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Motivations and Communication Effectiveness of Solar Energy Adoption among Malaysian Household Consumers

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ABSTRACT

Objective – This paper aims to explain the motivational drives underlying the use of solar energy and to examine the effectiveness of integrated marketing communication tools in the dissemination of solar PV information among household consumers in Malaysia.

Methodology/Technique – Data was collected using in-depth interviews, participant observations, and on-site visits to participants' homes. Sixteen private household consumers who were registered with the Sustainable Energy Development Authority Malaysia (SEDA), and who were located in different regions of several states in Malaysia, were selected using purposive and snowball sampling. The data was then transcribed and analyzed by identifying the themes and commonalities of the respondents.

Findings – The findings indicate that there are 4 motivating factors that lead to solar PV adoption. Those are: economic, societal well-being, environmental well-being, and knowledge/cognition. The integrated marketing communication tools found to be most effective include mass media (television), electronic media (including social media and websites) and interpersonal sources.

Novelty – The study elaborates on the motivations underlying the adoption of solar energy based on the real experiences of solar PV users. The study also assesses the effectiveness of integrated marketing communication tools used by various stakeholders in promoting solar PV systems based on user feedback.

Type of Paper: Empirical.

Keywords: Integrated Marketing Communication; Motivation; Residential; Solar Photovoltaic System; Sustainable Marketing.

JEL Classification: M31, O33.

1. Introduction

Concerns regarding global warming and the depletion of non-renewable fossil fuels have brought about the burgeoning solar energy market. Solar energy is eagerly growing as a potent source of renewable energy. It has been projected that this form of energy will supply around 30% of the world's energy demand by 2050.

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Solar photovoltaic (PV) energy is referred to as the "technology that uses the basic properties of semiconductor materials to transform solar energy into electrical power" (Platzer, 2015, p. 1). In Malaysia, the use of solar PV energy in residential sectors began to rise after the Malaysian Building Integrated Photovoltaic (MBIPV) Technology Application Project was launched in July 2005, with the aim of reducing the long-term cost of BIPV technology in Malaysia. It was hoped that the technology would be widespread and that the emissions of greenhouse gases would be reduced. A Feed-in Tariff scheme (FiTs) was introduced as a premium-priced, grid-connected PV electricity, paid to solar PV system owners by utility companies or a regulatory body (Pan & Ning, 2014). A FiTs also provided a platform for net energy metering (NEM), which can generate up to 500 megawatts (MW) of capacity. NEM was introduced on November 1, 2016 and is valid to 2020. NEM is a solar PV program applicable to all domestic, commercial, and industrial sectors, who are existing customers of Tenaga Nasional Berhad (TNB, a national electricity provider in Malaysia) in Peninsular Malaysia or Sabah Electricity Sdn Bhd (SESB) in Sabah and the Federal Territory of Labuan. NEM aims to encourage the deployment of renewable energy, as proposed in the 11th Malaysia Plan. The concept behind NEM is that the energy produced from the solar PV systems will be consumed first, and the excess will be exported and sold to the distribution licensee (TNB or SESB) at the prevailing displaced cost, as prescribed by the Energy Commission (2017). The more energy generated from the solar PV that is self-consumed, the more NEM consumers can save on their electricity bills by reducing the electricity imported from the utility company. Other benefits of NEM is a reduction in household electricity bills, enabling carbon footprint management, reducing financial losses with a Green Technology Financing Scheme (GTFS), and hedging against any possible future electrical tariff licenses.

Table 1. Annual power generation (in MWh) of commissioned renewable energy installations

Year	Biogas	Biogas (Landfill / Agri Waste)	Biomass	Biomass (Solid Waste)	Small Hydro	Solar PV	Geo-thermal
2017	9,897.55	132,072.86	204,490.54	15,985.23	63,081.10	326,788.89	0.00
2016	11,946.59	61,108.09	151,273.88	36,751.74	47,798.28	304,620.71	0.00
2015	16,988.66	41,122.39	197,207.62	18,090.07	55,406.38	260,432.29	0.00
2014	19,772.25	31,844.44	226,196.38	4,347.83	64,549.65	181,818.55	0.00
2013	12,962.68	9,804.10	209,407.59	11,144.25	79,081.75	50,656.70	0.00
2012	98.11	7,465.40	101,309.87	3,234.52	25,629.78	4,720.16	0.00

Source: Sustainable Energy Development Authority, Malaysia (2018)

