household characteristics that do not vary across choice tasks, and X_{qj} is the characteristics of the alternative situation of choice task j for individual q. α and β are the vectors of model parameters. In a multinomial logit framework, the parameters associated with one of the outcomes are normalized to zero namely, U_{q0}=0.Therefore, U_{qj} is the random utility of choosing the alternative situation over the status quo. If all the relevant respondent's characteristics (Z_q) are observed, the model given in Eq. (4) is a simple binomial logit. In general however, Z_q can include a host of parameters, many of which are not observed. In this case, this term can be considered as an individual fixed effect. The resulting model is a fixed-effect binary logit model proposed by Chamberlain (1980) and can be written as:

$$U_{qj} = \beta X_{qj} + u_q + e_{qj}; U_{q0} = 0 \quad \text{with } u_q = \alpha Z_q \qquad (5)$$

It should be noted that because of the presence of fixed effects in the model, vector X_{qj} can be equivalently replaced by the $X_{qj} - X_{q0}$, which measures the difference between the characteristics of the hypothetical alternative with the status quo. This implies that U_{qj} measures the net gained value through moving from actual situation (status quo) to a hypothetical status offered in choice task j. Given that the hypothetical alternatives may equally involve a better or worse situation regarding comfort, the individual specific term u_q can be interpreted as the (dis)utility of respondent q from changing their status quo.

Assuming a logistic distribution for the error term, the above model can be estimated by maximization of the conditional likelihood given the fixed effects (u_q). Results show that for a consistent estimation, incidental parameters u_q should be replaced by a minimum sufficient statistic namely, the number of positive responses for a given individual. If we denote the individual q's response for J choice tasks by the sequence ($y_{q1}, y_{q2}, \ldots, y_{qJ}$), where y_{qj}=1 if offer j is chosen, and y_{qj}=0 if offer j is not chosen, then the number of positive responses (accepted offers) for individual q is obtained by the sum $s_q = \sum_{j=1}^{J} y_{qj}$. The conditional probability can therefore be written as:

$$\Pr(y_{q1}, y_{q2}, \ldots, y_{qJ} \mid u_q) = \frac{\exp(\sum_{j=1}^{J} y_{qj} X_{qj} \beta)}{\sum d_{qj \in \Omega} \exp(\sum_{j=1}^{J} d_{qj} X_{qj} \beta)} \qquad (6)$$

where Ω is the set of all the sequences ($d_{q1}, d_{q2}, \ldots, d_{qJ}$) in which the number of positive responses is equal to that of the chosen sequence namely, ($\sum_{j=1}^{J} d_{qj}$ 1= $\sum_{j=1}^{J} y_{qj} \equiv s_q$. Hence, the numerator represents the probability of choosing the sequence ($y_{q1}, y_{q2}, \ldots, y_{qJ}$) and the denominator indicates the sum of the probabilities of all possible outcomes that entail the same number of accepted offers. The fixed-effect logit model is estimated using the maximum likelihood estimation method. Once the model parameters are estimated, the marginal rate of substitution between different attributes can be calculated. If one of the attributes is a numéraire or a monetary variable like price (p) the marginal willingness to pay for attribute x can be derived as:

$$WTP = \frac{\delta V/\delta x}{-\delta V/\delta p}$$

which is equivalent to the ratio of the corresponding coefficients in Eq. (4).

In this study, the experimental design is constructed based on the compensating surplus (CpS) welfare measure. It measures the change in income that would make an individual indifferent between the initial (lower environmental quality) and subsequent situations (higher environmental quality) assuming the individual has the right to the initial utility level. This change in income reflects the individual's WTP to obtain an improvement in environmental quality. Based on the indirect utility functions, the compensating surplus can be illustrated as follows:

$$V_0 (Z_i, X_0, M) = V_1 (Z_i, X_1, M\text{-}CpS) \qquad (7)$$

where M is income, X_0 and X_1 represent different levels of an environmental attribute, and Z_i represents other marketed goods.

