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Public Acceptance of Solar Energy: A Perspective of Households in Malaysia

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Abstract
Purpose: This article aims to study the public perspective towards solar energy and targeting the household group. Household refers to individuals and families.
Design/methodology/approach: With recent restricted conditions and the pandemic still widespread all over the country, online google forms have been selected to disseminate the survey. Chi square is employed to see the association in hypothesis 1.

Findings: This paper aims to investigate the understanding of the household towards solar energy including portraying their interest and opinion towards solar energy consumption at their premises. Majority of respondents show positive opinions, but this simply is not enough and is worrying because even they are aware, they do not exercise it. Hypothesis 1 tested and the result supported the hypothesis. Clearly indicates that interest, knowledge, awareness, support and culture are crucial, and initiatives and awareness need to be aligned.
Research limitations/implications: This research impacts the association of interest, awareness and support towards the household acceptance in consuming solar energy in daily transactions. The findings can be used as fundamental for the future studies
Practical implications: The findings and discussions are benefits input for policy maker. The policy generate should also consider boosting up empathy in the public. The empathy culture is crucial due to it shapes the citizen wellbeing and led to a better environment for global.
Originality/value: Profiling background study is used in this study to assess relationship between interest and accept to use solar.
Paper type: Research paper

Keywords: Solar energy, Interest, Citizen wellbeing, Environment, Pandemic

Introduction

Coal burning in producing energy activities are possibilities that contribute the massive amount of carbon emission, later triggering global warming and unpredictable weather. Coal has been used disproportionately and it led to its depletion. For example, Kuo (2019) shared the statistic of natural source and expectation to finish. See Table 1 below

Table 1: Natural Sources and Expecting Depletion Time

Natural sources	Expecting year to finish	How long to go
Oil	2052	30 years
Gas	2060	40 years
Coal	2090	70 years

Source: Kuo (2019)

The table above indicates that within 30 -70 years the natural sources are soon to deplete, furthermore one of the natural sources, coal was a main contributor to the Greenhouse gas emission to world (Ritchie & Rosser, 2020). Therefore, it is worth to stop the usage of coal in broad. For example, countries like South Korea, Japan has taken positive initiative to shut down any power plant that commit to coal in their production activities (Brock, 2020). Following this, it's supposed to be a global initiative to reduce the coal consumption mainly for the reason of environmental wellbeing.

For Malaysia context, solar has become a potential alternative energy because Malaysia receives sunlight in long hours. Jaafar, Kheng, and Kamaruddin (2002) add that with long hours of sunlight receives able to produce "5.5-Kilowatt hours per square meter (KWh/m2) solar radiation every day". Many scholars from Malaysia started to discuss about the solar acceptance among Malaysians (for example, Haw, Sopian, Sulaiman, Hafidz & Yahya, 2009; Kardooni & Yusoff, 2016; Ahmad, Mat Tahar, Cheng & Yao, 2017); however, the findings of public acceptance towards solar energy is still low. Hence, this paper aims to investigate the understanding of the household towards solar energy including portraying their interest and opinion towards solar energy consumption at their premises

Literature Review

Globally, the issue of energy has been discussed actively among the scholars in aspect of energy consumption, economic and social development and as well as improving the human wellbeing (for example, Haw, Sopian, Sulaiman, Hafidz & Yahya, 2009; Kardooni & Yusoff, 2016; Ahmad, Mat Tahar, Cheng & Yao, 2017; Levison & Oehme, 2017; Ritchie & Roser, 2020; Djurisic, Smolovic,, Misnic, & Rogic,2020). Previous findings highlight that more studies are crucially needed to improve the current climate change and to oversee the alternative energy resources needed as the natural energy resources are decreasing (for example, depletion of fossil fuel resources). Most of the studies on alternative energy focuses on solar and wind energy (Majeed, Khallid & Ibrahim, 2010). These energies are among the top choices for an alternative energy choice due to its noiselessness and non-carbon dioxide emission during the operation and requires simple operation and maintenance as well its flexibility scale (Dincer, 2011). It requires simple operation and maintenance because it does not need mechanical support such as motor or generator (as needed in hydro, wind, wave) or chemical support (as needed in bio fuels) (Shafie, Mahlia, Masjuki & Andriyana, 2011). Interestingly, recent researcher found that solar energy holds main character to generate a sustainable and secure energy for the future globally (Dmitrii et al., 2021).

