IRJEMS International Research Journal of Economics and Management Studies
Published by Eternal Scientific Publications
ISSN: 2583 – 5238 / Volume 2 Issue 2 June 2023 / Pg. No: 533-547
Paper Id: IRJEMS-V2I2P159, Doi: 10.56472/25835238/IRJEMS-V2I2P159

Original Article

Assessing Public Preferences for Solar development: A Case Study of Selangor State Malaysia

[1]Md Muhibbullah, [2]Rafia Afroz*, [3]Jarita Duasa
[1,2,3]Department of Economics, Faculty of Economics and Management Science, International Islamic University Malaysia.

Received Date: 08 June 2023 Revised Date: 18 June 2023 Accepted Date: 24 June 2023 Published Date: 29 June 2023

Abstract: *Even though the Malaysian government has taken numerous steps to promote renewable energy (RE), 75% of the nation's electricity still comes from fossil fuels. Because of this, the development of RE is gradual and is thought to be in its early phases. However, there aren't many research that examine Malaysian families' intentions and their willingness to pay (WTP) for solar photovoltaic (PV) technology. As a result, these problems are unresolved in Malaysia. The implementation of appropriate policies to encourage families to employ solar PV technology in order to increase the share of RE technology in the Malaysian energy mix is incredibly tough in this situation for the stakeholders and policy makers. In order to fill the knowledge gap, this study used the contingent valuation method (CVM) to survey Selangor State residents on their willingness to pay (WTP) for higher electricity surcharges in order to advance solar energy in Malaysia. A link to the poll and an online invitation were sent to 400 potential responders via email or social media. Results from estimated models demonstrate that household income, age, education level, gender, environmental consciousness, and membership in environmental organisations are major drivers of WTP. Malaysian families confront a number of obstacles, including high expenses, a lack of material and financial resources, a lack of knowledge, and a lack of social support, despite the potential viability of solar PV. The majority of respondents, according to the survey, are unable to take part in the NEM programme because they are unaware of the government's clean energy incentives and strategies. In order to reinforce current policies and increase the use of solar PV, a number of recommendations are given to decision-makers and solar market practitioners.*

Keywords: *Solar Development, Electricity, Organizations.*

I. INTRODUCTION

Oil, coal, and natural gas are the traditional fossil fuel-based energy sources that are responsible for much of the world's economic growth. Due to population growth and economic expansion, non-renewable energy (such as fossil fuels) consumption is rising as well. Energy is a necessary component of all economic operations. While many advanced technologies are currently developed around the world, most countries still have to rely on fossil fuels to generate electricity (Bang, 2010). Over 70% of the world's energy demand was met by fossil fuels (such as coal and oil) in 2017 (International Energy Agency), and their proportion of the total demand is rising (Solangi et al., 2011). Global primary energy demand is predicted to rise by nearly 60% between 2002 and 2030, with an average annual growth rate of 1.7%, according to Solangi et al. (2011). Emissions of greenhouse gases (GHGs) are rising along with rising fossil fuel usage for economic activity. These GHGs have a huge impact on the environment by absorbing increasing amounts of heat and contributing to air pollution and global climate change (Cosmi et al., 2003; Mathiesen et al., 2011).

With a gross domestic product (GDP) per capita (current US dollars) of 11414.8 based on a consistent GDP growth rate of 4.3% in 2019 (World Bank, 2020), Malaysia has a developing economy. Energy commission of Malaysia, 2017 declared that 6% annual growth in energy consumption is anticipated along with economic expansion. A 9.1% increase in energy demand was also seen in the industrial sector in 2018 compared to 2017 (Energy Commission, 2020). The residential sector alone used 21% of Malaysia's energy production in the first half of 2010, and the average yearly consumption per family is 3300 kWh (Taha, 2013). Additionally, it should be emphasised that fossil fuels, mostly coal and natural gas, account for nearly 90% of Malaysia's total electricity production (Economic Planning Unit, 2006). Although Malaysia's natural gas reserves are ranked 45th in the world (Central Intelligence Agency, 2020), Ahmad et al. (2011) claim that the nation could only maintain its present natural gas production for around 29 years. Additionally, even though Malaysia has a total reserve of 4.73 billion barrels of crude oil in 2017 (Energy Commission, 2019), its citizens must understand that if they cannot find a substitute for this non-renewable energy, one day this reserve may run out (Štreimikienė & Baležentis, 2015; Ashnani et al. 2014). Malaysia made a commitment to cut its carbon emissions by 40% by 2025 compared to the base year of 2005 at the Conference of Parties in Copenhagen (COP15, 2009). According to the Central Intelligence Agency (2020), Malaysia currently produces 226.8 million metric tonnes (MT) of CO_2 per year from energy usage, ranking 23rd globally. The Malaysian government's target of 20% renewable energy (RE) in the country's energy mix by 2025 is the focus of the 2035 Renewable Energy Transition Roadmap (RETR) (WEMO, 2017). According to the 11th Plan for Malaysia, the Malaysian government wants to reduce GHG emissions by 33% (EPU, 2016). It is estimated that 1MWp Solar photovoltaic (PV) plant can generate around 1390 MWH of electricity per annum, with a GHG emission reduction of 818.71 tCO2 per annum (Kumar et al., 2019).

Despite ongoing initiatives to encourage the use of renewable energy (RE) sources, Malaysia uses relatively little of them to produce power. Only 1% of the electricity produced in 2014 came from renewable energy sources (Energy Commission, 2017). The outcomes of the 10th Malaysia Plan (2011-2015) provide as proof of this. After the 10th Malaysia plan expired in 2015, Malaysia only managed to attain 300 MW while having a target of 985 MW for RE (Energy Commission, 2017). Due to Malaysia's advantageous geographic location, solar PV panels have the greatest potential to satisfy the country's substantial energy needs. Since Malaysia is located directly within the Sun Belt and, it has a significant amount of solar isolation (1400-1900 kWh/m2/year) with more than 10 hours of sunlight per day (Muhammad-Sukki et al., 2014) and it can generate solar-powered electricity throughout the country. Solar energy's main benefit is that it has fewer detrimental environmental effects. Malaysia continues to face considerable challenges in trying to increase the share of renewable energy in the country's energy mix, despite the fact that the government has created a number of policies to encourage the development of cleaner energy sources. The development of the solar industry in Malaysia has a number of obstacles, including a lack of household awareness and attitude towards the government's current RE policy and subsidies, the upfront cost of PV solar installation, and the aesthetics of solar panels (Aziz et al., 2017; Faiers & Neame, 2006; Zhang et al., 2012; Abd Rahman et al., 2019). As solar energy production gains in popularity, more people are keen to contribute to environmental benefits and more are willing to pay a share of the price for clean energy (Lee and Heo, 2016; Xie and Zhao, 2018).

The pace of solar energy's widespread adoption in Malaysia may be increased if Malaysians were ready to pay to the RE fund for solar energy research and development. The vast majority of Malaysians are still unwilling to invest in the FiT scheme, according to a recent survey that was conducted to understand the public's perspective and perceptions on renewable and solar PV installation under the FiT scheme. The survey found that Malaysians have a low level of understanding about the various incentives provided by the government (Muhammad-Sukki et al., 2011). Despite the Malaysian government's several measures to encourage RE, fossil fuels are still used to generate 75% of the country's electricity supply. As a result, the RE development process is slow and believed to be in its early stages. Nevertheless, there are very few studies that analyse the intention of the households and their willingness to pay (WTP) for solar PV technology in Malaysia. As a result, these problems are unresolved in Malaysia. The implementation of appropriate policies to encourage families to employ solar PV technology in order to increase the share of RE technology in the Malaysian energy mix is incredibly tough in this situation for the stakeholders and policy makers. A contingent valuation method (CVM) survey was conducted in Selangor State as part of this study, which was motivated by the knowledge gap, to analyse the influencing factors that affect households' willingness to pay (WTP) higher electricity surcharges for the development of solar energy in Malaysia.