Using the results from the multinomial logit, the CS can be estimated by employing the following equation [20].

$$CpS = -1/(\beta_M)\{\ln(\Sigma_i \exp^{V0}) - \ln(\Sigma_i \exp^{V1})\} \qquad (8)$$

The above equation allows for the valuation of multiple sites. This study considers only one site. Therefore, following [21] and [22], equation (6) is reduced to:

$$\mathbf{CpS = \{- 1/(|\beta_M|)\}(V_0 - V_1)} \qquad \mathbf{(9)}$$

where β_M is the coefficient of the monetary attribute and is defined as the marginal utility of income, and V_0 and V_1 represent initial and subsequent state, respectively.

3.3. Choice Modelling Implementation

According to choice experiment approach, consumers' WTP is ascertained based on their answer through questionnaire form. Respondents are asked a series of 6 very similar types of questions. This questions form also known as choice sets with three or more resource use options. Each of choice sets is defined by different levels of similar attributes. An experimental design procedure was used to form the choice sets by using SAS 9.0 statistical software.

Prior to determining the choice sets, there were several focus group sessions (FGDs) and intense literature searches to select the feasible atributes and their levels. All the FGDs members were provided with the background and issues of the study. The outcome of the FGDs with the defined attributes and levels is shown in Table 1. There was a generic format used in this study and defined as Type 1 (the existing house) and Type 2 and 3 (the improved alternatives). The actual name was shown, e.g., Terrace House (as existing house) and Green Home 1 and 2 (as the improved options).

Table 1: Attribute Definition and Levels of Attributes

Attributes	Definition	Attribute levels	
		Existing Type 1 /Terrace House	Proposed alternative Type 2 & 3 /Green Home 1 and 2
Carbon dioxide (CO_2) emission	Carbon dioxide amount of gas (CO2) that discharged through electric material utilization within one year.	1200kg	360kg 480kg 600kg
Rainwater harvesting system	Catchment system to keep rain water to use for water tree, toilet torrent, washing clothes, cars and motorcycles.	No	3000 liter 5000 liter
Natural indoor air ventilation	Air flow that is sufficient for occupant's comfort in it.	Not good	Good very good
Green areas	Percentage of greeneries area based on housing area more than 5 acre.	7%	13% 19%
Current house price (MYR*)	Double storey terrace house.	MYR260,000	MYR312,000 MYR338,000 MYR416,000

*1USD = MYR3.20 in year 2013

3.4. Study Areas and Sampling Strategy

A total of 300 heads of urban households were interviewed and surveyed using the questionnaire. All of the respondents resided in Kajang and Bandar Baru Bangi, Selangor, located in the central west of Peninsular Malaysia and was selected through stratified random sampling. The lists of the Municipal Councils were gathered from the government website and contacted to get the list of residential areas. By considered the high survey cost and budget constraints, the sample sized was deemed comfortable for use in surveys on environmental valuation studies in Malaysia.

A survey took 2 months to complete with the employment of 10 enumerators who picked respondents randomly around the residential areas within Kajang and Bandar Baru Bangi. Prior to conducting the surveys, the enumerators attended trainings conducted by the researchers. They were briefed on the choice model procedure, the idea of economic valuation, exposed to home visual images,the types of green home technologies, and the background of the study. They also participated in role-play exercises to expose the enumerators to ways of obtaining cooperation from the respondents. Enumerators were informed of possible biases during interviews and ways to minimize them. The enumeratos were also taken for a brief tour to familiarize them with the areas of the study sites, and also met with the area heads to seek their help in getting respondents to cooperate in the survey.

4. Results

4.1. Respondents' Profile

The respondents' profile for the total sample of 300 is analyzed according to their socio-demographic and attitudinal variables. The discussion covered the aspects of gender, race, number of households, education level, employment status and gross monthly income. The composition of male and female respondents was quite balanced, with a mean age of about 36 years. Malay respondents (59.7%) comprised the largest race composition of the survey. An average household was between 4 to 5 persons. Most of the respondents had completed at a degree level (36.0%), implying a high literacy rate of the samples. Respondents were mostly private sector workers (47.7%). The mean household income was between MYR2001 to MYR3000 (46.0%).

