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Willingness to Pay for Renewable Energy: Evidence From High Wind and Wave Energy Potential Areas

(Kesediaan untuk Membayar Tenaga Boleh Diperbaharui: Bukti dari Kawasan Berpotensi Tenaga Angin Kencang dan Ombak)

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ABSTRACT

The study aims to investigate consumers' willingness to pay for the development of renewable energy to encourage renewable energy consumption in the long run. This study further identifies the factors that influence consumers' willingness to pay for renewable energy. A face-to-face questionnaire, with a contingent valuation method was administered to 672 residential electricity users in the East Coast of Peninsular Malaysia, areas that have high wind and wave energy potentials with large hydropower. The findings show that the average consumers' willingness to pay is about RM 4.90 or about USD 1.18 per month on electricity bills as a contribution to a Renewable Energy Fund. The results further show that the consumers' willingness to pay for renewable energy is significantly influenced by the proposed bid price, income, confidence level and education. The findings may help the government in creating a useful framework to ensure sustainable development in the future.

Keywords: Willingness to pay; renewable energy; contingent valuation method; Malaysia; wind energy; wave energy
JEL: Q00, Q40, Q41, Q49, Q50, Q51

ABSTRAK

Kajian ini bertujuan untuk mengkaji kesanggupan membayar pengguna terhadap pembangunan tenaga boleh baharu bagi menggalakan penggunaan sumber dalam jangka masa yang panjang. Kajian ini turut mengenal pasti faktor-faktor lain yang dapat mempengaruhi kesanggupan membayar pengguna terhadap tenaga boleh baharu di Malaysia. Soal selidik bersemuka, dengan kaedah penilaian kontinjen telah diberikan kepada 672 pengguna elektrik kediaman di Pantai Timur Semenanjung Malaysia, kawasan yang mempunyai potensi tenaga angin dan ombak tinggi dengan kuasa hidro yang besar. Keputusan menunjukkan kesanggupan membayar pengguna terhadap tenaga boleh baharu dipengaruhi secara signifikan oleh harga bida yang ditawarkan, pendapatan, tahap keyakinan dan pendidikan. Purata kesanggupan membayar adalah kira-kira RM 4.90 atau sekitar USD 1.18 sebulan ke atas bil elektrik sebagai sumbangan kepada Dana Tenaga Boleh Baharu. Kajian di peringkat ini boleh membantu kerajaan dalam membuat rangka kerja yang berguna bagi memastikan pembangunan tenaga yang mampan di masa hadapan.

Kata kunci: Kesanggupan membayar; tenaga boleh baharu; kaedah penilaian kontinjen; Malaysia

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INTRODUCTION

Current energy consumption in the country is increasing due to the rise in population. Population increase leads to an increase in energy demand, requiring higher power supply generation. Global electricity consumption has also been on an increasing trend from 1971 to 2014 (World Bank 2021). Swift development of industry, technology, and building construction has led to greater electricity consumption. This increase is corroborated by electricity consumption data in the top five energy consuming countries i.e. Iceland, Norway, Bahrain, Kuwait and Canada (World Bank 2021). Therefore, higher electricity consumption in these countries because of their extensive market power may influence an increase in technology and industry. Higher reliance on fossil fuel sources such as petroleum, natural gas, and coal also causes an increase in carbon dioxide emissions. According to a report from the IEA (2018), electricity generation from coal and gas power plants would be elevated significantly and increase carbon dioxide emissions from sectors by about 2.5%. Access to cheap fossil fuels in the economic development of industrialised countries tend to contribute to environmental degradation and global climate change (Paravantis et al. 2018; Jacobson & Delucchi 2011). Hence, carbon dioxide emissions adversely affect climate change and greenhouses gas emission.

The population increase in Malaysia has been accompanied by a corresponding increase in electricity consumption particularly in the residential sector. As reported by MEIH (2018), electricity consumption in Malaysia increased from 2000 until 2016. The final energy consumption in Malaysia using fossil fuel to generate electricity increased from 1990 to 2016 (MESH 2018). It's proven that energy demand for present and future use will increase and at the same time dependence on traditional energy will also increase. Referring to Ahmed et al. (2014), the consumption of fossil fuel in electricity generation has contributed to greenhouse gas emissions mainly in the form of carbon dioxide that causes climate change. Babatunde et al (2018) also confirmed that electricity generation is responsible for the largest share of GHG emissions in Malaysia. The higher consumption of traditional energy leads to global climate change and other negative impact such as health problems, environmental degradation, changes to the landscape and biodiversity, and energy security disruption (Azlina et al. 2018). As a consequence, the transition from traditional energy or fossil fuels to renewable energy is necessary to fulfil the unlimited needs and at the same time reduce carbon dioxide emissions, ensuring energy safety and improving environmental quality.