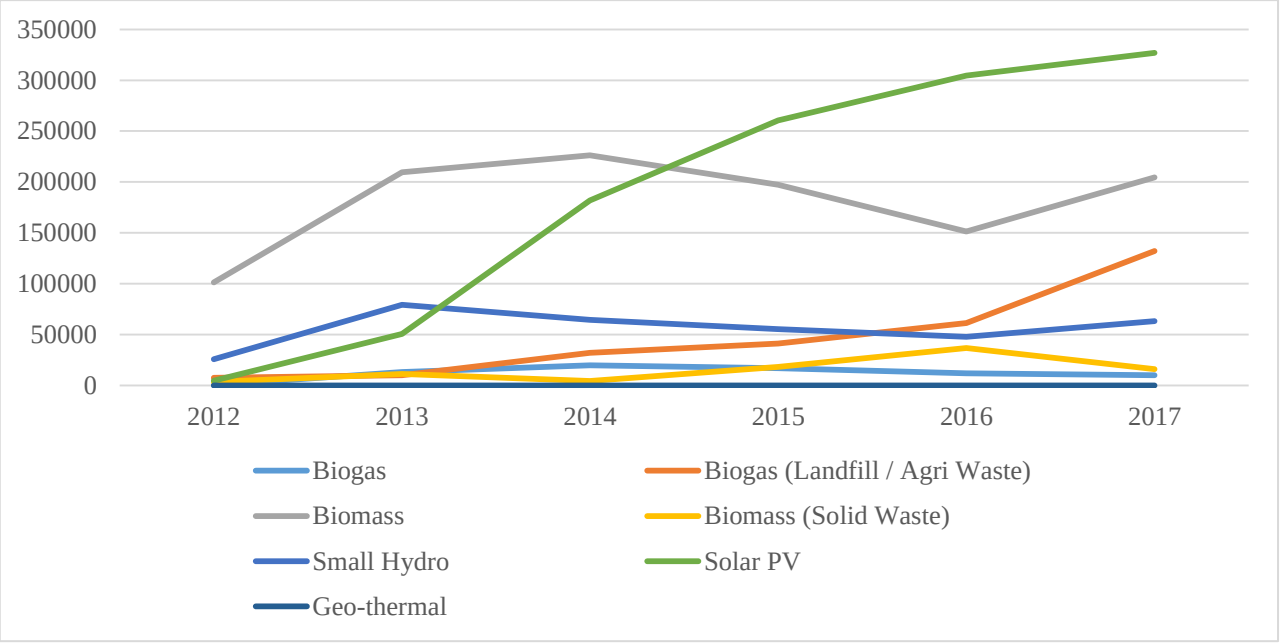

Figure 1. Electricity generation mix of renewable energy (Sustainable Energy Development Authority, Malaysia, 2018)

Until 2017, solar PV energy was the main source of renewable energy, generating the largest amount of electricity when compared with other types of renewable energy sources in Malaysia (see Table 1 and Figure 1). It is predicted that from 2020, solar energy will lower carbon dioxide (CO2) emissions in Malaysia by up to 7 million tons per year, with estimated electricity production estimated to range from 11,000 GWh in 2010 to 25,579 GWh by 2050 (Sustainable Energy Development Authority, 2018). Despite this positive outlook, more attention needs to be paid to the demand of solar energy among end users or household consumers. Although solar PV energy recorded the highest number of annual power generation levels (MWh) for commissioned renewable energy installations when compared with other renewable energy sources, some studies have shown that many households have not yet installed solar PV energy units (Gomesh, Daut, Irwanto, Irwan and Fitra, 2013; Solangi, Badarudin, Kazi and Aman, 2013). The hesitation of some consumers to install solar PV units forms the basis for this research.

1.1 Background of Study

Research on the adoption of solar power among residential or household consumers remains in its infancy (Davidson, Steinberg and Margolis, 2015; Drury et al., 2012; Rai and Robinson, 2013; Rai and Beck, 2015). Studies by Sommerfeld and Buys (2014) and Sommerfeld, Buyes, and Vine (2017) have found that much of the research on renewable energy focusing on consumer behaviors often focuses on a single attitudinal dimension (environmental, economic, or social), thereby failing to comprehensively examine the connection of these factors to the adoption of solar power. In addition, many previous studies are based on statistical data such as financial capacity, home ownership status, and education (Byrnes, Brown, Foster and Wagner, 2013; Macintosh and Wilkinson, 2011). As a result, there is a lack of research examining consumer motivation to adopt solar PV, which may provide better insights into the outcomes of the integrated marketing communication tools used in the dissemination of solar energy information, particularly among residents or household consumers - the real adopters of solar PV.