Previous research revealed that solar energy can be one of the solutions to mitigate climate change and pollution issues (Creutzig et al., 2017; Irfan et al., 2019a). This is because the ability of solar energy could produce such as producing clean energies (Arnulf, 2007; Roland, 2007), reducing carbon emissions (Sweerts et al., 2019), generating cheap energy (Irfan et al., 2019b), and as a stabiliser in future prices for electricity (Kabir et al., 2018). The benefits apparently are important for the wellbeing betterment. For Malaysia context, solar energy has been considered suitable due to its strategic geographical location. Implementation of solar energy would indicate a successful story, but it depends on how well solar energy been accepted by the public. The greater acceptance by the public, the wider usage of solar energy in daily transaction. Hence, provide us with a better environment to be lived in and human wellbeing is improved.

Contextual Factors in Public Acceptance

Contextual factors are used to address the public acceptance of solar energy (Ben-Cheikh, Abdellatif & Bakini, 2015). The factors including political and strategic factors, socio-economic, cultural and geographical (Brohmann et al., 2007). For example, in Malaysia, renewable energy for the electricity generations were introduced in the fifth-fuel policy under the 8th and 9th Malaysian plans (Hashim & Ho, 2011). This introduction is potentially intent to prepare and to help the country related to matter using renewable energy sources in electricity generation. See Table 1. Financial support also in government consideration when introducing this renewable energy ecosystem (Ahmad & Tahar, 2014; Muhammad-Sukki et al., 2011). In another aspect from end user perspective, many scholars found that Malaysia still receive low attention and acceptance from the public towards renewable (Alam et al., 2014; Lim & Lam, 2014), specifically from area motivation and attitude towards solar energy acceptance (Solangi et al., 2015; Muhammad-Sukki et al., 2011). Malik and Ayop (2020) highlight that knowledge and awareness on solar energy play a role in adopting that energy into their routine transaction.

Hypothesis Development

In relation to the above discussion, this article found out that interest of individuals in terms of having the right knowledge on solar, awareness about solar, know the benefits of solar, those

play role to influence individual intention to accept the energy solar in their daily life. The hypothesis as below:
Hypothesis null: There is no association between interest in solar and intention to accept the solar energy
Hypothesis alternative: There is an association between interest in solar and to accept the solar energy

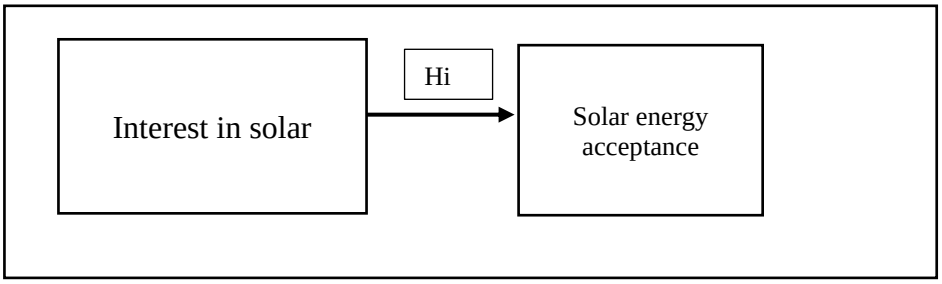

Figure 1: Interest and Solar Acceptance Framework

Methods
This study targets household in urban area. Households are chosen because they are the majority decision maker including deciding is either to use solar energy in their house or not. Besides, urban is targeted location, and, they might have more knowledge and more exposure on solar energy benefits.
With recent restricted conditions and the pandemic still widespread all over the country, online google forms have been selected to disseminate the survey. Three steps have been taken to make sure the data is well collected. See Figure below.