From the point of view of problems linked with climate change and scarcity of fossil fuel in the future, renewable energy sources are seen as able to overcome this problem because they are environmentally friendly, energy saving, inexhaustible, available for use by everyone, and create new employment opportunities. Malaysia has various forms of renewable energy such as solar, hydropower, biomass, biogas, and thermal energy. Additionally, in the planning to expand the use of renewable energy in electricity generation, there are several policies that have been implemented which are the National Green Technology Policy (2009), Renewable Energy Act (2011), and National Energy Efficiency Action Plan (2016–2025) that focus on sustainable energy and energy security. Furthermore, the Renewable Energy Act enforced by Sustainable Energy Development Authority (SEDA) is responsible for the execution of the Feed-in-Tariff (FiT) mechanism to be introduced to electricity consumers as additional charges in their electricity bill. These charges are channelled to the renewable energy fund. In parallel with SEDA (2021), the government aims to achieve a target of 31% renewable energy in power capacity by 2025.

Even though Malaysia has implemented various initiatives to encourage the consumption of renewable energy, there are still critical challenges to its widespread adoption. According to Abdullah et al. (2019), consumption of renewable energy in Malaysia presently is only at 2% of the total energy usage and the bulk of renewable energy is contributed by solar power. This shows that Malaysia's renewable energy consumption is still at a low level. The cost of producing energy from renewable sources is higher than traditional energy because of fixed asset and construction costs, difference in resource endowments, and power supply stability (Xie & Zhao 2018; Sundt & Rehdanz 2015; Yoo & Kwak 2009). Therefore, to promote the implementation of renewable energy, the government should take serious action not only to compensate for the higher cost of production from the producers but also need to ask consumers about their preferences (Guo et al. 2014). As a consequence, the support from consumers is a vital element in the development of renewable energy and the contribution from consumers is also needed to cut the cost of renewable energy supply. For that reason, it is important to know whether consumers are willing to pay (WTP) to increase the proportion of electricity generated from renewable energy and key factors which are likely affecting their willingness to pay.

In this study, consumers will be asked about their WTP for renewable energy and spending some of their income to contribute to the renewable energy fund. Hence, the purpose of this study is to estimate the consumers' WTP for renewable energy in Malaysia and identify the factors affecting the WTP for renewable energy. Renewable energy sources are a vital alternative to compensate for the scarcity of fossil fuels and provide useful information on consumers' reaction towards WTP for renewable energy. The government will use

the information from the view of consumers to upgrade their policy for future use in all sectors including consumer electricity. To investigate the consumers' WTP for renewable energy, the Contingent Valuation Method (CVM) was employed as a method to measure the WTP.

This remainder of this study is organised as follows. Section 2 expresses the literature review of the CVM. Section 3 clarifies the methodology that was used to measure the WTP. Section 4 presents the result and discussion using descriptive statistics and econometric analysis and lastly Section 5 simplifies the conclusion and policy recommendations for future research.

LITERATURE REVIEW

The essential theoretical foundation of willingness to pay (WTP) is benefits are defined as increases in utility (human wellbeing). It refers to the maximum price a customer is willing to pay for a product or service, where they gain a positive change. This concept derived from welfare economics which focused on the valuation of benefits and has received a lot of attention in economic valuation of environmental goods (Freeman 2003).

With respect to renewable energy, it can be viewed as an environmental public good which is privately provided and has the characteristics of private goods such as excludability from and rivalry of consumption. Moreover, renewable energy can provide improvement on environmental quality because it has positive external effects on the environment. For instance, electricity generated from renewable sources, green buildings, hybrid transports and energy-saving household appliances can help reduce emissions of greenhouse gases and other air pollution and protect the environment.

A contingent valuation method (CVM) is one of the most popular methods used by environmental and resource economists to value environmental goods. The CV literature grew rapidly after the National Oceanic and Atmospheric Administration (NOAA) Panel Report, led by Nobel Prize winners Kenneth Arrow and Robert Solos endorsed the effectiveness of contingent valuation methods. The CVM involved a survey approach which develops a hypothetical market to elicit respondents' willingness to pay (WTP) for environmental public goods (Mitchell & Carson 1989; Bishop & Romano 1998; Carson et al. 2001). Using the CVM, a good is described and respondents are asked about their WTP in either closed-ended question or an open-ended format. The dichotomous choice method, which looks for 'yes' or 'no' answers to an offered bid, is commonly preferred to other methods (e.g., open-ended method) as it most closely estimates the "take it or leave" nature of most market trades.