In addition to this, a lack of accurate information further inhibits the adoption of green electricity (Ozaki, 2011). This can be linked to a lack of explanation of the underlying role of information dissemination systems in creating knowledge of the technological characteristics of renewable energy production and its uses (Koh and Hoi, 2002). In particular, there is a significant gap in the research on solar adoption and how it may be linked to the information context, including government agencies, peer effect, and information from utility providers, and its effectiveness in disseminating relevant solar energy information to household consumers (Rai, Reeves and Margolis, 2016). Addressing these gaps could provide greater insights into the factors that motivate consumers to adopt solar energy and could improve the effectiveness of the integrated marketing communication programs of related government agencies and utility providers in general. Thus, the current study aims to explain the motivation underlying the adoption of solar energy and examine the effectiveness of integrated marketing communication tools in disseminating solar PV information among household consumers in Malaysia.

1.2 Motivation

The decisions to adopt technology by household consumers within a social context are shaped not only by environmental values or economic structures, but by a complex mixture of consumer behaviors. Research on renewable energy and consumer decisions is often been based on single attitudinal dimensions or environmental, economic, or social aspects; there is not yet a body of research that focuses on a comprehensive understanding of all of the aspects influencing a consumer's decision to use a product (Sommerfeld and Buys, 2014; Sommerfeld et al., 2017). In addition, many previous investigations into the use of solar PV have are based on statistical data that focuses on consumer issues such as financial capacity, home ownership status, and education (Byrnes et al., 2013; Macintosh and Wilkinson, 2011). As a result, there is a lack of research on consumer motivation to adopt solar PV. Examining this topic may provide greater insights into the ways in which consumers may impact the successful outcomes of integrated marketing communication tools used in spreading solar energy information, particularly among residents or household consumers.

The reasons underlying adoption behavior can be traced back to the theoretical explanations of motivations behind a behavioral trait. Motivation is an important determinant that drives humans to behave in certain ways; it is also a highly dynamic construct that is constantly reacting, and hence, evolves with one's experiences (Schiffman and Wisenblit 2015). Past studies have examined the reasons behind a consumer's choice for solar energy. For example, Gomesh et al. (2013) investigates the level of acceptance of solar energy among Malaysian students and members of the public. That study uses 4 determinants: choices of renewable energy in Malaysia, level of understanding of renewable energy, level of acceptance of solar energy, and future prospects for solar energy in Malaysia. Gomesh et al. (2013) also investigates the acceptance of solar energy technologies from the perspective of the general public using a quantitative approach. However, the responses did not provide sufficient indicators for measuring actual solar energy adoption. The reason for this can be attributed to the fact that people in Malaysia are generally not aware of government incentives and policies toward renewable energies, as well as a systemic unwillingness to adopt solar energy (Muhammad-Sukki et al., 2011).

Past studies also have found that smart energy technologies must be well designed and compatible with the current needs of consumers. Ahmed (2015) states that, according to the perspective of a renewable energy provider, energy cost reductions and increasing market prices are some of the most significant factors underlying consumer adoption of renewable energy. The economic advantage of renewable energy is also an important motive, particularly among household consumers in Thailand (Chaianong and Pharino, 2015). In addition, a study on smart energy found that economic factors are considered to be the main driver for

behavioral change (Oseni et al., 2013) when compared with other factors, such as peer pressure. On the other hand, the payback period is not considered to be a motivating economic factor for solar energy adoption (Schelly, 2014). In addition, social needs have also been found to motivate the adoption of solar PV in Thailand (Chaianong and Pharino, 2015), whereby the increasing use of renewable energy has helped in mitigating air pollution caused by fossil fuels. Furthermore, solar energy has enabled communities in the rural areas of Thailand to achieve a better quality of life and economic well-being at a reasonable cost. On the other hand, a study by Ozaki (2011) did not detect any link between social norms and green electricity adoption. Apart from social needs, the adoption of a solar PV system is also associated with egotistic needs. In order to keep solar adopters closely affiliated within the circles of communities that can afford to own a solar PV unit, deep awareness and sufficient technical knowledge of the solar PV system would be advantageous. Such competencies are necessarily related to the occupation and level of education of consumers, indicating there is an element of social prestige in adopting a solar PV system.