II. LITERATURE REVIEW

WTP is a popular approach to assess the economic value of public goods such as natural resources (Thi et al., 2022), agricultural technologies (Anugwa et al., 2022), green energy (Ahmed et al., 2022), green urban space (Idris et al., 2022), and environmental protection (Shahzad et al., 2022). Whitehead and Cherry (2007), for example, reported that respondents in North Carolina were willing to pay $4.24 per month, but Roe et al. (2001) found that the average WTP values in the United States was US$6.13 per month. According to Lee et al., 2022, customers are willing to pay an additional $3.21 per month for power generated from RE in South Korea. In addition, South Korea's WTP is lower compared to other advanced nations, implying that these WTP values may be influenced by policies aimed at increasing understanding and acceptability of RE, which do not exist in Korea. Guo et al., 2014 found that Beijing residents' average WTP for renewable electricity was USD 2.7–3.3 (CNY 18.5–22.5) per month. Alternatively, for China, Zhang and Wu (2012) conducted similar studies and found that the WTP values are different.

Previous studies found that different factors can affect the WTP of the respondents for green electricity or solar power, including age (Xie and Zhao, 2018; Ayodele et al., 2022; Lee et al., 2016; Liu et al., 2013), education (Azlina et al., 2018; Guo et al., 2014; Xie et al., 2018), gender (Han et al., 2020; Muhammad et al., 2021; Sun et al., 2016; Uehleke, 2016), income (Ayodele et al., 2021; Benjamin et al., 2022; Guo et al., 2014), household member (Jin et al., 2006; Wang & Zhang, 2009; and Afroz et al. al. ., 2009), knowledge about renewable energies (Alba & Hutchinson, 1987; Pieniak et al., 2010; Pieniak et al. 2013; Hao et al., 2019). As can be observed, there are significant disparities in WTP between locations and categories of individuals; nevertheless, it is impossible to tell if the same findings may be obtained in various research owing to variances in conditions. The majority of past research relied on face-to-face interviews to gather expert and customer opinions and preferences. There are primarily two types of stated preference approaches for estimating expressed preferences for public goods: choice experiment (CE) and CVM. Respondents in CE are presented with a succession of possibilities in pairs or mixes of three, and they must select preferred alternatives from the choice sets (Álvarez-Farizo & Hanley, 2002). This technique requires that the qualities and their associated boundaries be realistic, consistent with the government's goals, and relevant and obvious to respondents (Longo et al., 2008). The CE approach has limitations in the current Malaysian energy market and may not be the best way to estimate willingness to pay. CVM, on the other hand, has grown in popularity since its first introduction by Ciriacy-Wantrup (1947) due to its easy and practical application. Respondents are asked to declare their WTP as if the market existed in a hypothetical situation using this strategy (Taale & Kyeremeh, 2016). With environmental deterioration and an increasing concern for renewable energy (Nomura and Akai, 2004), CVM has become the most extensively used tool to measure WTP for sustainable public goods (Oerlemans et al., 2016), and several research have been conducted. An important factor influencing CVM's findings is the adopted elicitation methodology, i.e. the manner in which respondents are told about the WTP questions (Oerlemans et al., 2016). Bidding games, open-ended (OE) questions, payment card (PC), dichotomous choice (DC) and others are among the common techniques (Frew et al., 2003). Whitehead and Cherry (2007) used a single bounded dichotomous choice method to study the WTP of the respondents for green energy in developing countries. Li et al. (2005) conducted telephone and online surveys to detect household's WTP for reducing US dependency on fossil fuels. In our study, our focus was on the urban population, because this sample includes over 80 percent of electricity users and because differences in the welfare of the RE between the rural and urban households have been identified. Results of the Azlina et al. (2018) analysis using CVM that households of Malaysia are willing to pay for Renewable Energy Fund as much as RM3.2 per month on average. The study aims to estimate the WTP of the households for their use of solar power in Kuala Lumpur. To this end, in order to identify the WTP of households for the development of solar energy in Malaysia and the factors influencing them, a CVM has been conducted with the dichotomous choice double-binding format.

A) Theoretical Framework of CVM

According to the hypothesis, using an item that is both a private good (electricity) and an environmental good gives household's satisfaction. Although there are no differences between electricity and other energy sources, our discussion is based on the fact that different types of energy have varied environmental benefits (Kotchen, 2011). Consider the following notation for an indirect utility function.

$$U = f(I, E, P, Z) \text{ ----------------------------- (eq. 1)}$$

Where I is the income of the households, E is environmental quality, P is the prices of relevant goods and services and Z is socio-economic characteristics of the respondents (Kim et al., 2012; Lee and Heo, 2016; Taale and Kyeremeh, 2016). It should be noticed that utility is rising in I and E while falling in P and Z, as per the random utility hypothesis. A common formulation of the Random Utility Model (RUM) is the Additive Random Utility Model (ARUM) (Kolstoe & Cameron, 2005). The ARUM assumes that observable and random preferences can be added together to separate the utility function.

$$U_i = V_i + \varepsilon_i \text{ ----------------------------- (eq. 2)}$$

Where V_i is the observable component and ε_i is the random variable. It is also noted that $V_i = f(I, E, P, Z)$. Assume that a respondent is informed that solar energy will be more expensive than other-fuel energy when the status of E improves from a given level of E_0 to E_1. The respondent must decide whether or not to pay the more contribution to the RE fund for solar energy development in Malaysia. When the payment does not reduce the respondent's overall economic utility, the response is usually favorable. This willingness can be demonstrated in the following ways:

$$V_i = f(I, E_o, P, Z) = V_i = f(I - WTP, E_1, P, Z) \text{ ----------------------------- (eq. 3)}$$

Where E_0 represents the electricity from fossil fuels and E_1 is electricity from solar energy and WTP is the maximum contribution to RE fund to develop solar energy in Malaysia (Xie & Zhao, 2018). The respondent's preference for the suggested improvement is shown by the likelihood that he will say "yes." As a result, the probability that a respondent will say "yes" to a suggested bid is now:

$$Pr(yes) = f(I - WTP, E_1, P, Z) > f(I, E_0, P, Z) \text{ ----------------------------- (eq. 4)}$$

WTP in part also refers to the reduction in electricity costs attained by switching from fossil fuels to solar power. As a result, the socioeconomic qualities of the respondent and the parameters of the power supply determine a household's WTP (Hensher et al., 2003). Additionally, since utility depends on both observable and random components, any change in utility brought on by an increase in the availability of power will be equal to the variance in the observable and random components. We can express WTP as follows:

$$WTP_i = \beta_i V_i + \varepsilon_i \text{ ----------------------------- (eq. 5)}$$

Where β_i is the vector of estimated coefficients of the variables, V_i is the vector representing the respondent's socioeconomic characters and electricity supply characteristics, and ε_i is the error term that captures all other factors that affect households' WTP that have not been included in the model. The error term is thought to have a typical normal distribution with a variance of 1 and a mean of 0. The final questionnaire had three main sections. Questions about the respondents' knowledge, attitudes, and opinions towards RE as well as the challenges they faced when using solar energy in the home are presented in the first section. In section B, there are inquiries meant to gauge Malaysian families' willingness to pay for solar energy development through CVM. Respondents are also informed that generating power from solar energy is one of the goals for diversifying the nation's energy sources and reducing emissions. The RE Act of 2011 established the RE Fund (KWTBB) to secure the survival of the natural fossil fuel reserves. Sustainable Energy Development Authority (SEDA) is responsible for managing and overseeing the RE Fund. The renewable energy (RE) Act of 2011 imposes 1.6% surcharges on consumers' power consumption (No. 28 in the sample bill image), which must be directed to the RE Fund (KWTBB). The surcharge, however, only applies to monthly consumption that exceeds 300 kW. Therefore, the total consumption charges for the current billing period are subject to a 1.6% surcharge. This sum is delivered to SEDA. This is exempt from GST. Despite SEDA's accomplishment in obtaining RM600 million from the levy for the RE Fund in 2014, the sum is not enough to support the RE projects. To fulfil this objective, RE fund is developed and the Later, they have been asked if they are ready to pay additional electricity charges to contribute to SEDA's RE fund and how much they are willing to increase the surcharge amount from previous amount. A question also asked whether they believe that the government can provide a sustainable energy source in Malaysia or not (Mitchell et al., 1989). Figure 1 illustrates the CVM valuation questionnaire which was used in this study to assess measure the WTP of the households for additional charges to develop solar energy in Malaysia.