Over the past two decades, the use of CVM for measuring WTP for renewable energy has been widely used in many different circumstances, especially in developed countries. For example Solomon and Johnson (2009) used CVM to comprehend the public's valuation of mitigating global climate change through its willingness to pay for biomass. Nomura and Akai (2004) conducted a CVM study to estimate Japanese consumers' willingness to pay for electricity generated from renewable energy systems. Yoo and Kwak (2009) applied the CV method to obtain a preliminary evaluation of the benefits from the introduction of a policy that raises the percentage of green electricity consumption from 0.2% to 7% of the total electricity supply in Korea. Zografakis et al. (2010) evaluated the citizens' public acceptance and willingness to pay for renewable energy sources in Greece. Kim et al. (2012) analyzed the willingness of Korean households to pay more for electricity generated by renewable energy such as wind, photovoltaic (PV) cells, or hydropower through the contingent valuation method.

Park et al. (2016) investigated consumer's WTP of renewable energy as a substitute to nuclear and fossil energy in Korea. Using CVM to estimate WTP, they found that the average WTP for RE is KRW 102 388 (USD 85). It is also reported that electricity bill, bid price, age, level of interest in RE, level of RE safety, ethics, economy, residence, household, nuclear preferences, level of interest in nuclear, level of nuclear safety, income and regional economy were important factors which influenced WTP. A similar study by Lee et al. (2017), has been conducted in South Korea. Using a single-bounded dichotomous choice (SBDC) contingent valuation method, they reported that the mean WTP was KRW 3402 (USD 3.30) per month and income, number of children under the age of eight, and knowledge of RE significantly influenced WTP.

Ntanos et al. (2018) examined the WTP for renewable energy in Greece and identified that education status, subsidies provided by the government, actions for the expansion of RE undertaken by the state and motivation by socio-politics were positively influenced for expansion of renewable energy sources in the electricity mix. They also found that the WTP for a wider penetration of renewable energy sources into the electricity mix was estimated to be 26.5 euros per quarterly electricity bill. Meanwhile, Pyzalska (2019) investigated the WTP for green electricity among residents in Poland and factors affecting WTP. Using a CVM, they identified that age, income, environmental attitudes, peer support, education and knowledge play the most important role in explaining consumers' WTP for green electricity. The mean for WTP was USD3.5 per month, which is quite low due to lack of knowledge and experience about green energy and green electricity tariffs.

In the case of developing countries, although there is an increasing number of studies on the WTP for renewable energy (see for example Numata et al. 2021; Bakessen & Schuler 2020; Entele 2020; Han et al. 2020; Jin et al. 2019; Xiea & Zhao 2018; Azlina et al. 2018; Osiolo 2017; Alam & Bhattacharyya 2017; Ghosh et al. 2017), the WTP for renewable energy of Malaysian consumers has not been widely explored yet. In fact, the highlights of past studies for the contingent valuation method in Malaysia have been widely used in other fields such as tourism (Samdin et al. 2008; Yacob et al. 2009), conservation (Hassan-Basri et al. 2020, Adamu et al. 2015; Thalany), transportation (Hassan-Basri et al. 2019, Mahirah et al. 2015), water services (Mahirah et al 2019, Mahirah et al. 2018, Mahirah et al. 2015). Although Lim and Lam (2014) investigated the consumers WTP for green electricity in the case of Malaysia, however this study only reported 'yes' or 'no' answer to the WTP question. Meanwhile, a recent study by Abdullah et al. (2021) which aims to predict public willingness to pay (WTP) for energy generated from RE sources, used an exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for their analysis.

METHODOLOGY

SAMPLING PROCEDURE AND DATA COLLECTION

The data on household WTP for renewable energy used in this study was derived from January 2020 until March 2020. This study was conducted by face-to-face interviews via questionnaire which is easier to close with respondents and brief them as well. The study was conducted using a face-to-face interview for the contingent valuation study because well-trained interviewers can assist in briefing the scope for detailed questions and answers (Lim et al. 2014). The sample of respondents in this study were users of residential electricity and households with a monthly income.

The survey was carried out in the state of Kelantan, Terengganu, and Pahang or known as East Coast of Peninsular Malaysia. The survey was divided into the three metropolitan areas in each state which are Kota Bharu (Kelantan), Kuala Terengganu (Terengganu) and Kuantan (Pahang). These three states have a lot of renewable energy potential especially wind and wave energy due to its unique geographical advantage located in coastal areas of the South China Sea (Nik et al. 2011, Lim & Lam 2014 and Abdullah et al. 2019). Also, large hydropower can be found at Kenyir Hydro Power Station in Terengganu, Cameron Highland Hydro Power Station in Pahang and Pergau in Kelantan (Abdullah et al. 2019). Although the percentage of economic development and contribution from these three states are still low compared to other states in Malaysia (DOSM 2019), however, it is interesting to explore how households in these states part of their income to contribute to the development of renewable energy in Malaysia, as showed by their willingness to pay.