It is also believed that environmentally friendly and eco-centric attitudes also reflect a level of consciousness beyond one's basic needs, relating to a person's duty to take care of the environment. Adopting environmentally friendly behaviors, including the use of a solar PV system, is associated with a motivation to fulfil one's self-actualization needs. However, there remains a lack of support for any significant relationship between environmental awareness and an intention of adopting sustainable household technologies (Ahn, Kang and Hustvedt, 2016). Any firm association between consumers' feelings toward environmental issues and the adoption of green electricity (Ozaki, 2011), or the need to be environmentally friendly in solar technology adoption (Schelly, 2014). Thus, it is important to elaborate on the reasons or factors underlying solar energy adoption among household consumers from a motivational perspective.

1.3 Integrated Marketing Communication

Although literature in this area has begun to empirically analyze the information dissemination processes involved in residential decision making with respect to solar adoption, many studies have aggregated household-level heterogeneity without considering the insights of real adopters (Rai et al., 2016). Past studies have focused on the general public's perception toward media or sources of solar energy information (Sulaiman, Azman and Saboori, 2014) and social acceptability of renewable energy technology in Malaysia (Al-Fatlawi, Saidur and Rahim, 2014). In addition, the lack of accurate information being received on solar energy is recognized as being one of the most important factors inhibiting the adoption of green electricity (Ozaki, 2011). The breadth of explanations underlying the role of information dissemination systems in creating awareness of renewable energy production and its use (Koh and Hoi, 2002), particularly at a level that members of the public can understand, is therefore considered to be a negative factor. In particular, solar adoption, being linked to the information context, which comprises of the government agencies, peers, and utility providers, and its effectiveness in disseminating relevant solar energy information to household consumers, is yet to be investigated (Rai et al., 2016). Therefore, research is needed on the effectiveness of integrated marketing communication tools in spreading solar PV information among adopters and household consumers in Malaysia.

Starting in the early 1990s, integrated marketing communication (IMC) has become a significant topic for both academics and firms (Holm, 2006). IMC can be defined as the process of using promotional tools in a unified way so that a synergistic communication effect can be created (O'Guinn, Semenik, Allen and Scheinbaum, 2015). IMC is a process through which companies accelerate returns by aligning communication objectives with corporate goals (Schultz and Schultz, 2004), and it is used to coordinate and align all communication activities at every customer touchpoint. IMC is used to ensure that brand personality, messages, and positions are delivered to the customer with consistency across all forms of

communication (Smith, Berry and Pulford, 1999). In a typical IMC campaign, more than one tool might be used. The most notable IMC tools are advertising, sales promotion, direct marketing, public relations, personal selling, events, and sponsorship (Kotler and Keller, 2006).

The growth of the Internet and other related technologies has given rise to many opportunities for new marketing strategies and has improved the company–customer relationship (Ngai, Xiu and Chau, 2009). In addition, the introduction of social media has produced a new paradigm in the IMC domain: the content, timing, and frequency of communications are out of the direct control of the company's executives (Mangold and Faulds, 2009). Email marketing is another aspect of Internet marketing by which companies can directly connect to existing and prospective customers. Word of mouth reports by consumers themselves is also facilitated online, known as viral marketing (Bruyn and Lilien, 2008). Other IMC tools highlighted by O'Guinn et al. (2015) include mass media, sales promotion, point-of-sales, direct marketing, personal selling, event sponsorships, branded entertainment, public relations, publicity, corporate advertising, outdoor signage, billboards, transit and aerial advertising, Internet or interactive marketing, electronic word of mouth (e-WOM (which includes social networks such as Twitter and WhatsApp), and podcasting (mobile). These integrated marketing communication tools can be used to disseminate information regarding solar PV among the public.

Few studies have investigated the link between the steps of the decision-making process, such as motivation to adopt and sources of information, and the role of consumer opinion (Graziano and Gillingham, 2015; Rai and Robinson, 2013), mass media (Kardooni, Yusoff and Kari, 2016), and social media (De Filippo and Serrano-López, 2018). However, some studies have examined the effectiveness of such tools in reaching final household consumers. Thus, it is important to analyze the effectiveness of IMC tools in disseminating solar PV information among adopters.