Table 2: Respondents' Profile

Items	N=300	Percentage (%)
Gender		
Male	170	56.7
Female	130	43.3
Age		
Mean	36.6	
Race		
Malay/Native	179	59.7
Chinese	94	31.3
Indian	26	8.7
Other	1	0.3
Number of Households		
Mean	4.77	
Education level		
Primary school	6	2.0
Lower secondary school	50	16.7
Higher secondary school	45	15.0
Certificate / Diploma	77	25.7

Degree	108	36.0
Master/PhD	14	4.7
Employment Status		
Government	94	31.3
Private	143	47.7
Own bus/self-employed	32	10.7
Housewife / not working	20	6.7
Retired	11	3.7
Gross Monthly Income (MYR*)		
2001-3000	138	46.0
3001-4000	57	19.0
4001-5000	47	15.7
5001-6000	30	10.0
6001-7000	9	3.0
7001-8000	5	1.7
>8001	14	4.6
*1USD = MYR3.20 in year 2013		

4.2. Responses to Choice Sets

Table 3 shows the number and the percentage of respondents who preferred the different options under the generic questionnaire form: 26.0% of respondents opted for the baseline option (i.e., Option1 and Terrace, respectively). The result indicates a strong preference for the Green Home 1 (43.3%).

Table 3: Analysis of Respondents to Choice Sets

Options	N(%)
Option1 / Terrace house	78(26.0)
Option 2 / Green Home 1	***130(43.3)***
Option 3 / Green Home 2	92(30.6)
Total	**300(100.00)**

4.2.1. Model Results

Multinomial Logit (MNL) basic model (Model 1). For the MNL basic model (Model 1), the utility of each function is determined by the attribute levels in the choice sets:

$$\mathbf{V}\boldsymbol{i} = \mathbf{ASC_0} + \boldsymbol{\beta_1}\mathbf{*CO2} + \boldsymbol{\beta_2}\mathbf{*RWH} + \boldsymbol{\beta_3}\mathbf{*AIR} + \boldsymbol{\beta_4}\mathbf{*GREEN} + \boldsymbol{\beta_5}\mathbf{*PRICE}$$

for i = 1, 2, 3 and $ASC_0 = 0$ for Vi = 1

MNL extended model (Model 2). The MNL extended model assumes that there are several socioeconomic and environmental attitudinal variables influence the preferences and behavior of the respondents. Equation 2 is specified as:

$$\mathbf{V}\boldsymbol{i} = \mathbf{ASC_0} + \alpha_1\mathbf{ASC_0AGE} + \alpha_2\mathbf{ASC_0HHOLDS} + \alpha_3\mathbf{ASC_0RACE} + \alpha_4\mathbf{ASC_0GENDER} + \alpha_5\mathbf{ASC_0MEMBER} + \alpha_6\mathbf{ASC_0ACADEMIC} + \alpha_7\mathbf{ASC_0SECTOR} + \alpha_8\mathbf{ASC_0CATEGORY} + \alpha_9\mathbf{ASC_0INCOME} + \alpha_{10}\mathbf{ASC_0TERRACE} + \alpha_{11}\mathbf{ASC_0BANGLOW} + \alpha_{12}\mathbf{ASC_0OWN} + \alpha_{13}\mathbf{ASC_0RENT} + \alpha_{14}\mathbf{ASC_0CONSEPT} + \beta_1\mathbf{*CO_2} + \beta_2\mathbf{*RWH} + \beta_3\mathbf{*AIR} + \beta_4\mathbf{*GREEN} + \beta_5\mathbf{*PRICE}$$

for i = 1, 2, 3 and ASC_0 = 1 for Vi = 1, variables definition in Table 4 and results shows in Table 5.

Table 4: Variables Definition

Variables	Definition
Vi	Individual utility taking the value of one (1) for choose an option and zero (0) not choose option
ASC_0	*Alternative spesific constant* (ASC) taking the value of one (1) for improved options and zero (0) for baseline option
CO_2EMS	Carbon dioxide (CO_2) emission
RWHS	Rainwater harvesting system
AIRVENT	Natural indoor air ventilation
GREENAR	Green area
HSEPRICE	Current house price
AGE RESD	Age of respondent (ratio data) Number of residents residing in the respondents' house (ratio data)
RACE	Dummy variable (DV) equaling one (1) if respondent is Malay
GENDER	DV=1 for male
MBR	DV=1 if respondents who are members of any environmental related organizations
ACADEMIC	DV=1 if respondents who attain academic qualifications at tertiary level
SECTOR	DV=1 if respondents who are government servants
CATEGORY	DV=1 if respondents who are categorized as professionals and management related personnel
HHINC	DV=1 if respondents whose household income is more than RM5,000.00 per month.
TERRACE	DV=1 if respondents who are residing at terrace house
BUNGALOW	DV=1 if respondents who are residing at banglow house
OWNHSE	DV=1 if respondents who are residing in their own properties
RENTHSE	DV=1 if respondents who are residing in their rent properties
CONCEPT SUPPORT	DV=1 if respondents who know the concept of green home DV=1 if respondents who would support environment be protected.