Referring to the data from the World Population Review (2019), the population in each city was 314 916 in Kota Bharu, 285 065 in Kuala Terengganu, and 366 229 in Kuantan. The households were identified by applying a random sampling procedure. The total number of households that was included in this survey was identified by using a formula by Krejcie and Morgan (1970). The following is Krejcie and Morgan's (1970) formula for the sample size:

$$s = \frac{x^2\, NP(1-P)}{d^2\,(N-1)} + x^2 P(1-P) \tag{1}$$

Where S is the desired sample size, x^2 is the table value of chi-squared for one degree of freedom at 95% confidence level, N is the population size, P refers to population proportion (assumed to be 0.5 to allocate the maximum sample size), and d is the degree of accuracy shown as a proportion (0.05) in line with Azlina et al. (2018). By using this formula, the total sample size for the survey is 384 respondents. However, this study eventually employed the data for 790 respondents included in this survey. The study only used 672 reliable respondents for the extended analysis.

THE CONCEPTUAL MODEL

Based on the theory and previous research, the conceptual framework of consumer's preferences towards renewable energy expressed by their WTP is presented in Figure 1. It suggests that bid price, income, level of education, number of households, age, gender, marital status, race, occupation, electricity bill, level of confidence and knowledge on Renewable Energy Fund can affect WTP.

QUESTIONNAIRE DESIGN

The questionnaire was used in a pre-test with 30 respondents in November 2019. The result from the pre-test was used to improve the final questionnaire by employing the test of reliability and validity of questions. The pre-test is important to avoid ambiguous and vague questions which are common features of hypothetical bias in CV bias (Azlina et al. 2018). To manage the problem of hypothetical bias, enumerators should explain to respondents in the simplest of words, so they can understand the hypothesis as well.

The final questionnaire was divided into four sections. The first section introduces an awareness of environment, renewable energy, and non-renewable energy. In this section, respondents will be asked about their opinion and perception of the environment as the 'warm-up' questions. The second section is concerned

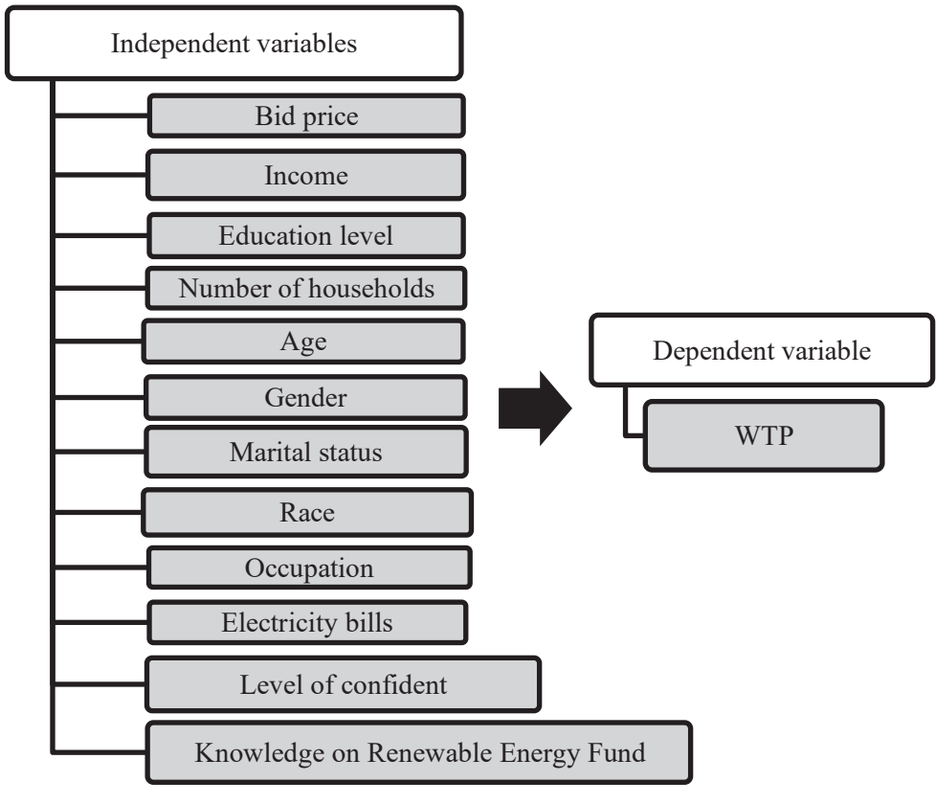

FIGURE 1. The conceptual model of consumer's willingness to pay (WTP) for renewable energy

with knowledge of renewable and non-renewable energy. Respondents should state their knowledge and attitude towards renewable and non-renewable energy and indicate whether they have taken note or otherwise.

The third section is to identify the Willingness to Pay (WTP) for renewable energy. This section presents to respondents the scenarios regarding the contingent valuation scenarios and questions about WTP. The CVM is used to measure the stated preference for non-market goods and the scenario hypothesis that dominates in the questionnaire may affect the WTP (Xie & Zhao. 2018; Oerlemans et al. 2016; Burghart el. 2007). Before proceeding to WTP, respondents will be given an explanation about scenario hypothesis related to renewable energy in Malaysia. Afterwards, respondents will be asked about their WTP as an addition on their electricity bill to encourage the expansion of electricity generation from renewable energy. There are six different bid prices which are exactly RM1, RM2, RM4, RM6, and RM 10. In the SBDC questions, the respondents should answer either 'Yes' or 'No' to the bid price offered. Consequently, there will be two outcomes of the SBDC which are 'Yes' and 'No'.