2 Theoretical Underpinnings of the Study

According to Maslow (1954; 1968), human motivation is based on the notion that there is a hierarchy of human needs. Maslow's hierarchy of needs comprises five levels that rank in order of importance from biogenic needs at the lower level to psychogenic needs at the highest level. According to that theory, individuals seek to satisfy lower-level needs before higher-level needs. The theory assumes that an individual's priorities shift from lower to higher levels in the hierarchy. Unsatisfied needs at the lower level motivate a person's behavior and push the individual to fulfil those basic needs. After one level's needs are fairly satisfied, the needs in the next level become a new primary motivator for the individual and so on.

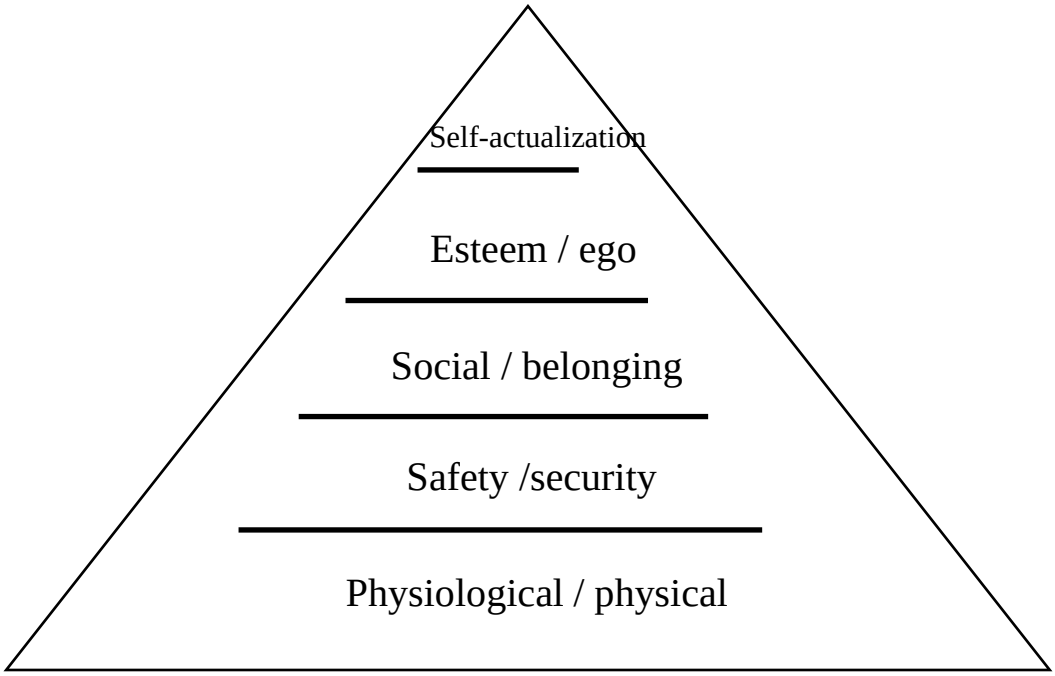

Figure 2. Maslow's hierarchy of needs (Maslow, 1954; 1968)

As stated, there are five levels of needs in Maslow's hierarchy of needs: physiological, safety, social, egoistic, and the need for self-actualization, which is the highest level (refer to Figure 2). Physiological needs are the primary needs required to sustain biological life, comprising of food, water, shelter, clothing, and all biogenic requirements. After one's physiological needs have been satisfied, safety and security needs become the driving forces behind human behavior; these include not only physical safety, but also order, routine, stability, familiarity, and control over one's life and environment. Health care, education, insurance policies, and savings accounts are some examples that would fulfill one's safety and security needs. Due of this, savings in terms of a reduction in bill payments as a result of using solar PV system could be placed at this level. The next level contains the social needs consisting of love, affection, belonging, and acceptance by others. The installation of a solar PV system could be associated with the need to fulfil social needs, especially when adopters are initially approached, and later influenced by, close acquaintances or family members who are adopters themselves. Here, consumers may adopt to feel a sense of belonging and acceptance by others.

When these social needs are satisfied, egoistic needs, comprising of self-esteem, self-acceptance, success, personal satisfaction, recognition from others, status, reputation, and prestige, can be strived for. The adoption of a solar PV system can be associated with the fulfillment of egoistic needs to keep adopters within other circles of adopters, that is, among those who can afford to install the system and have sufficiently high awareness of, and technical knowledge about, the system.

Once those egoistic needs have been fulfilled, individuals strive to fulfil their self-actualization needs. Self-actualization refers to one's desire to achieve his or her highest potential. Self-actualization needs also refer to the spiritual needs that arise when one strives to gain consciousness of his or her purpose of being or existence in the universe (Md Harizan, 2016). Thus, adopting environmentally friendly behavior, including the use of solar PV systems, can be associated self-actualization needs.