A double-bounded dichotomous question structure has been developed in order to prevent "strategic bias," or the overestimation or underestimation bias of WTP. Additionally, to determine whether or not the respondents are eager to declare their self-interest in order to expose the true preference that could affect decision-making. As a result, the bias associated with overestimating or underestimating WTP would be diminished. It will be presumed that the respondents are pleased to support alternative energy sources in order to create a sustainable energy supply and environment if they agreed to pay an additional amount. There were questions in section C about the respondents' socio-demographic characteristics, such as gender, age, household income, education, occupation, and family size. Also, status of household energy demand and usage; energy systems currently using by households related questions were asked in this section. The questionnaire has been formatted in English, side by side with Bahasha Melayu. To avoid biasness, back translation has been made for both languages. The interviews have been conducted with the heads of the households, alternatively chosen the spouse or any family members in the absence of the household head. As for the online survey, even it has been mentioned to answer by either by household head or spouse, after getting responses it has been identified that some household members also shared the household information on behalf of household head.

B) Logit Model

The binary logit model has been adopted in this study's CVM to assess respondents' willingness to pay (WTP) for the installation of new renewable energy technology, particularly solar energy, in Malaysia. WTP for the installation of new technology in Malaysia is the dependent variable. Since the dependent variable is a dummy, it takes the value of 1 if the respondents are willing to pay an additional fee to utilise electricity produced by a renewable energy source and 0 otherwise. Logit regression can be used when the dependent variable is expressed in a 0–1 form (Wang et al., 2012). As a result, the logit model is used in this work. The logit model's parameters are estimated using the Maximum Likelihood (ML) approach. The likelihood ratio index was calculated as a measure of the logit model's quality of fit. As a result, the model evaluates the relationship between several variables and respondents' willingness to pay (WTP) for solar energy technology. The design is as,

$$Log P_j/(1-P_j) = Z_j = \beta_0 + \beta_j X_j + e \text{ ------------------- (3.4)}$$

Where,

P_j = 1 if the respondent is willing to pay for solar installation
P_j = 0 for otherwise
X_j = Independent variables
β_0= Constant term
β_j= Coefficient of independent variables
e = The error or disturbance term
i = 1, 2, 3… n.

Assuming no negative values for solar installation, the mean WTP will be determined using the following formula proposed by Hanemann (1989):

$$E(WTP) = \left(\frac{1}{\beta_1}\right)^* ln\left(1 + exp^{\beta_0}\right) \text{ --------------------------- (3.5)}$$

The population affected by the proposed adoption of renewable energy will be multiplied by n in order to create total WTP. The advantage received from the suggested RE in monetary units can thus be considered the overall WTP (Alberini & Cooper, 2000)

The dependent variable in CVM is WTP of the respondents to generate electricity form solar energy technology in Malaysia. The independent variables of this model are socio-economic variables such as household education (EDU), income (HIC), age (AGE), gender (GEN), household size (HS), organization (ORG) and Knowledge about the solar photovoltaic system. These factors were derived from the survey and were added as independent variables since they were thought to be interesting from a theoretical standpoint. The Priori Expectations of the independent variables from the earlier investigations are presented in this section. The socioeconomic and environmental variables are referred to as independent variables in this study. Table 1 summarised the independents variables and their prior expectations.

III. RESULTS AND DISCUSSION

A) Knowledge and Opinions as Well as Beliefs about Renewable Technologies Such as Solar Energy

Figure 2 shows that participants were also asked if the public should be informed widely about RE. In total, 53.5% of participants strongly agreed, followed by 36% of agreeing individuals, 7.40% of neutral participants, 2.30% of disagreeing participants, and 0.78% of severely disagreeing participants. The majority of respondents thought that the general public needed to know about RE. Since the majority of the participants have not completed a higher education, they may have realised the value of education in understanding specific topics.

Since RE is regarded as a clean energy source and a replacement for current fossil-based energy sources, it goes without saying that it is crucial to comprehend. The implementation of the RE programme would also enable improvements in energy efficiency and the organic fuel economy, the resolution of local energy and water supply issues, an improvement in living standards and job opportunities for locals, as well as the assurance of sustainable growth in remote areas of the desert and mountain regions. Since RE technology is still in its early stages of adoption in Malaysia, the general public should be aware of what it is.

About 65.90% of respondents strongly agreed that RE energy should be the focus, compared to 26% who agreed, 7% who were neutral, 0.80% who disagreed, and 0.80% who strongly disagreed. Since the majority of respondents were aware of solar energy, more than half (65.9%) highly agreed, 26% agreed, 7% were neutral, and the remaining 0.8% disagreed or strongly disagreed that RE will act as a potential replacement for present energy sources in the future, as shown in Figure. This shows that the majority of respondents are accepting of a successful future brought about by the application of RE technology. According to this poll, 53.50% of respondents highly agreed, 27% agreed, 16.79% agreed but weren't sure, 2.30% disagreed, and 0.80% strongly disagreed with the idea that introducing RE technology would have a positive impact on the environment and reduce emissions. This suggests that the majority of respondents are aware of the main goals of creating sustainable energy via RE technologies. Due to the increasing fossil fuel energy use, CO2 emissions have increased proportionately, making Malaysia's vulnerability to climate change even greater (Ahmed et al., 2019; Suki et al., 2020; Destek & Sarkodia, 2019). Since 2000, Malaysia has had an annual forest loss of 140,200 hectares, or 0.65 percent of its total forest area. As a result, Malaysia's biodiversity is dwindling (Bekhet & Othman, 2018). The supply of natural resources has decreased by more than 50%, leading to an ecological shortage of 85%, while the ecological footprint has increased by more than 140% in Malaysia between 1971 and 2014. The nation is therefore one of those who use more natural resources than they have (Begum et al., 2006). The potential contribution of RE technology to improved energy generation efficiency was also asked of the responders. The deployment of RE technology will result in the provision of electricity, according to almost 60% of respondents who agreed strongly, 30% who agreed, 10.90% who were neutral, 1% who disagreed, and 0.20 percent who severely disagreed. Energy poverty and a lack of electricity in rural areas in industrialised countries are aggravating factors (Borhanazad et al., 2013). Grid power supply is not commercially viable in remote areas due to the high delivery costs and resulting lack of transportation. Evidently, the application of RE technology can resolve this problem. In Malaysia in particular, rural electrification using hybrid renewable energy systems (HERS) proved a workable alternative for remote areas without electricity. A single system is created by combining a variety of RE sources into HERS.

B) Energy Usage of the Households

Table 2 demonstrates that 21% of participants consume less than 500 kilowatts of electricity per month. However, 79 percent of respondents stated that they use more than 500 kilowatts of electricity each month. Table 3 demonstrates how much energy is used by families' water heaters. The majority of respondents (51%) use electricity to heat their water, followed by electric and gas combos (23%) and solar (17%). Gas is used by 9% of respondents. The absence of technologies suitable for widespread usage, such as solar panels, appears to be the main reason behind Malaysia's seeming lack of interest in renewable energies. The attitudes of the respondents towards the development of a consumer society with low carbon emissions were next probed. The majority of responders (76%) expressed interest in solar energy. The usage of solar energy has a lot of potential in light of this great interest.

C) The Obstacles Faced by the Households to Use Solar Energy

The problems they encountered and the underlying causes that discourage potential customers from embracing solar energy were the next questions posed to the respondents. Table 4 demonstrates the challenges that homes faced when employing solar power. The initial cost (mean = 4.337), lack of financial knowledge (mean = 4.267), obtaining the best price (4.209%), lack of access to the technology (mean = 3.682), and lack of awareness (mean = 3.605) are the most significant and significant barriers that prevent households from using solar energy.

D) Public Opinion on how to Increase Solar Energy Usage in the Households

In the questionnaire used in this study the respondents were asked to give their views on measures that could take by government to increase solar usage in the households. The results in Table 5 demonstrated that the measures mostly recommended by the respondents are government incentives to build solar power plants (mean = 4.341), increase solar panel installation (mean = 4.236), finding trustworthy contractor (mean = 4.205) and introducing solar photovoltaic technology in my house allows me to reduce emission of greenhouse gases (mean = 4.205).

E) Respondents' Attitudes toward Payment

Each respondent was asked to explain why they chose to answer "No" to the WTP question. In Table 6, the number and proportion of respondents who indicated they would be willing to pay for solar energy-generated electricity are shown.