Table 5: Results of MNL Model		
Variables	**Basic Model (Model 1)**	**Extended Model (Model 2)**
ASC_0	0.6346* (0.3516)	1.7223*** (0.4977)
ASC_0_AGE		-0.2711E-01 (0.7457E-02)
ASC_0_RACE		0.3106** (0.1390)
ASC_0_GENDER		-0.1432 (0.1325)
ASC_0_MEMBER		-0.5923** (0.5233)
ASC_0_AKADEMIC		0.3763** (0.1515)
ASC_0_SECTOR		0.3348* (0.1739)
ASC_0_CATEGORY		0.1939 (0.1648)
ASC_0_INCOME		1.0841*** (0.2454)
ASC_0_TERRACE		0.1145** (0.1453)
ASC_0_BANGLOW		-0.8258 (0.3227)
ASC_0_OWN		0.1289 (0.1851)
ASC_0_RENT		0.3807E-01*** (0.1941)
ASC_0_CONCEPT		0.4350E-01*** (0.1430)
ASC_0_INFO		0.3815** (0.1452)

Note: Parentheses indicate the standard errors of the respective coefficients.
*Significant at 10% levels
** Significant at 5% levels
*** Significant at 1% levels

4.2.2. Implicit Prices

The implicit price (IP) reflects the marginal rate of substitution (MRS) between each of the identified non monetary attributes and the monetary attribute. These IP are obtained as the ratio of the coefficients of each attribute to those of the monetary attribute. These are also reflects the WTP for an additional unit of that attribute to be present, ceteris paribus. The attribute coefficients from the MNL models were used to compute the IP shown in Table 5.

Table 5: Estimates of Implicit Prices (MYR)

Attribute	MNL (Model 1)	MNL (Model 2)
CO_2	90	95
RWH	3	4
AIR	15,865	16,345
GREEN	2,520	3,020

4.2.3. Ranking of Attribute

Table 6 shows an estimation of Compensating Surplus (CpS) for the non-monetary attributes. The analysis helps to identify the relative preference or important of the attributes to the households; AIR is ranked the most preference non-monetary attribute and RWH least preference to them. GREEN ranks second with CO_2 third important. The findings show that the household cares very much the natural indoor air ventilation probably due to the global warming problem. RWH captures the least attention and this may be due to the amount of water supply more than enough for our country needs.

Table 6: Estimation of CpS for the Non-monetary Attributes

Attribute	MNL (Model 1)	MNL (Model 2)	Ranking of Preference
CO_2	1	1	3
RWH	30	23.75	4
AIR	0.0057	0.0058	1
GREEN	0.0357	0.0315	2

5. Conclusion

The findings also reveal that Malaysian society preferred green home as compared to conventional housing for their future sustainable lifestyle. AIR is most preferred under non-monetary attribute, followed by GREEN, CO_2 and RWH captures the least preferred amongst households. This study may be useful for policy makers and relevant authorities to provide more public-receptive housing facilities. Malaysian household is willing to pay for house improvements, provided that such improvements are beneficial and obvious to them. Results also are crucial, as it identifies a demand for better house options in the country.

This study demonstrated that choice model can be successfully applied in developing countries, such as Malaysia, with careful construction of choice sets, questions, and effective in data collection. Close consultations with the stakeholders through FGD are critical to understand the nature of the environmental problems and to select the attributes and levels that were the main aspects of choice model design [23].

This information may help the government to strategize housing policies that are more implementable and acceptable by all stakeholders. Finally, by weighing these values along with the market values of benefits and costs for the available improved options, policy makers such as Ministry of Housing and Local Government shall give some incentive scheme such as tax rebate for households or developers to stimulate the development of green home industry in Malaysia. Future work should examine the possibility of other attributes effect to Malaysian consumers'.