Although Maslow's hierarchy of needs theory provides the basic platform for the motivational drivers underlying solar energy adoption among household consumers, these drivers can be further explained by the

social cognitive theory of communication (Bandura, 1986; 2009), which may further elaborate on the solar adoption rates among household consumers and its relationship to the information context. Due to the influential role that IMC plays in society, understanding the psychosocial mechanisms through which symbolic communication influences human thought, affect, and action is of considerably important (Bandura, 2001). Fundamentally, the social cognitive theory explains psychosocial functioning in terms of triadic causation from an agentic perspective (Bandura, 1986). Based on the agentic transactional perspective, human self-development, adaptation, and change is embedded in social systems, whereby people are the producers and products of social systems.

In these social systems, influential people adopt new ideas from the media and pass them on to their followers by using their personal influence. The relative importance of interpersonal and media sources of information in initiating the adoption process varies for different activities, and for the same activity at different stages in the adoption process (Pelz, 1983). People are initially reluctant to adopt new practices that involve significant costs and risk, until they see the advantages that have been gained by early adopters, which in the current study, may be a reduction in electricity bills paid to the utility providers as a result of installing a solar PV system at home. Modeled benefits accelerate technology diffusion by weakening the restraints of the more cautious potential adopters.

Furthermore, media has the ability to implant ideas either directly or through leveraging previous adopters. Analyses of the role of mass media in social diffusion must distinguish between the effect of media on learning modeled activities and on adoptive use, here examining how media and interpersonal influences affect these separable processes. In some instances, media both teaches new forms of behavior and creates the motivators for action by altering people's value preferences, efficacy beliefs, outcome expectations, and perceptions of opportunity structures. In other words, media teaches, but other adopters provide the motivation to perform what has been learned through observation. On the other hand, the effect of media may be entirely socially mediated. That is, people who have had no exposure to media are influenced by adopters who have had the exposure and become the transmitters of these new ways themselves. Within these different patterns of social influence, media can serve as the originator, enforcer, influencer, and motivator for other people to adopt solar energy.

3. Research Methodology

The current study uses more than one method of data collection (Bryman and Bell, 2007) including conducting in-depth interviews, participant observations, and carrying out on-site visits to respondents' homes. Prior to data collection, the questions for the interviews were developed and validated by field experts. Sixteen private household consumers who are registered with the Sustainable Energy Development Authority Malaysia (SEDA) and located in different regions of Malaysia were selected using purposive and snowball sampling. Both Bahasa Malaysia and English were used in the interviews, which took about 45 minutes each. The interview sessions elicited the participants' motivational factors underlying the adoption of a solar PV system and their opinions regarding the marketing communications tools used to acquire information about solar PV systems. The respondents were also required to demonstrate their knowledge of the solar PV system they had installed at their home. The interview sessions were audio recorded, and notes were made by enumerators. The recordings were then transcribed and analyzed by identifying the themes and commonalities found among the respondents. A respondent validation process was conducted to seek corroboration and to ensure a good correlation between the findings, perspectives and experiences of the respondents (Bryman and Bell, 2007). This was done by emailing the draft of the research findings to the respondents to obtain their feedback. The respondents were generally satisfied with the drafts, and their

comments were taken into consideration for the final report. For reporting purposes, each respondent was assigned an anonymous code for identification (e.g., R001 represents Respondent 1 and so on).

4. Results and Discussion

Table 2 shows the respondents' profiles. Most of the respondents were between the ages of 30 and 39 (50.00%), male (81.25%), earning RM5,000.00 and above per month (56.25%), married (93.75%), having three children or more (62.5%), living in their own terrace house (56.25%), and currently residing in the central region of Malaysia (56.25%). Most of the respondents had homes installed with a grid-connected solar PV system (62.50%). The start-up costs for installing the PV solar system were born either through loans or the respondents' own savings.