Respondents' reasons for saying “no” to the WTP question are presented in Table 7. The findings reveal that 19.6% of the non-contributors said they had no additional income even though they would have made a contribution, and that these were sincere zero WTP responses brought on by low family income. About 34.3% of those who did not contribute did not believe that the programmes might encourage an increase in the production of electricity from RE resources. Additionally, 24.5% of respondents believed that the government should be in charge of subsidising solar energy research and development. Additionally, 8.8% of respondents believed that only those who pollute the environment should be responsible for paying for it, while 5.9% of respondents said that encouraging the expansion of power generation from RE resources is not that significant. The remaining 6.9% of respondents said that progress in solar energy could be made without their input. According to WTP (Johnston et al., 2017), there isn't a single set of best practises for handling protest responses at the moment. Therefore, we adopt the strategy that is the most conservative, in which the protest reaction is incorporated into the zero-bid group. Other energy policy CVM applications have frequently adopted this strategy (e.g., Lee and Heo, 2016; Kotchen et al., 2013; Xie and Zhao, 2018).

F) Respondents' WTP

In response to the WTP question, 81.8% (327 homes) of the respondents said they would be willing to make a larger donation to help Malaysia's research and development fund for solar energy (Table 8). 73 families, or the remaining 18.2%, reported having no WTP. Although not unusual, the rate of protest responses is rather high (Meyerhoff & Liebe, 2008; Chen, 2015; Xie and Zhao, 2018). Table shows the distribution of replies by household for the proposed RE fund contribution. The frequency of "yes" replies is expected to grow as the proposed contribution of the RE fund increases. However, the data in Table show that as the proposed contribution is raised, fewer respondents replied "yes" to the WTP questions. As a result, the outcomes of this study backed up the law of demand hypothesis. Bateman et al., 2002 discovered that the findings of their CVM survey supported the law of demand theory, and they concluded that if the CVM survey was correctly done, the results would support this economic theory.

G) Factors Affecting WTP of the Households to develop Solar Energy in Malaysia

In order to ascertain whether Malaysian households were WTP for solar energy development and to ascertain what factors influenced their WTP, regression analysis utilising logit models was conducted in this study. Table 9 provides an overview of the statistics and explanations of the chosen independent variables utilised in the logit models. Model 1 only includes the bid variable, whereas Model 2 also takes into account socioeconomic or attitudinal factors. As a result, Model 2 has a higher Pseudo R2 value than Model 1, confirming a superior model fit. The calculated outcomes of both models show that, at the 1% level of significance, the coefficients of the bid variable are negative and statistically significant. It suggests that when bid value increases, households are less likely to respond "yes" to the WTP inquiry. This result validates this CVM investigation's WTP estimates and is consistent with a priori assumptions from economic theories (Dogan and Muhammad, 2019; Horton et al., 2003; Chen et al., 2015).

The results in model 2 indicate that the WTP for solar energy development in Malaysia is significantly impacted by bid amount, income, gender, education, age, knowledge about renewable energy of the respondents. However, involve with environmental organization and the number of people living in the house were not significant factors determining WTP of the households for solar energy development and research in Malaysia. Referring to the coefficient related to education, this study finds that level of education significantly influences respondents' WTP for solar energy development and research in Malaysia and the Exp (β) or odds ratio is—5.05. This result reveals that respondents who are highly educated have the chance of paying 5.05 times more than the respondents who are lower educated, other things remaining the same. The study's results agree with those from earlier studies. For instance, Jin et al. (2019) discovered a positive and significant correlation between education and citizens' willingness to pay for the development of solar energy in Beijing, China. Furthermore, Han et al. (2020) hypothesised that respondents with higher levels of education have higher WTPs for the research and development money for solar energy in Myanmar. Therefore, it seems that more education-based efforts are necessary to increase support for solar research and development in Malaysia.

This study also discovered a substantial positive correlation between respondents' WTP for solar research and development and their monthly income level, with an odds ratio of 6.62. It means that the households with higher income have a chance of paying 6.62 times more than the households with lower income, other things remaining the same. This result is in line with earlier empirical studies carried out in both industrialised and developing nations. For example, research by Han et al. (2020) and Jin et al. (2019) indicated that wealth had a significant beneficial impact on WTP for green electricity. An odds ratio of 0.33 indicates that female respondents are substantially less eager to give than male respondents. According to this, if all other factors remain constant, female respondents had a chance of paying 0.33 times less than male respondents. However, the findings of Dogan and Muhammad (2019) for Turkey are consistent with our findings because women in developing countries such as Malaysia are less likely to be enabled than male households. These disparities can be ascribed to women's financial status, socio-cultural condition, and economic circumstance in terms of WTP for renewable energy. It is also estimated that age has an odds ratio of 0.96. This suggests that the younger respondents are more than 0.96 times likely to WTP for solar energy development in Malaysia than older respondents, other things remaining the same. Although they highly favour green electricity, older people's WTP decline as they age because they have apprehensive views towards homes. Kim et al. (2012) and Chan et al. (2015) discovered similar outcomes. However, Zorić and Hrovatin (2012) also discovered that ageing had a detrimental effect on Slovenia's WTP for renewable energy. They suggested that in addition to improving public awareness, green marketing should also target younger, better educated, and wealthier households. Last but not least, the odds ratio of 4.48 for knowledge and awareness suggests that for every unit increase in knowledge and awareness score, the likelihood of adopting solar energy increases by more than 4.48 times. This means that, assuming other factors stay the same, the likelihood of a household adopting solar energy improves by 4.48 times for every unit improvement in knowledge and awareness. As households are exposed to renewable energy sources like wind, solar, and geothermal energy, they become more knowledgeable about them and are therefore more inclined to use them to meet their energy needs. This suggests that increasing household understanding of the benefits of switching to renewable energy sources over other forms of non-renewable energy generation will serve as a motivator for households to do so. This study backs with previous findings (Ng'eno, 2014; Shen et al., 2015; Adepoju and Akinwale, 2019) showing knowledge and awareness of RE is a crucial factor of its adoption.

IV. CONCLUSION AND RECOMMENDATION

Despite the Malaysian government's several measures to encourage RE, fossil fuels are still used to generate 75% of the country's electricity supply. As a result, the RE development process is slow and believed to be in its early stages. Nevertheless, there are very few studies that analyse the intention of the households and their WTP for solar PV technology in Malaysia. Hence, these issues are unaddressed in Malaysia. In this scenario, it is completely very difficult for the stakeholders and policy makers to implement effective policies to encourage the households to use the solar PV technology for increasing the share of RE technology in the Malaysian energy mix. Motivated by the research gap, this study tried to contribute to the existing literature by conducting a CVM to ask the households in Selangor State if they are WTP more electricity surcharges to develop solar energy in Malaysia. 400 potential respondents were issued an online invitation with a link to the survey via email or social media. The study's conclusions showed that household income, age, education level, gender, environmental consciousness, and involvement in environmental organisations are significant predictors of WTP. The results in model 2 indicate that the WTP for solar energy development in Malaysia is significantly impacted by bid amount, income, gender, education, age, knowledge about renewable energy of the respondents. However, participation in environmental organisations and the number of occupants were not important variables in influencing the WTP of the households for solar energy research and development in Malaysia.

In the past 30 years, Malaysia has made significant strides towards using renewable energy sources in addition to fossil fuels. According to the November 2015 "Nationally estimated contributions to the United Nations Framework Convention on

Climate Change," Malaysia pledged to reduce the percentage of greenhouse gas emissions in its gross domestic product by 45% by 2030 compared to 2005. Malaysia totally depends on investment from industrialised nations, such as financial aid and technological transfer, in order to achieve this goal. Malaysia's first attempt at incorporating green power was to use biomass profitably in the early 2000s; as a result, by 2015, biomass accounted for 1% of all energy production. It is anticipated that more green energy would be used to protect the environment and stop climate change. The Malaysian government's efforts to develop and promote the renewable energy sector are represented by the time-long incentives. A recent study helped to better understand how the public feels and what they expect from solar PV installations and sustainable energy sources under the NEM. Despite the fact that the NEM scheme is expanding in scope in the solar panel industry, the study's findings reveal that the majority of Malaysians are unaware of the government's incentives and rules for renewable energy sources. As a result, they are unable to participate in the NEM scheme. The NEM system would have a reasonable return on investment, per the cost-benefit analysis. Malaysian houses have a number of challenges despite photovoltaic solar energy's availability, including high costs, a lack of physical and financial infrastructure, a lack of understanding, and a lack of social aid. If there is enough information in the media, this obstacle can be overcome, and renewed entry into Malaysia may be observed. But unless the broader public is made aware of it, this effort won't be able to operate at its full potential. Furthermore, the initial goal of generating 5.5 percent of electricity from renewable sources by 2015 will be missed without widespread popular support. Governments and private businesses can launch training and marketing campaigns to inform people about the use of renewable energy in an effort to speed up the adoption process. Media like publications, television, and local campaigns can be used to spread awareness of the advantages of solar energy. Since RE is seen as a clean energy source and a replacement for traditional fossil fuels, it is obviously crucial to understand it. Adopting the RE plan would also improve energy efficiency and the economics of organic fuels, as well as ease local concerns about water and energy supplies, raise the local population's standard of living, offer job opportunities, and promote long-term growth. Since it is still in the early stages of adoption in Malaysia, the general public should define RE technology specifically. To facilitate community acceptance of renewable energy, the government and private businesses can create marketing and training initiatives. From a corporate perspective, a comprehensive marketing strategy must be devised in order to make users aware of the product. In order to maintain the cost of using renewable energy at an affordable level, the government must ensure the provision of necessary policy support. Based on the survey results and literature reviews, a number of recommendations are made. Which are:

A) Incorporate Adequate Framework for Regulation

This calls for a suitable, robust, and effective regulatory framework that would address market imperfections and entice businesses to enter the RE generating industry. FiT should be included in the legal framework as a catalyst for entry into the RE-energy industry, RE industries, and RE research and development (R&D). The decreased environmental pollution will also mean that society will need to contribute to a fund that will be used to pay for the RE electricity. This is especially important because retail tariffs omit external costs and contain subsidies that are being reduced. A method would be to incorporate a specific cost into a specific RE fund inside the energy price structure. R&D in RE technology and innovation has a direct spillover effect (for example, via enhanced boiler technologies, etc.), making it a regulator that would operate as an accelerator in the development of RE industries. These outcomes include the rate of growth in the use of RE, the gradual (or steady) decline in the use of fossil fuels for the production of conventional electricity, and the decrease in CO2 emissions.

B) Support RE Companies with Conducive Environments

The term "EM industry" refers to the manufacturing of RE or finished items (such as boilers, turbines, PV modules, etc.), as well as the support industries for RE production (such as technicians, consultants, engineers, and construction workers). The focus is on real estate and the related sectors, also known as real estate businesses. Fiscal stimuli, indirect support for lowering transaction costs, and assistance for SMEs in the RE sector are all part of the incentive package. This goes above and beyond the NEM policy, which encourages people to work in the RE power generation sector.

In Malaysia, RE is a unique technology that necessitates the development of human resources to support the growth of the RE industry. However, Malaysia needs to find a short-term solution to the human resource shortage by luring scientists to the country. Instead of innovation, research and development's (R&D) goal is invention.

For instance, innovation (also known as "the concept of the giants standing on the shoulders") helped advance the microprocessor. It is therefore necessary to build a thorough R&D plan that results in new products and services in order to hasten the expansion of RE industries. By making technology use more accessible and affordable, innovation also contributes to the spread of RE. As a result, it is necessary to design an R&D strategy to define demand, employ legislation to encourage innovation, and support R&E efforts.

Programmes for advocacy should be designed to deliver particular messages to particular populations. To get a buy-in to the idea of clean social payments, for instance, an investment advocacy campaign and a RE market entry must express a message that is very different from a normal public advocacy plan. All advocacy activities share the same goal of increasing stakeholder awareness of the advantages of using RE and participation in RE businesses.

The policy mission should be assessed and (if necessary) time-expanded after the foundation has been laid. For instance, an appropriate regulatory structure would have been in place to incorporate the regulation if the policy were amended in five years. Nevertheless, it might need to be improved upon or replaced as necessary by a new impetus as part of the continual policy vision objective.

C) Human capital development

Because it may have the greatest impact on the nation, human capital development is an essential factor. The Malaysian government recognises the value of human development as it may boost the country's overall productivity and flexibility, both of which are crucial for the transition between the community and the economy. As a result, the government is urged to build the required infrastructure. However, it is crucial to encourage people to enrol in tertiary colleges because the number of persons in the country with a university education is low (13.9 percent in 2001). This requires figuring out what inspires someone to complete high school and how the government might drive them.

Therefore, it is necessary to produce RE experts at the same time to encourage the growth of new capacities and skills among common people. However, there is a sunset clause that applies to these proceedings. The Ministry of Finance, the Minister of Higher Education, the Minister of Human Resources, and other relevant governmental organisations must coordinate institutional arrangements to accomplish this goal.

V. LIMITATIONS OF THE STUDY

Due to budget and time constraints, this study is limited to the state of Selangor in Malaysia. As a result, more states can be included in future studies. There are also some other associated elements that could affect the intention of the households to adopt solar PV that could be integrated. In this way, the findings of the future studies can benefit various stakeholders such as households, TNB, producers, solar farms, and policymakers. Furthermore, future research could concentrate not only on solar energy but also on other types of renewable energy.

CVM Valuation QUESTION

Right now, I am going to read some information on renewable energy development policy in Malaysia. One strategy to diversify the nation's energy sources is to produce power using renewable energy sources. In order to ensure that future generations continue to benefit, it is essential that we maintain the natural resources. Therefore, it is important to promote the wise use of natural resources like gas, coal, and oil. The RE Fund (KWTBB), created by the RE Act of 2011, was established to ensure the survival of the natural fossil fuel reserves. Sustainable Energy Development Authority (SEDA) is responsible for managing and overseeing the RE Fund. The renewable energy (RE) Act of 2011 imposes 1.6% surcharges on consumers' power consumption (No. 28 in the sample bill image), which must be directed to the RE Fund (KWTBB). The surcharge, however, only applies to monthly consumption that exceeds 300 kW. Therefore, the total consumption charges for the current billing period are subject to a 1.6% surcharge. This sum is delivered to SEDA. This is exempt from GST. Despite SEDA's accomplishment in obtaining RM600 million from the levy for the RE Fund in 2014, the sum is not enough to support the RE projects.

Q6. Would you be ready to apply a fee to your power bill in order to support the expansion of electricity production from RE resources, taking into account your household's income and expenses? So, what is your willingness to pay (WTP)?

Q7. Additional Willingness to Pay (WTP) if more than 0.01%

Q7 (i). Are you willing to pay an additional 0.02% surcharge on your electricity bill to promote the growth of electricity generation from RE resources?

a) Yes
b) No

Q7 (ii). Additional WTP if more than 0.02%

a) Yes
b) No

Q7 (iii). If more WTP

a) Yes
b) No

Q7 (3). The highest amount of WTP (2nd Phase)

Q8. How much the most you are willing to pay for the cost so that the government can achieve this program to promote the growth of electricity generation from RE resources? (Amount in RM)

Q9. Reason for no WTP

Q10. If your answer is no for the Q6, answer this question. Which of the following reason closely related to your decision?

a) Have no extra income otherwise would contribute
b) Don’t think that the programs can promote the growth of electricity generation from RE resources
c) It is the government responsibility
d) To promote growth of electricity generation from RE resources is not that important
e) It is the responsibility of only those who pollute the environment should pay for it
f) No answering