Lastly, section four contains the profile of respondents and their socio-demographics. The questions require respondents to respond towards household monthly income, age, gender, race, education, marital status, type of occupation, household size, number of children, and electricity bill.

ECONOMETRIC MODEL

The Contingent Valuation Method (CVM) was analysed by Dichotomous Choice (DC) questions which were Single-bounded Dichotomous Choice (SBDC). Respondents have to answer either 'Yes' or 'No' to the bid price offered depending on their willingness to pay to increase their utility. In DC questions, respondents will be asked after the description of a hypothetical market with either 'Yes' or 'No' to their WTP (Feldman 2012). Furthermore, CVM using a close-ended format to estimate the consumers' WTP can improve the efficiency of estimated variables of WTP (Hanemann et al. 1991). This study applied the close-ended format in the DC CVM approach to gain a more precise WTP and increase the response rate of respondents.

DC CVM is a simple method to develop because it is more efficient and reliable than other methods (Calia & Strazerra 2000). The bias can be reduced by extracting DC CVM (Cameron & Quiggin 1994). The DC was divided into two approaches which were SBDC and DBDC. From one point of view, SBDC gives more time to respondents to respond to the questions and reduces the response distortion to a minimum (Calia

& Strazzera 2000). In an evaluation of the relative efficiency of the elicitation formats, the National Oceanic and Atmospheric Administration (NOAA) (1992) made a powerful case to counter OE questions and suggested 'take it or leave it' types of questions for the SBDC format particularly in the price mechanism as standard practice in CVM (Prasenjit & Sarmila 2009). Thus, this study employed the SBDC questions instead of DBDC questions.

Providing a clear estimation of potential effects and bias arising from Dichotomous valuation establishes the appropriate model (Azlina et al. 2018). As such, the econometric model is essential to describe the possibilities of answers. According to Xie & Zhao (2018), the logit model is used to analyse the regression to find if respondents have a positive attitude towards green electricity development and finding the factor that influences their attitude. In this study, the logit model was utilised to identify the factors affecting consumers' WTP. The technique used to evaluate the logit model is maximum-likelihood (ML) estimation and this technique is most widely used (Lee 1997). Thus, this study applied the logit model in advance. In this regard, the SBDC came out with two probabilities which were 'Yes' and 'No' to the bid price offered. Referring to Hanemann et al. (1991), the model formulation is established as follows:

$$Prob\ (Yes)=Prob\ (MWTP>BID)=G\ (BID;\theta) \quad (2)$$

$$Prob\ (No)=Prob\ (MWTP<BID)=G\ (BID;\theta) \quad (3)$$

Where BID refers to bid price, *MWTP* stands for maximum willingness to pay (WTP) and *G (BID;θ)* shows the cumulative distribution function (CDF) of WTP. The model regression uses CDF due to the response variable being dichotomous which captures 0-1 values (Mahirah et al. 2015; Gurajati 2003). To estimate the mean of WTP, the logit model is used and described in the equation as follows:

$$Prob(Yes)=(1+e^{-\Delta v})^{-1} \quad (4)$$

The probability of respondents saying 'Yes' is shown above where *e* refers to the exponential function and Δv represents the logit index expression. Despite using SBDC, the answers have two options which are known as dummy variables and explained as below:

$$C=1;if\ WTP>x \quad (5)$$

$$C=0;if\ WTP<x \quad (6)$$

Where *C* demonstrates the consumers' WTP for renewable energy and *x* stands for one of the independent variables that affects the WTP. If the respondents say 'Yes' to the bid price, then *C=1*. In contrast, if the respondents say 'No' to the bid price, then *C=0*. Accordingly, mean WTP as recommended by Alam and Bhattarcharyya (2017) is written as below:

$$Estimate\ mean\ of\ WTP = \frac{1}{1+e^{-\Delta v}} \quad (7)$$

Where Δv is equal to $\alpha + \beta i(x)$, while α represents a coefficient constant, βi stands for coefficients of explanatory variables, and *x* shows the independent variable that affects the WTP.