Table 2. Summary of Demographic Profile

	N	%
Age		
30 to 39	8	50.00
40 to 49	3	18.75
50 to 59	4	25.00
60 and above	1	6.25
Gender		
Male	13	81.25
Female	3	18.75
Income per month (RM)		
Less than RM 1,999.00	2	12.50
RM 2,000.00 to RM 2,999.00	1	6.25
RM 3,000.00 to RM 5,000.00	4	25.00
RM 5,000.00 and above	9	56.25
Race		
Malay	10	62.5
Chinese	3	18.75
Indian	2	12.50
Others	1	6.25
Marital status		
Single	1	6.25
Married	15	93.75
Number of children		
None	2	12.50
1	1	6.25
2	3	18.75
3	5	31.25
4 and more	5	31.25

Type of housing		
Traditional/village	1	6.25
Bungalow	4	25.00
Semidetached	2	12.50
Terrace	9	56.25
Location		
Northern Malaysia (Penang, Kedah)	4	25.00
Central Malaysia (Perak, Selangor)	9	56.25
Eastern Malaysia	3	18.75

4.1 Motivational Drivers Underlying Solar Energy Adoption

The findings indicate that there are 4 motivating factors contributing to the adoption of solar PV: economic, societal well-being, environmental well-being, and knowledge/cognitive. Economic factors were found to be the main motivation behind adoption and can be associated with the need for safety, which is at the second level in Maslow's hierarchy. The need to save resources in terms of monetary value was crucial for the adopters. Below are some examples of comments made by the respondents.

"It (solar PV system) saves cost. It generates a side income. The operational and maintenance costs are low and almost negligible compared with other renewable energies." (R008)

"I've never paid high electricity bill monthly since the installation of the solar PV system although my electricity usage rate is higher than other normal users." (R014)

"In addition, the need to have a stable and sustainable electricity supply for domestic use also motivated them."

"It is safe and easy to install anywhere (on the rooftops or on the floor) without interfering with other people." (R009)

The need to improve societal well-being and environmental well-being was found to be the second and third most important reasons that motivated solar PV adoption. Those needs correspond with the social and self-actualization needs in Maslow's hierarchy, respectively. This includes the need to belong and to be accepted by others, particularly within circles adopting the solar PV system and other environmentally friendly lifestyles. The need for self-actualization can be seen as governing the motivation for adopting the solar PV system, which is seen when the respondents express a sense of self-awareness of their duty to protect the environment from further damage by using clean and renewable solar energy.

"There is no noise pollution (from solar PV operation). It is suitable for housing areas." (R009)

The least dominant need was expressing knowledge about a solar PV system and the respondents' ability to install it, which corresponds to Maslow's need for self-esteem, whereby the installation and use of a PV solar system is considered a symbol of status, reputation, and prestige by the adopters. The solar PV signifies

their socioeconomic status as having good educational qualifications, a high income from well-paid professions, and distinctive knowledge about the solar PV system. This emerging trend was also related to the unexpected commonality in a technical interest and a 'do-it-yourself' (DIY) lifestyle (Schelly, 2014).

"I am using this product because I am working at the company that sells environmentally friendly products. Therefore, I have a good knowledge of this product (solar PV system)." (R004)

"I've been aware of the greenhouse gas effect for a long time and also electricity savings at home. I decided to use solar PV as the replacement (for conventional electricity generation). Now, I can save from 60–80% of electricity usage at home." (R016)

Table 3. Analysis of Themes

Themes	Respondent ID	N	%
Motivations			
Economic	001-016 (except 009)	15	94.75
Societal and environmental well-being	004, 006, 007, 009, 010, 011, 012, 013, 015	9	56.25
Knowledge/cognitive	004, 006, 010, 011, 012, 015, 016	7	43.75
Undefined variables	004, 013	2	12.5
Communications			
Impersonal—Mass media, electronic media, web sites	001, 002, 003, 004, 010, 011, 012, 013, 014, 016	10	62.5
Interpersonal—Friends, family members, customers, neighbors	001, 002, 003, 004, 006, 013, 014, 015, 016	9	56.25
Users' testimonials	004, 005, 010, 011, 012	5	31.25
Suggestions for improvements	004, 005, 006, 007, 008, 009	6	37.5
Satisfaction			
High satisfaction	001-016 (except 014)	15	93.75
Not really satisfied	014	1	6.25

Based on Maslow's hierarchy of needs, the findings of this study have provided further explanation for the motivational factors underlying green consumer behavior within the context of solar energy adoption. The need for safety in terms of monetary resources saved and having a continuous electricity supply was one of the most common reasons for solar PV adoption. Social need was found to be the second most important motivator, relating particularly to maintaining circles of influence, while the need for self-actualization was rated as equally important because of the respondents' desire to have a better and cleaner environment. The need for self-esteem was also found to be an important motive for adoption, where the installation of a solar PV signified social status and recognition for its adopters.