Figure 1. CVM Valuation Questionnaire

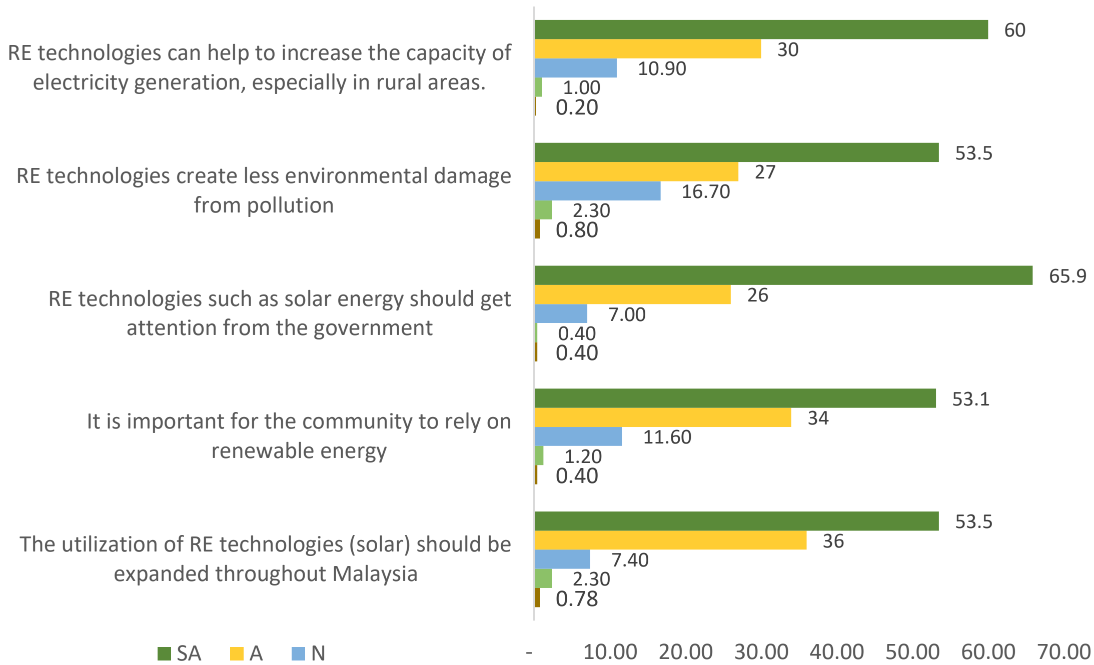

Figure 2: Knowledge and opinions as well as belief about RE Technologies

Table 1. The Theoretical Expectations of Dependent and Independent Variables

Variables	**Definition**	**Expected Sign**
Dependent Variable		
Willingness to Pay	Dummy to represent willingness to pay '1' and not willingness to pay '0'	+
Independent Variables		
BID	Extra payment for electricity generation from solar energy (RM/kwh)	
Education (EDU)	Dummy to represent the respondent who has diploma degree & above "1", and others "0".	+
Household Income (HI)	If the respondents' income is below 3000 RM, it takes 1, If the respondents' income is between RM 3001-10,000 RM, it takes 2 otherwise it takes the value of 0.	+
Gender (GEN)	Dummy to represent male '1' and female '0'	+/-
Age (AGE)	In Years	+/-
Organization (ORG)	If any household member is involved with environmental organization '1', otherwise '0'	+/-
Number of Dependent (DEP)	Numbers	+/-
Knowledge about renewable energy	Household's knowledge about the renewable energy. If yes '1', otherwise '0'	+

Table 2: Monthly Electricity Usage of the Households

Average electricity use (kw/month)	**Frequency**	**Percentage**
Below 500KWh	84	21
500–1000KWh	120	30
1000–3000KWh	92	23
3000–5000KWh	40	10
5000–10000KWh	32	8
More than 10000 KWh	32	8
Total	**400**	**100**

Table 3. Monthly Energy Usage of the Households' Water Heater

Energy	Frequency	Percentage
Electricity	203	51
Gas	37	9
Electricity and Gas	92	23
Solar	68	17
Total	**400**	**100**

Table 4. The Obstacles faced by the households to use solar energy

	Mean	Std. Deviation
Limited information on Renewable energy	3.628	1.1540
High initial/instalment cost	4.337	0.9817
Limited financial information	4.267	0.8611
Obtaining best possible price	4.209	0.9054
Lack of awareness	3.605	1.2656
Lack of access to the technology	3.682	1.2062

Table 5. Public Opinion on how to increase solar energy usage in the households

Measures	Mean	Std. Deviation
Increases taxes	2.895	1.2877
Finding trustworthy contractor	4.205	0.9338
Increase solar panel installation	4.236	0.8790
Increase taxes on fuels	3.074	1.1992
Government incentives to build solar power plants	4.341	0.8037
Increase taxes on businesses that release GHG's into the atmosphere	4.054	1.0311
Introducing solar photovoltaic technology in my house allows me to reduce emission of greenhouse gases	4.205	0.7693

Table 6. Willingness to Pay for Logit

WTP	No	Percentage
No	73	18.3
Yes	327	81.8
Total	**400**	**100.0**

Table 7. Respondents' Reasons of Refusing to Pay (multiple response)

Reasons	No	Percentage
Have no extra income otherwise would contribute	20	19.6
Don't think that the programs can promote growth of electricity generation from RE resources.	35	34.3
It is the government responsibility	25	24.5
To promote growth of electricity generation from RE resources is not that important	6	5.9
It is the responsibility of only those who pollute the environment should pay for it	9	8.8
Solar energy can be developed without their contributions	7	6.9

Table 8. Distribution of Responses by Proposed Contribution of RE fund

Percentage of RE fund	Yes		No	
	Number of respondents	%	Number of respondents	%
1.7	102	25.4	298	74.6
1.8	76	19	324	81
2	63	15.7	337	84.3
2.1	61	15.7	339	84.3
2.6	25	6.2	375	93.8

Table 9. Logit Model Analysis Results

	Model 1				Model 2			
Variable	**Coefficient**	**Std. Error**	**z-Statistics**	**Prob.**	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
Bid	-0.02	0.00	-6.81	0.000	-0.34	0.12	-2.83	0.020
C	0.94	0.10	9.89	0.000	-0.72	0.27	-2.65	0.008
Education					1.62	0.51	3.17	0.002
Income					1.89	0.29	6.50	0.000
Gender					-1.11	0.28	-3.92	0.000
Age					-0.04	0.01	-5.12	0.000
Organization					1.31	0.58	2.25	0.024
No of family member					-0.28	0.11	-2.69	0.007
Knowledge					1.51	0.36	4.24	0.000
Summary Statistics								
Log likelihood	69.08				432.40			
Prob>ch^2	0.000				0.000			
Pseudo R^2	0.05				0.364			
Number of Observation	400				400			

VI. REFERENCE

[1] Abd Rahman, N. A., Kamaruzzaman, S. N., & Akashah, F. W. (2019). Scenario and Strategy towards Energy Efficiency in Malaysia: A Review. In *MATEC Web of Conferences* (Vol. 266, p. 02012). EDP Sciences.

[2] Adepoju, A. O., & Akinwale, Y. O. (2019). Factors influencing willingness to adopt renewable energy technologies among micro and small enterprises in Lagos State Nigeria. *International Journal of Sustainable Energy Planning and Management*, *19*, 69-82.

[3] Afroz, R., Hanaki, K., & Hasegawa-Kurisu, K. (2009). Willingness to pay for waste management improvement in Dhaka city, Bangladesh. *Journal of environmental management*, *90*(1), 492-503.

[4] Ahmad, S., Ab Kadir, M. Z. A., & Shafie, S. (2011). Current perspective of the renewable energy development in Malaysia. *Renewable and sustainable energy reviews*, *15*(2), 897-904.

[5] Ahmed, A., Ge, T., Peng, J., Yan, W. C., Tee, B. T., & You, S. (2022). Assessment of the renewable energy generation towards net-zero energy buildings: A review. *Energy and Buildings*, *256*, 111755.

[6] Ahmed, N., Thompson, S., & Glaser, M. (2019). Global aquaculture productivity, environmental sustainability, and climate change adaptability. *Environmental management*, *63*(2), 159-172.

[7] Alba, J. W., & Hutchinson, J. W. (1987). Dimensions of consumer expertise. *Journal of consumer research*, *13*(4), 411-454.

[8] Alberini, A., & Cooper, J. (2000). *Applications of the contingent valuation method in developing countries: A survey* (Vol. 146). Food & Agriculture Org.

[9] Álvarez-Farizo, B., & Hanley, N. (2006). Improving the process of valuing non-market benefits: combining citizens' juries with choice modelling. *Land economics*, *82*(3), 465-478.

[10] Anugwa, I. Q., Onwubuya, E. A., Chah, J. M., Abonyi, C. C., & Nduka, E. K. (2022). Farmers' preferences and willingness to pay for climate-smart agricultural technologies on rice production in Nigeria. *Climate Policy*, *22*(1), 112-131.

[11] Ashnani, M. H. M., Johari, A., Hashim, H., & Hasani, E. (2014). A source of renewable energy in Malaysia, why biodiesel?. *Renewable and Sustainable Energy Reviews*, *35*, 244-257.

[12] Ayodele, T. R., Ogunjuyigbe, A. S. O., Ajayi, O. D., Yusuff, A. A., & Mosetlhe, T. C. (2021). Willingness to pay for green electricity derived from renewable energy sources in Nigeria. *Renewable and Sustainable Energy Reviews*, *148*, 111279.