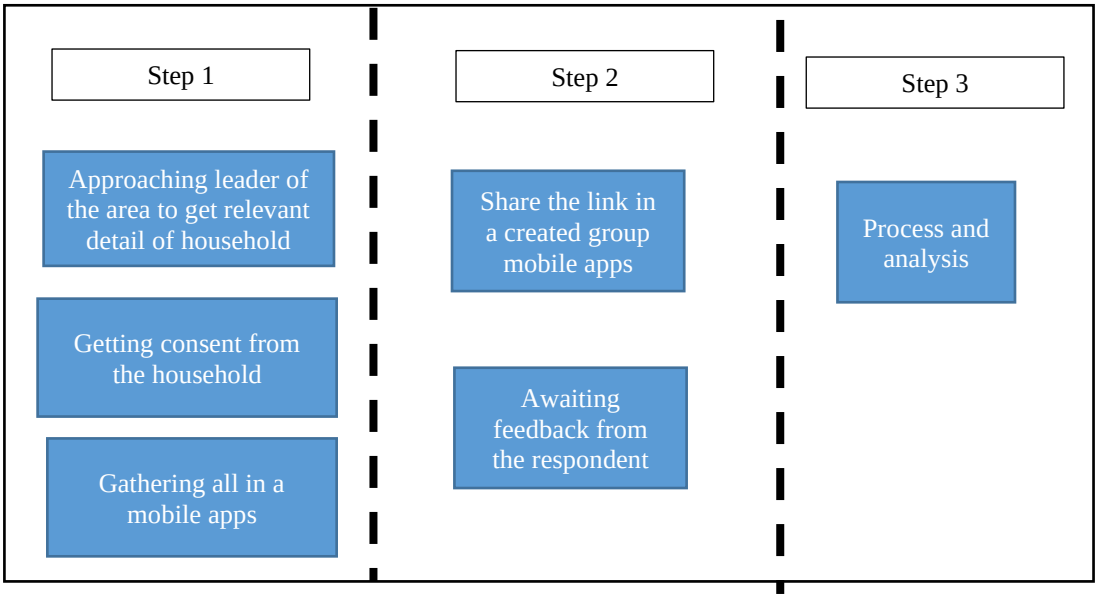

Figure 2: Steps of Data Collection in Pandemic

Figure 2 illustrates the three steps of data collection during the pandemic. Since its pandemic, approach is very limited in mass straightaway to the individual. Backdoor activity needs to be done prior 3 steps in data collection such as identifying the house urban residential area. The activities including several items to consider such as the size, and easy access to approach the respondent.

It starts with first step, covers i) approaching leader of the residential area to get approval to access the area and detail of household. There are 50 houses in that chosen residential area, approximately 200 pax of household we approached. ii) getting consent from the household the name list. The consent and their will to volunteer are needed, this approach might provide the researcher quite accurate and pure perspective opinions. Only 142 gave their consent, the remaining not joining the survey due to several reasons. Later, gathering all (those who have gave consent) in one mobile application group (called Whatsapp). In step 2, the researchers share the link of google form in the group. We give them ample time to answer the survey; within two weeks. This short period of time is to ensure the respondents remember to answer the form. Within a week, the respondent will be given a reminder via Whatsapp group. Finally, after two weeks, we analyse the data. We managed to process 117 surveys. Figure below shows the step taken for data collection.

Findings

This paper aims to investigate the understanding of the household towards solar energy including portraying their interest and opinion towards solar energy consumption at their premises. This paper receives 117 survey to analyse; majority respondent are female (78) as compared to male (39).

The results highlight first on household interest towards solar energy, and it shows majority have interest on solar energy. These results are shown in Table 2 below. It apparently shows that more than 85% of household know something about Renewable Energy technologies and are interested to use solar energy but lacking on knowledge and financial assistance.

Table 2: Solar Interest among the Household

Opinions	Agree	Disagree	No opinion
I know something about (renewable energy (RE) technologies	86%	3%	11%
I interested to use solar energy but have neither the knowledge nor financial means to do so	89%	3%	8%

The Table 2 shows that majority have the interest towards solar energy and perhaps to consume it at their premises. But in order to have it, they also consider their financial status due to its installation price being quite high. On top of that, their perspective towards environmental issues is considered in this study as below table.

Table 3: Opinion on Environmental Issues

Opinions	Agree	Disagree
I am concerned about environmental issue, and I take an active interest	59%	41%
I am concerned about environmental issue but my interest in them is only in passing	41%	59%

Table 3 above shows the difference opinions towards environmental issues. Only 69 of them are aware about the pollution and depletion of natural resources and they are actively support with their right action. This will help to reduce the environmental issues. However, 48 of them are aware but do nothing.

Next analysis is to find out even they are aware and support, would they use solar-generated electricity if it costs you 10%-20% more than does (fossil fuels) Gas/Coal/Oil generated energy? Table 4 illustrate the answer.