Consumers' willingness to pay (WTP) for renewable energy is the dependent variable of the model in this study. In the context of this study, the value that consumers places to get electricity from renewable sources is indirectly measured by the amount they are willing to pay for it. WTP is determined and explained by other independent variables such as bid price, socio economic and demographic variables. Based on the theoretical consideration and conceptual framework discussed earlier, the summary of variables and its description is shown below in Table 1:

WTP is the dependent variable which represents the participation decision or willingness to pay response for the renewable energy development. BID is the explanatory variables which comprise of six bid sets where it is expected to have a negative sign. INC is expected to influence the WTP positively. YAKIN1 is a binary variable indicating whether household confident to pay an additional amount on their electricity bill where a positive relationship is expected. GEN, MARITAL, RACE, WORK and KNOW also refers to binary variables which value takes 1 for the "male", "single", "Malay", "government" and "yes" answers, respectively, zero otherwise. AGE, EDU_YR, JUM_HH and BILL is expected to have a positive relationship with WTP for renewable energy.

RESULT AND DISCUSSION

As stated previously, the objective of this study is to estimate the consumers' WTP for renewable energy and identify factors that affect consumers' WTP. To achieve the objectives, the result was exposed to descriptive statistics, econometric analysis, and discussion.

DESCRIPTIVE STATISTICS

The result from the descriptive statistics revealed the socio-demographics of respondents and variables that affected WTP. In addition, there were several variables that influenced consumers' WTP which were bid prices, household income, level of confidence for WTP, gender, age, marital status, years of education, number of household members, race, and type of employment. The outcome from the descriptive statistics is indicated in Table 2 below:

Table 2 shows the results of the descriptive statistics where the average bid price or BID is RM 5.14 at the initial bid price as measured in six bid prices set to

TABLE 1. Description of dependent and independent variables

Categories of Variable	Variable name	Description and measurement
Dependent variable	WTP	Response on willingness to pay (Yes = 1, No = 0)
Independent variable	BID	Bid price (RM1, RM2, RM4, RM6, RM8 and RM10) (The amount of the bid proposed)
	INC	Household income (per month)
	YAKIN1	Level of confident for WTP (1 = confident, 0 = not confident)
	GEN	Gender (1 = male, 0 = female)
	AGE	Age of the respondents (years)
	MARITAL	Marital status (1 = single, 0 = married)
	EDU_YR	Years of education (0-19 years)
	JUM_HH	Number of household members
	RACE	1 = Malay, 0 = non-Malay
	WORK	Types of employments 1 = Government, 0 = non-government
	BILL	Monthly electricity bill (RM)
	KNOW	Knowledge of Renewable Energy Fund (Yes = 1, No = 0)

TABLE 2. Result of descriptive statistics

Variable name	Description and measurement	Mean	Std. dev.	Min	Max
BID	Bid price (RM1, 2, 4, 6, 8, 10)	5.14	3.19	1	10
INC	Household income	3215.24	2784.57	100	17000
YAKIN1	Level of confident for WTP (1 = confident, 0 = not confident)	0.71	0.45	0	1
GEN	Gender (1 = male, 0 = female)	0.31	0.46	0	1
AGE	Age of respondents	32	14	18	90
MARITAL	Marital status (1 = single, 0 = married)	0.55	0.50	0	1
EDU_YR	Years of education (0-19 years)	13.45	3.38	0	19
JUM_HH	Number of household members	5.14	2.31	1	17
RACE	1 = Malay, 0 = non-Malay	0.94	0.23	0	1
WORK	Types of employments 1 = Government, 0 = non-government	0.65	0.48	0	1
BILL	Monthly electricity bill	112.17	106.78	10	1000
KNOW	Knowledge of Renewable Energy Fund	0.33	0.47	0	1

TABLE 3. Respondents' 'Yes' and 'No' responses with different bid amounts

Bid amount (RM)	Sample size	Number of responses (%)	
		Yes	No
1	119	83.19	16.81
2	122	66.39	33.61
4	117	57.26	42.74
6	124	44.35	55.65
8	111	34.23	65.77
10	120	40.00	60.00
Total	713	54.42	45.58

different respondents. The average household income or INC is about RM 3215.24 monthly. The dummy variables in this study are the level of confidence for WTP assigned as YAKIN1 where 1 is for confident and 0 for otherwise and mean of YAKIN1 is approximately 0.71 which shows that most respondents have a high confidence level for WTP. By following the dummy variables, gender remark or GEN is assigned as 1 for male and 0 for female, and the mean of gender is 0.32 which indicates that the majority of respondents were female. The majority of respondents' ages are assigned as AGE and the value is around 32 years old which means that there were younger respondents than older respondents.

Marital status or known as MARITAL in the dummy variables is 1 for single and 0 for married, and on average, marital status is about 0.61 which shows that more respondents were single. Years of education contain 0 to 19 years of studies where 0 stands for no formal education, 1–6 years refer to primary schooling, 7–11 years indicate secondary schooling, 12–13 denote certificates and diplomas, 14–16 assigned as degrees, and 17–19 years allude to postgraduate studies. The mean of variable EDU_YR is 13.45 which shows that most respondents had around 13 years of education. Next, the average number of household members assigned as JUM_HH is 5.14 which reveals that most respondents had five household members. By employing the dummy variables again, the race known as RACE is coded as 1 for Malay and 0 for otherwise and expresses that the mean of race is about 0.94 where the majority of respondents were Malay. Mean monthly electricity bill (BILL) is RM112.17 and KNOW, which refers to knowledge of Renewable Energy Fund is 0.33, which indicates that the majority of the respondents did not aware of this fund in their electricity bill. Finally, type of employment as a dummy variable is assigned as WORK where 1 is for government and 0 for others. The result shows that the mean of WORK is 0.65 which indicates that most of the respondents worked in the government sector.