[13] Ayodele, T. R., Ogunjuyigbe, A. S. O., Ajayi, O. D., Yusuff, A. A., & Mosetlhe, T. C. (2021). Willingness to pay for green electricity derived from renewable energy sources in Nigeria. *Renewable and Sustainable Energy Reviews*, *148*, 111279.

[14] Aziz, N. S. N. A., Wahid, N. A., Sallam, M. A., & Ariffin, S. K. (2017). Factors Influencing Malaysian Consumers' Intention to Purchase Green Energy: The Case of Solar Panel. *Global Business and Management Research*, *9*(4s), 328-346.

[15] Azlina, A. A., Kamaludin, M., & Sin, M. S. (2018). Willingness to Pay for Renewable Energy: Evidence from Malaysian's Households. *Jurnal Ekonomi Malaysia*, *52*(3), 143-151.

[16] Azlina, A. A., Kamaludin, M., & Sin, M. S. (2018). Willingness to Pay for Renewable Energy: Evidence from Malaysian's Households. *Jurnal Ekonomi Malaysia*, *52*(3), 143-151.

[17] Bang, G. (2010). Energy security and climate change concerns: Triggers for energy policy change in the United States?. *Energy policy*, *38*(4), 1645-1653.

[18] Begum, R. A., Siwar, C., Pereira, J. J., & Jaafar, A. H. (2006). A benefit–cost analysis on the economic feasibility of construction waste minimisation: the case of Malaysia. *Resources, conservation and recycling*, *48*(1), 86-98.

[19] Bekhet, H. A., & Othman, N. S. (2018). The role of renewable energy to validate dynamic interaction between CO2 emissions and GDP toward sustainable development in Malaysia. *Energy economics*, *72*, 47-61.

[20] Benjamin, E. O., Hall, D., Sauer, J., & Buchenrieder, G. (2022). Are carbon pricing policies on a path to failure in resource-dependent economies? A willingness-to-pay case study of Canada. *Energy Policy*, *162*, 112805.

[21] Borhanazad, H., Mekhilef, S., Saidur, R., & Boroumandjazi, G. (2013). Potential application of renewable energy for rural electrification in Malaysia. *Renewable energy*, *59*, 210-219.

[22] Central Intelligence Agency. (2011). The World Factbook. Accessed from: https://www.cia.gov/library/publications/the-world-factbook/geos/my.html (Accessed on: September 28, 2020)
[23] Chan, K. Y., Oerlemans, L. A., & Volschenk, J. (2015). On the construct validity of measures of willingness to pay for green electricity: Evidence from a South African case. *Applied Energy*, *160*, 321-328.
[24] Chen, W. Y. (2015). Public willingness-to-pay for conserving urban heritage trees in Guangzhou, south China. *Urban Forestry & Urban Greening*, *14*(4), 796-805.
[25] Ciriacy-Wantrup, S. (1947). Major economic forces affecting agriculture with particular reference to California. *Hilgardia*, *18*(1), 1-76.
[26] COP15. (2009). United Nations Climate Change conference on climate change global risk challenges & decisions. Available at: https://www.certh.gr/dat/22FB0268/file.pdf
[27] Cosmi, C., Macchiato, M., Mangiamele, L., Marmo, G., Pietrapertosa, F., & Salvia, M. (2003). Environmental and economic effects of renewable energy sources use on a local case study. *Energy Policy*, *31*(5), 443-457.
[28] Destek, M. A., & Sarkodie, S. A. (2019). Investigation of environmental Kuznets curve for ecological footprint: the role of energy and financial development. *Science of the Total Environment*, *650*, 2483-2489.
[29] Dogan, E., & Muhammad, I. (2019). Willingness to pay for renewable electricity: A contingent valuation study in Turkey. *The Electricity Journal*, *32*(10), 106677.
[30] Economic Planning Unit (EPU), Malaysia. (2016). *11th Malaysia plan (2016-2020).* Putrajaya: Prime Minister's Department.
[31] Economic Planning Unit (EPU). (2006). *Ninth Malaysia Plan 2006-2010*. Economic Planning Unit, Putrajaya, Malaysia
[32] Energy Commission (ST), Malaysia. (2015). *Malaysia energy statistics handbook 2015.* Available at: http://www.st.gov.my. (Accessed: 30 March 2020)
[33] Energy Commission (ST), Malaysia. (2017). *Energy in Malaysia: Towards a brighter future.* Vol. 12. The IBR Asia Group, Selangor, Malaysia
[34] Energy Commission (ST), Malaysia. (2019). *Malaysia energy statistics handbook 2019.* Energy Commission, Putrajaya, Malaysia. Available at: https://meih.st.gov.my/documents/10620/bcce78a2-5d54-49ae-b0dc-549dcacf93ae (Accessed on: 15 July 2020).
[35] Energy Commission (ST), Malaysia. (2020). Malaysia energy information hub. Online Data. Retrieved on July 15, 2020. Retrieved from: https://meih.st.gov.my/statistics
[36] Faiers, A., & Neame, C. (2006). Consumer attitudes towards domestic solar power systems. *Energy policy*, *34*(14), 1797-1806.
[37] Guo, X., Liu, H., Mao, X., Jin, J., Chen, D., & Cheng, S. (2014). Willingness to pay for renewable electricity: A contingent valuation study in Beijing, China. *Energy Policy*, *68*, 340-347.
[38] Guo, X., Liu, H., Mao, X., Jin, J., Chen, D., & Cheng, S. (2014). Willingness to pay for renewable electricity: A contingent valuation study in Beijing, China. *Energy Policy*, *68*, 340-347.
[39] Han, M. S., Biying, Y., Cudjoe, D., & Yuan, Q. (2020). Investigating willingness-to-pay to support solar energy research and development in Myanmar. *Energy Policy*, *146*, 111820.
[40] Hanemann, W. M. (1989). Welfare evaluations in contingent valuation experiments with discrete response data: reply. *American journal of agricultural economics*, *71*(4), 1057-1061.
[41] Hao, Y., Liu, H., Chen, H., Sha, Y., Ji, H., & Fan, J. (2019). What affect consumers' willingness to pay for green packaging? Evidence from China. *Resources, Conservation and Recycling*, *141(2)*, 21-29.
[42] Hensher, D. A., Greene, W. H., & Rose, J. M. (2003). Using classical inference methods to reveal individual-specific parameter estimates to avoid the potential complexities of WTP derived from population moments.
[43] Horton, B., Colarullo, G., Bateman, I. J., & Peres, C. A. (2003). Evaluating non-user willingness to pay for a large-scale conservation programme in Amazonia: a UK/Italian contingent valuation study. *Environmental Conservation*, *30*(2), 139-146.
[44] Idris, I., Hoque, M. E., & Susanto, P. (2022). Willingness to pay for the preservation of urban green space in Indonesia. *Cogent Economics & Finance*, *10*(1), 2008588.
[45] International Energy Agency (IEA). (2017). *World Energy Outlook.* Paris, France.
[46] Jin, J., Wang, Z., & Ran, S. (2006). Comparison of contingent valuation and choice experiment in solid waste management programs in Macao. *Ecological Economics*, *57*(3), 430-441.
[47] Kim, J., Park, J., Kim, H., & Heo, E. (2012). Assessment of Korean customers' willingness to pay with RPS. *Renewable and sustainable energy reviews*, *16*(1), 695-703.
[48] Kolstoe, S., & Cameron, T. A. (2017). The non-market value of birding sites and the marginal value of additional species: biodiversity in a random utility model of site choice by eBird members. *Ecological economics*, *137*, 1-12.
[49] Kotchen, M. J., & Grant, L. E. (2011). Does daylight saving time save energy? Evidence from a natural experiment in Indiana. *Review of Economics and Statistics*, *93*(4), 1172-1185.
[50] Kotchen, M. J., Boyle, K. J., & Leiserowitz, A. A. (2013). Willingness-to-pay and policy-instrument choice for climate-change policy in the United States. *Energy Policy*, *55*, 617-625.
[51] Kumar, M. N., Sudhakar, K., & Samykano, M. (2019). Techno-economic analysis of 1 MWp grid connected solar PV plant in Malaysia. *International Journal of Ambient Energy*, *40*(4), 434-443.
[52] Lee, C. Y., & Heo, H. (2016). Estimating willingness to pay for renewable energy in South Korea using the contingent valuation method. *Energy Policy*, *94*, 150-156.
[53] Lee, C. Y., & Heo, H. (2016). Estimating willingness to pay for renewable energy in South Korea using the contingent valuation method. *Energy Policy*, *94*, 150-156.
[54] Lee, C. Y., & Heo, H. (2016). Estimating willingness to pay for renewable energy in South Korea using the contingent valuation method. *Energy Policy*, *94*, 150-156.
[55] Lee, C. Y., & Heo, H. (2016). Estimating willingness to pay for renewable energy in South Korea using the contingent valuation method. *Energy Policy*, *94*, 150-156-167.
[56] Li, X. D., Wu, X., & Zhang, Z. H. (2005). Study on social WTP for environmental impacts based on the LCA theory. *Journal of Harbin Institute of Technology*, *11*.
[57] Liu, W., Wang, C., & Mol, A. P. (2013). Rural public acceptance of renewable energy deployment: The case of Shandong in China. *Applied energy*, *102*, 1187-1196.
[58] Longo, A., Markandya, A., & Petrucci, M. (2008). The internalization of externalities in the production of electricity: willingness to pay for the attributes of a policy for renewable energy. *Ecological economics*, *67*(1), 140-152.
[59] Mathiesen, B. V., Lund, H., & Karlsson, K. (2011). 100% Renewable energy systems, climate mitigation and economic growth. *Applied energy*, *88*(2), 488-501.