4.2. The Effectiveness of IMC Tools in Solar Energy Adoption

The IMC tools found to be effective by the adopters were mass media (television), electronic media (including social media and websites) and interpersonal sources. Interpersonal sources, such as user testimonials and recommendations by friends, family members, neighbors, and other acquaintances, were

frequently mentioned by the respondents as the most important medium through which the information about the solar PV system reached them.

"I have been using this product (solar PV) for more than 5 years. I am very satisfied with the product and have recommended my friends buy the product too." (R006)

Having been dependent on mediums involving impersonal sources before, the respondents faced difficulties in scouring for more information about the solar PV system, even though they had acquired basic knowledge about it.

"Previously, I only have the basic knowledge about this environmentally friendly product (solar PV system), and I do not know where I can obtain more information about this. My younger brother has suggested a place from which I can obtain the product." (R006)

"At first, I was so worried about handling the product (solar PV system) after installing it for a year. I didn't have the knowledge even though I am usually using it. After listening to my neighbor's explanations, only then I became confident and understand on how to handle the product." (R015)

Even though the start-up costs of a solar PV system are considered to be high, most of the respondents expressed high satisfaction in using the system.

"Although the required start-up cost was high, I am very satisfied with the product. I've been using the solar energy for 10 years, and even to today, no damages were noticed, and only regular maintenance is required." (R004)

"I am very satisfied after using the solar PV system, which was installed on the rooftop of my house 7 years ago. The installation costs were high (between RM10,000.00 to RM12,000.00 per KW), and many people were not affording to own it and assumed that it was a waste of money and resources, but it will pay back after long-term use, and it is also safe." (R013)

These findings show that when solar PV systems were first introduced, the formal and impersonal communication channels used to disseminate information about the solar PV system to the general public were not sufficiently effective in reaching the initial target market. Information disseminated via impersonal sources needed to be supplemented with interpersonal sources, such as appointing influential opinion leaders who would be among the innovators in solar PV adoption. Impersonal media teaches the public and potential adopters, but current adopters provide the incentive motivation to perform what they have learned through observation. In addition, adopters who previously had no exposure to media on solar PV were influenced by adopters who were exposed, and they then became the transmitters, diffusing solar PV information to others.

5 Conclusion and Recommendation

This study elaborates on the motivational drivers underlying solar PV adoption among household consumers in Malaysia. Based on Maslow's hierarchy of needs, the motivational aspects that had not been adequately addressed in previous studies were further examined; this includes the need for safety in securing a sustainable, reliable, and safe electricity supply, which was found to be the most important motivating factor underlying solar energy adoption. This need was followed by a need to belong to the social circle of

other adopters of solar PV systems. The need to preserve the environment was found to be less important, and the respondents did not particularly consider themselves to be pro-environment when adopting solar energy. The need for self-esteem through the expression of knowledge and being cognitively competent was found to be the least important motivating factor. Based on these findings, solar energy system providers, as well as the respective government agencies and other stakeholders, should take the above-mentioned motivational elements into consideration when marketing their solar PV systems.

In addition, the current study also examines the effectiveness of IMC tools in disseminating solar PV information to household consumers in Malaysia. Based on the social cognitive theory of mass communication, the way media distributes the idea of adopting solar PV systems to its market audience can be further implemented directly or through adopters. Further efforts in acquiring solar information from neighbors and friends who have adopted solar PV is strongly required despite contrasting findings in some previous studies, such as Rai et al. (2016). Thus, future marketing and communication programs should use both impersonal and interpersonal media to reach potential solar energy adopters more effectively and efficiently. Spokespeople and opinion leaders who are also solar energy adopters should also be appointed in promoting solar PV systems as they have more influence and wide social circles, as measured by their number of social media followers.

Finally, it can be concluded that the decision to adopt a solar PV system is not made in a vacuum. Adopters were driven predominantly by economic factors, when compared with other social and environmental factors. This proposes a question for future research as to whether a solar PV system can be positioned as "pocket-friendly" despite being "environmentally friendly," which is commonly promoted by green energy marketing champions. In addition, the effect of changes in policies, incentives, and programs of solar PV on adopters in other countries may also be further examined and compared so that the variation in adopters' motivational drivers and the suitability of IMC tools used in reaching target audiences can be continuously assessed and improved. Due to the limited time and resources faced in the current research, future research should examine larger samples, which would enable the findings to be generalized.

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