Table 3 expresses the responses of 'Yes' or 'No' with six different bid prices which were RM 1, RM 2, RM 4, RM 6, RM 8 and RM 10 to 713 respondents in total. The highest response of 'Yes' was 83.19% at RM 1, while the lowest response of 'Yes' was 34.23% at RM 8. The findings show that responses of 'Yes' to bid price decreased from RM1 to RM8 but increased again at RM 10. However, the number of 'No' responses increased at RM 8 or around 65.77% and decreased at RM 1 or about 16.81%. Thus, the results imply that the response of 'No' increased from RM 1 to RM 8 and decreased at RM 10.

ECONOMETRIC ANALYSIS

This study presents an extension analysis by employing the logit model. The logit model was used to identify the variables that affect consumers' WTP towards renewable energy. The model was divided into two models which were model 1 indicating all variables and model 2 which refers to only significant variables based on the result in model 1. The findings of model 1 and model 2 are expressed as below:

Table 4 reveals the estimation results of SBDC using the logit model. In model 1, the variables that are statistically significant are bid price (LBID), household income (INC), level of confidence for WTP (YAKIN1)

TABLE 4. Estimation results of single bounded dichotomous choice using logit model

Variables	Coefficients – Model 1	Coefficients –Model 2
LBID	-1.0251 (0.000)***	-0.9984 (0.000)***
INC	0.0001 (0.012)**	0.0001 (0.002)***
YAKIN1	1.5933 (0.000)***	1.5580 (0.000)***
GEN	-0.2192 (0.254)	-
AGE	-0.0009 (0.932)	-
MARITAL	-0.1542 (0.579)	-
EDU_YR	0.0475 (0.094)*	0.0518 (0.047)*
JUM_HH	0.0275 (0.483)	-
RACE	0.2383 (0.531)	-
WORK	0.2298 (0.205)	-
BILL	0.0012 (0.183)	-
KNOW	0.20740 (0.262)	-
Constant	-0.9860 (0.178)	0.0183 (0.940)
Mean WTP	4.9231 (0.000)***	4.9311(0.000)***
Pseudo R2	0.1842	0.1764

Notes: ***,**,* are P-values that are statistically significant at 1%, 5% and 10% levels, respectivelyTe, num remner apero, qua redit; nocchice

and level of education (EDU_YR). The variables of LBID and YAKIN1 are statistically significant at the 1% level whereas the coefficients of INC and EDU_YR are statistically significant at 5% level and 10% level, respectively. In addition, the LBID variable shows a negative relationship towards WTP for renewable energy, while the variables of INC, YAKIN1, and EDU_YR positively affect WTP for renewable energy.

Switching to model 2, only significant variables were included in this model based on significant variables in model 1. The result in Table 4 shows that only four variables are significant which are LBID, INC, YAKIN1, and EDU_YR. The variables of LBID, INC and YAKIN1 are statistically significant and negative at 1% level whereas EDU_YR is statistically significant and positive at 10%. Next, the estimated mean of WTP for model 1 is about RM 4.92, whereas mean WTP for model 2 is around RM 4.93. In other words, the mean is approximately RM 4.90 (USD 1.18) for both models. The mean of WTP shows that the variable is significant at 1% level.

From the result, a discussion is needed to compare if this research is parallel to previous studies or otherwise. The key questions translated into answers were one of the important things that appeared in past literature reviews of similar research into public attitudes towards renewable energy projects (Paravantis et al. 2018; Stigka et al. 2014). Thus, this section presents the discussion of the results grounded on economic theory and previous studies.

Looking back to the previous part of analysis the descriptive statistics showed that the average monthly household income was around RM 3215.24, indicating that the majority of households came from the B40 income class where household income is below RM 4395 (DOSM 2020). However, the monthly household income was higher than that found in past studies in Malaysia such as by Azlina et al. (2018). From the percentage of 'Yes' responses to the bid price offered, the WTP showed a decrease when the bid price increased. The result indicated that WTP and bid price was negatively related and equal to the demand theory where the higher the price, the lower the demand. This finding is also similar to those found in some of the previous literature (Azlina et al. 2018; Arega & Tadesse 2017; Guo et al. 2014).