[60] Meyerhoff, J., & Liebe, U. (2008). Do protest responses to a contingent valuation question and a choice experiment differ?. *Environmental and Resource Economics*, *39*(4), 433-446.

[61] Mitchell, R. C., Carson, R. T., & Carson, R. T. (1989). *Using surveys to value public goods: the contingent valuation method*. Resources for the Future Press.

[62] Muhammad, I., Shabbir, M. S., Saleem, S., Bilal, K., & Ulucak, R. (2021). Nexus between willingness to pay for renewable energy sources: evidence from Turkey. *Environmental Science and Pollution Research*, *28*(3), 2972-2986.

[63] Muhammad-Sukki, F., Abu-Bakar, S. H., Munir, A. B., Yasin, S. H. M., Ramirez-Iniguez, R., McMeekin, S. G., ... & Karim, M. E. (2014). Feed-in tariff for solar photovoltaic: The rise of Japan. *Renewable energy*, *68*, 636-643.

[64] Ng'eno, B., & Mwangi, A. (2014). Burden of HIV infection among children aged 18 months to 14 years in Kenya: results from a nationally representative population-based cross-sectional survey. *Journal of acquired immune deficiency syndromes (1999)*, *66*(Suppl 1), S82.

[65] Nomura, N., & Akai, M. (2004). Willingness to pay for green electricity in Japan as estimated through contingent valuation method. *Applied Energy*, *78*(4), 453-463.

[66] Oerlemans, L. A., Chan, K. Y., & Volschenk, J. (2016). Willingness to pay for green electricity: A review of the contingent valuation literature and its sources of error. *Renewable and Sustainable Energy Reviews*, *66*, 875-885.

[67] Oerlemans, L. A., Chan, K. Y., & Volschenk, J. (2016). Willingness to pay for green electricity: A review of the contingent valuation literature and its sources of error. *Renewable and Sustainable Energy Reviews*, *66*, 875-885.

[68] Pieniak, Z., Aertsens, J., & Verbeke, W. (2010). Subjective and objective knowledge as determinants of organic vegetables consumption. *Food quality and preference*, *21*(6), 581-588.

[69] Pieniak, Z., Vanhonacker, F., & Verbeke, W. (2013). Consumer knowledge and use of information about fish and aquaculture. *Food policy*, *40(2)*, 25-30.

[70] Roe, B., Teisl, M. F., Levy, A., & Russell, M. (2001). US consumers' willingness to pay for green electricity. *Energy policy*, *29*(11), 917-925.

[71] Shahzad, T., Shah, S. T. H., Rais, S. I., Mansoor, A., & Zaman, K. (2022). People's attitude towards willingness-to-pay for environmental protection in Pakistan. *Environmental Science and Pollution Research*, 1-20.

[72] Solangi, K. H., Islam, M. R., Saidur, R., Rahim, N. A., & Fayaz, H. (2011). A review on global solar energy policy. *Renewable and sustainable energy reviews*, *15*(4), 2149-2163.

[73] Štreimikienė, D., & Baležentis, A. (2015). Assessment of willingness to pay for renewables in Lithuanian households. *Clean Technologies and Environmental Policy*, *17*(2), 515-531.

[74] Suki, N. M., Sharif, A., Afshan, S., & Suki, N. M. (2020). Revisiting the Environmental Kuznets Curve in Malaysia: The role of globalization in sustainable environment. *Journal of Cleaner Production*, *264*, 121669.

[75] Sun, C., Yuan, X., & Yao, X. (2016). Social acceptance towards the air pollution in China: evidence from public's willingness to pay for smog mitigation. *Energy Policy*, *92*, 313-324.

[76] Taale, F., & Kyeremeh, C. (2016). Households′ willingness to pay for reliable electricity services in Ghana. *Renewable and Sustainable Energy Reviews*, *62*, 280-288.

[77] Taale, F., & Kyeremeh, C. (2016). Households′ willingness to pay for reliable electricity services in Ghana. *Renewable and Sustainable Energy Reviews*, *62*, 280-288.

[78] Taha, F. (2013, November). Development of Energy Labelling in Malaysia. In *Past, Present and Future. APEC Seminar on Cooperation on Energy Labelling* (pp. 1-5).

[79] Thi, C. H., Kirby, M., & Tran, L. D. (2022). User willingness to pay for natural resource conservation at Bach Long Vy Island, Vietnam. *Vietnam Journal of Earth Sciences, ahead of* print(ahead of print), 1-18. https://doi.org/10.15625/2615-9783/16969

[80] Uehleke, R. (2016). The role of question format for the support for national climate change mitigation policies in Germany and the determinants of WTP. *Energy Economics*, *55*, 148-156.

[81] Wang, Y. W., Yang, Y. H., & Zhao, N. (2012, April). Effect of air pollution on sunshine hours in China. In *EGU General Assembly Conference Abstracts* (Vol. 14, p. 1928).

[82] Wang, Y., & Zhang, Y. S. (2009). Air quality assessment by contingent valuation in Ji'nan, China. *Journal of environmental management*, *90*(2), 1022-1029.

[83] Whitehead, J. C., & Cherry, T. L. (2007). Willingness to pay for a green energy program: a comparison of ex-ante and ex-post hypothetical bias mitigation approaches. *Resource and energy economics*, *29*(4), 247-261.

[84] Whitehead, J. C., & Cherry, T. L. (2007). Willingness to pay for a green energy program: a comparison of ex-ante and ex-post hypothetical bias mitigation approaches. *Resource and energy economics*, *29*(4), 247-261.

[85] World Bank. (2020). The World Bank in Malaysia. Retrieved from: https://www.worldbank.org/en/country/malaysia/overview (Accessed on: 29 July 2020).

[86] World Energy Markets Observatory (WEMO) report. (2017). World Energy Markets Observatory: A strategic overview of the global energy markets, 19th Ed. Capgemini. Available at: https://www.capgemini.com/wp-content/uploads/2017/11/wemo2017-vst27-web.pdf

[87] Xie, B. C., & Zhao, W. (2018). Willingness to pay for green electricity in Tianjin, China: Based on the contingent valuation method. *Energy Policy*, *114*, 98-107.

[88] Xie, B. C., & Zhao, W. (2018). Willingness to pay for green electricity in Tianjin, China: Based on the contingent valuation method. *Energy Policy*, *114*, 98-107.

[89] Xie, B. C., & Zhao, W. (2018). Willingness to pay for green electricity in Tianjin, China: Based on the contingent valuation method. *Energy Policy*, *114*, 98-107.

[90] Zhang, L., & Wu, Y. (2012). Market segmentation and willingness to pay for green electricity among urban residents in China: The case of Jiangsu Province. *Energy Policy*, *51*, 514-523.

[91] Zhang, X., Shen, L., & Chan, S. Y. (2012). The diffusion of solar energy use in HK: what are the barriers?. *Energy Policy*, *41*, 241-249.

[92] Zorić, J., & Hrovatin, N. (2012). Household willingness to pay for green electricity in Slovenia. *Energy policy*, *47*, 180-187.