References

[1] Shafii, F. (2007). Sustainable buildings in South-East Asia: Opportunities and implementation. Conference on Sustainable Building South-East Asia (SB07). Kuala Lumpur, Malaysia.

[2] Turcotte, D.A. (2006). Sustainable development: A better holistic view. New Solutions, 16(4).

[3] Chiu, R.L.H. (2004). Socio-cultural sustainability of housing: A conceptual exploration. Housing, Theory and Society, 21(2), 65-76.

[4] Enterprise Community Partners, Inc (ECP). (2007). "Green communities criteria", Columbia, MD: Enterprise Community Partners, Inc. Retrieved from http://www.greencommunitiesonline.org/

[5] Shafii, F. & Othman, M.Z. (2007). Sustainable buildings in the Malaysian context. Conference on Sustainable Building South-East Asia (SB07). Kuala Lumpur, Malaysia, 5-7 November 2007.

[6] Banfi, S., Farsi, M., Filippi, M., & Jacob, M. (2008). Willingness to pay for energy-saving measures in residential buildings. Energy Economics, 30, 503-516.

[7] Abdulla, F.A. & Al_Shareef, A.W. (2009). Roof rainwater harvesting systems for household water supply in Jordan. Desalination, 243, 195-207.

[8] Herrmann T. & Schmida U. (1999). Rainwater utilization in Germany: efficiency, dimensioning, hydraulic and environmental aspects. Urban Water, **1**, 307 – 316.

[9] Ghisi, E., Bressan, D.L., & Martini, M. (2007). "Rainwater tank capacity and potential for potable water savings by using rainwater in the residential sector of southeastern Brazil", Building and Environment, 42(4), 1654-1666.

[10] Platts-Mills, T.A.E. (1995). Is there a dose response relationship between exposure to indoor allergens and symptoms of asthma? Journal of Allergy and Clinical Immunology, 96, 435-440.

[11] National Association of Home Builders (NAHB). (2006). NAHB model green home building guidelines. Washington, DC: National Association of Home Builders. Retrieved from http://www.nahb.org/fileUpload_details.aspx?contentTypeID=7&contentID=1994)

[12] Haber, G.M. (1977), "The Impacts of Tall Buildins on Users and Neighbors", In: Conway D, editor. Human response to tall building. Stroudsburg, PA: Dowden, Hutchinson, & Ross. 45-57.

[13]]Nichols, K.W. (1977). "Urban office buildings: view variables", In: Conway D, editor. Human response to tall building. Stroudsburg, PA: Dowden, Hutchinson, & Ross. 72-80.

[14] Ulrich, R. (1994). View through a window may influence recovery from surgery. Science, 224, 420–421.

[15] Lagercrantz, L, Wistrand, M., Will, U., Wargocki, P., Witterseh, T., & Sundell, J. (2000). "Negative impact of air pollution on productivity: Paper presented at the proceedings of healthy buildings", Helsinki, Finland.

[16] Louviere, J.J., Hensher, D.A. & Swait, J.D. (2000). Stated choice methods—Analysis and applications. Cambridge. Cambridge University Press.

[17] Greene (2003). Econometric Analysis. New York. Macmillan Publishing Company.

[18] Thomas (2000). Économétrie des variables qualitatives. Dunod, Paris.

[19] Adamowicz, W., Louviere, J. & Williams, M. (1994). Combining revealed and stated preference methods for valuing environmental amenities. Journal of Environmental Economics and Management, 26: 271–292.

[20] Boxall, P., Adamowicz, M, Swait, J., Williams, M. & Louviere, J. (1996). A comparison of stated preference methods for environmental valuation. Ecological Economics, 18: 243-253.

[21] Morrison, M. D., Bennett, J. W. & Blamey, R. K. (1999). Valuing improved wetland quality using choice modeling. Water Resources Research, 35: 2805-2814.

[22] Pek, C.K. & Jamal, O. (2011). A choice experiment analysis for solid waste disposal option: a case study in Malaysia. Journal of Environmental Management, 92: 2993-3001.