The SBDC result by applying the logit model demonstrated that only four variables were statistically significant i.e. bid price (BID), household income (INC), level of confidence for WTP (YAKIN1) and education (EDU_YR). The bid price variable was significantly and negatively related to WTP which is similar to some past studies (Lee et al. 2017; Lim et al. 2014; Abdullah & Jeanty 2011; Yoo & Kwak 2009). The second variable that was significant and positive to WTP was household income which demonstrates that the higher the income, the higher the WTP. This finding is identical to many previous studies including the ones by Azlina et al. (2018), Paravantis et al. (2018), Xie and Zhao (2018), Alam and Bhattarcharyya (2017), Arega and Tadesse (2017), Lee et al. (2017), and Taele and Kyeremeh (2016).

The level of confidence and education shows that it is significantly and positively associated with WTP for renewable energy. Most of the past literature indicated that knowledge and attitudes towards WTP are variables that significantly and positively relate to WTP. For instance, the study by Ntanos et al. (2018) implied actions for expansion of renewable energy as significantly positive to WTP. Similarly, knowledge about energy sources is significantly positive as reported in the research by Xie and Zhao (2018), Lee et al. (2017) and Aravena et al. (2012).

CONCLUSION

Presently, the increase in carbon dioxide emissions is being caused by higher consumption of traditional energy. In addition, the population growth may lead to increasing electricity consumption and at the same time amplifying demand for traditional energy. Thus, to overcome the dependency on limited traditional energy or fossil fuel, renewable energy has become an area of interest because its sources are more beneficial to the environment and have preferable social and economic impact. Although various policies in renewable energy development have been introduced by the government, renewable energy in Malaysia is still at a low level. The major challenge to develop renewable energy is its high costs. To minimise these costs, they can be passed to the consumers as well as making efforts to encourage the consumers to accept the renewable energy environment.

The main focus of this study was to estimate the willingness to pay (WTP) for renewable energy in Malaysia and identify the factors affecting consumers' WTP. By applying the Contingent Valuation Method (CVM), the survey was carried out with 713 respondents via face-to-face survey. The mean of WTP was found to be about RM 4.90 (USD 1.18). In addition, bid price, household income, level of confidence for WTP, and education level significantly influenced the consumers' WTP. Bid price had a negative relationship towards WTP. Contrastingly, the higher the household income, the higher the WTP which showed that household income had a positive relationship with WTP. The level of confidence for WTP had a positive effect where the higher the level of confidence, the higher the WTP. Education level was significantly positive to WTP. In other words, consumers show positive support towards renewable energy and contribute some money to stimulate renewable energy development.

The main findings from this study shows that Malaysian citizens are willing to pay significant amounts

per month in increased electricity bills in order to have an improved electricity production through renewable energy projects and reduced dependency on fossil fuels. Aggregating to the national level across the roughly 9.25 million consumers in Peninsular Malaysia (TNB Annual Report 2019), these findings translate to WTP among citizens of about RM543.9 million per year. In addition, based on 1.6% of renewable energy fund to be paid by consumers, the total estimated RE fund (KWTBB) that could be generated is about RM8.7 million per year. RE Fund (KWTBB) is collected by the Government and will be used to promote growth of electricity generation from renewable energy resources. The compensating variation as projected from the study is quite significant and can further enhance renewable energy development in Malaysia. This is in favour of Malaysia's target to achieve a target of 31% RE in power capacity in 2025 and 40% in 2035.

In general, the result of this study can be beneficial to the policy makers, government, private sector, and consumers. It shows that for policy purposes, the findings from this study offers a starting point in understanding the benefits of introducing renewable energy. Although the reported mean WTP is considered low compared to other countries, consumers show positive support towards renewable energy development and willing to contribute some money to stimulate renewable energy development in Malaysia. This suggest that government can raise funds to compensate for the higher cost of renewable energy development by adding a surcharge to utility bills. Moreover, policy makers and utilities sector may alter their strategy and new planning by focussing on the target group of consumers (for instance those with higher income) to increase monetary funding to finances the expansion of renewables. In addition, it is obvious that increased confidence level and knowledge will increase public support on renewable energy policy. Because the level of confidence and education have a significant positive effect on the WTP, it is apparent that there is a great need for local government to raise awareness and should further educate the public about the importance of clean energy to our environment. This is where the consumers can help meet government goals on renewables and the urgency of changing the sources of energy production should be put on the top priority.

The result of this study can be beneficial to the policy makers, government, private sector, and consumers. The policy makers can use this information to create new planning to enhance renewable energy development and focus on the target group of consumers together with a fair and equitable burden on the community. This research can assist the government in making a framework to be introduced in the medium and long-term uses and consider the diversity of renewable energy since Malaysia is still at a low level in renewable energy use. On top of that, consumers of all ages or stages should be encouraged to accept renewable energy using a sense of awareness for the environmental impact and more knowledge about the benefits of renewable energy. Further research should be conducted including other states in Peninsular Malaysia, Sabah, and Sarawak with the assumption that the WTP will be higher.

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