Table 4: Solar is Preference Even the Costs is 10%-20% More than Does (fossil fuels) Gas/Coal/Oil Generated Energy

Opinions	Yes	No	Not sure
Would they use solar-generated electricity if it costs you 10%-20% more than does (fossil fuels) Gas/Coal/Oil generated energy?	51%	20%	29%

Table 5 below shows the respondents opinion on the importance of factors of Solar Energy Policy Development in Malaysia. Besides knowledge, interest, support from surrounding and authority may motivate public to accept solar energy in their daily consumption.

Table 5: Factors of Solar Energy Policy Development in Malaysia

Opinion	Important	Unimportant	No response
Public Knowledge	94.9	3.4	0.8
Public Awareness	97.5	1.7	
Mass media policy makers	86.4	4.2	8.5
Policy makers	93.2	1.7	4.2
Private sector	88.1	5.9	5.1
Local regulations	88.1	5.9	5.1
Local culture	86.4	8.5	4.2
Subsidies & Incentives	94.1	4.2	0.8

Table above shows majority perceive the importance of expose to the knowledge and awareness, get support from the authority such as mass media policy makers, policy makers, local regulations, subsidies and incentives and as well as the positive and supportive local culture.

In relation to the table above, government support also been ranked on top important among the respondents. Analysis below illustrates the respondent perspective on increasing subsidies to solar energy appliances and reducing subsidies for fossil fuel to make sure the well development for solar energy and its market. See Table below.

Table 6: Perspective on Increasing Subsidies and Reducing Fossil-fuel Usage

Opinion	Important	Unimportant	No response
Increasing subsidies to solar energy appliances	92.4	1.7	5.1
Reducing usage of fossil fuel	68.6	15.3	15.3

Respondents are supported to increase the subsidies for solar energy appliances. With the increase in subsidies, the respondents expect to have more cheaper price for solar appliances. However, 69% of respondents agree that government to reduce subsidies for fossil fuel thus it supports the development of solar energy technology and its market.

From the table above (2-6), it seems that there is prerequisite to see whether there is an association between interest and accept to use solar. Table below illustrate the Chi Square test

Table 7: Association between Interest in Solar Energy and Accept to Use Solar

	Chi Square	df	P value
Pearson Chi-Square	6.556	2	0.038
Likelihood ratio	6.599	2	0.037

The table above shows explanation that P-value is less than the significance level of 0.05, it supports to reject hypothesis null. Thus, interest in solar and intention to use solar is associated.

Discussion and Conclusion

In section findings, earlier tables show the concept understanding towards solar energy concepts among the urban household. Majority of respondents show positive opinions, but this simply is not enough and is worrying because even they are aware, they do not exercise it. This finding contrast with Khambalkar, Katkhede, Dahatonde, Korpe and Nage (2010) and Irfan et al. (2021), their findings reveal that the user with awareness and belief would lead to willingness in renewable energy consumption including solar energy. In relation with this paper's findings, Malaysian need fully and updated information on solar energy to influence their willingness towards solar energy consumptions (Cheam, Lau, & Wei, 2021).

Hypothesis 1 tested and the result supported the hypothesis. Clearly indicates that interest, knowledge, awareness, support and culture are crucial, and initiatives and awareness need to be aligned. Otherwise, if the public always receive subsidies but not enough info and awareness disseminated to public; it may make the government effort or researcher findings worthless.

Theoretical Implications

These findings are about the relationship between the interest, awareness and support of household and their acceptance towards solar energy consumptions. The findings provide an understanding of household Malaysian trending in solar energy acceptance. It explains that understanding on solar energy and environment dilemma and awareness of solar energy are helpful in solving environmental issues are not sufficient to accept solar energy in their daily consumptions.

Practical and Social Implications

The present findings need to be considered as an input for related solar energy policy. The findings emphasise on the needs of financial assistance towards installing solar machinery in their premises. This note may help the policy maker to generate a more friendly and emphatic sound policy and procedure for society and community. A wellbeing environment is created with this new look policy and procedure.

Limitations and Suggestions for Future Research

Conducting research in pandemic zone really need positive and proactive communication to reach amount number of respondents. For future research, the element in this research needs to be a bit thorough such as include the information and motivation element. This reason is highlighted because, sometimes the respondent aware and have interest, but the exposure from reading right information may improve their motivation to accept the solar energy in their daily transactions.

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