

# ICRP 2019

## 4<sup>th</sup> International Conference on Rebuilding Place

### RAISING ENERGY-SAVING AWARENESS WITH THE HOME ENERGY REPORT

Zahirah Mokhtar Azizi (a)\*, Nurul Sakina Mokhtar Azizi (b), Siti Aida Samikon (c),  
Nasyairi Mat Nasir (d)  
\*Corresponding author

(a) Architecture and Built Environment, Faculty of Engineering and Environment, Northumbria University,  
Sutherland Building, Newcastle Upon Tyne NE1 8ST, United Kingdom, [zahirah.azizi@northumbria.ac.uk](mailto:zahirah.azizi@northumbria.ac.uk)

(b) School of Housing, Building and Planning, Universiti Sains Malaysia, 11800 Penang, Malaysia,  
[sakinamokhtar@usm.my](mailto:sakinamokhtar@usm.my)

(c) Faculty of Science Technology Engineering and Mathematics, International University of Malaya Wales, Kuala  
Lumpur, Malaysia, [ctaida@iumw.edu.my](mailto:ctaida@iumw.edu.my)

(d) Faculty of Architecture, Planning & Surveying, Universiti Teknologi MARA, Shah Alam (UiTM), Malaysia,  
[nasya168@uitm.edu.my](mailto:nasya168@uitm.edu.my)

#### *Abstract*

Household electricity consumption per capita has been steadily increasing every year. Current literature on energy has largely focussed on energy efficient technologies. There has been little attention on consumer awareness of home energy use. In an effort to create awareness, Malaysia launched the Home Energy Report in 2015. However, it is not known whether the Home Energy Report has helped improve residents' energy-saving awareness. This paper seeks to examine users' feedback on the use of the Home Energy Report for improving energy-saving awareness. Thirty residents in Penang who received the Home Energy Report were interviewed. The findings showed that while the Home Energy Report is received by all participants, only 30 percent of respondents accessed it regularly at least once a month, whereas the remaining 70 percent accessed it intermittently. The study revealed mixed findings where about half of the participants shared a positive complete experience with using the Home Energy Report and the other half had a somewhat rewarding or unrewarding experience. The study concluded that the lack of user orientation to the Home Energy Report and the poor efficiency of its design operability were the underlying problems impacting the users' experience. As a result, poor experience with the Home Energy Report has hindered its effectiveness in creating energy-saving awareness. The findings reveal the limitations of the existing Home Energy Report in raising energy-saving awareness and promote a new area for future energy management research.

© 2019 Published by Future Academy [www.FutureAcademy.org.UK](http://www.FutureAcademy.org.UK)

**Keywords:** Home Energy Report, energy management strategy, energy-saving behaviour, energy efficiency, Malaysia.



This is an Open Access article distributed under the terms of the Creative Commons Attribution-Noncommercial 4.0 Unported License, permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## 1. Introduction

Buildings consume up to 40% of the world's energy generated and are responsible for one-third of greenhouse gas emissions worldwide (Mohammad et al., 2014). As a developing country, Malaysia's expansion on economic activities and growing population have driven continuous growth in the building sector. The surge of new building developments create substantial demand for energy and has shown an increasing trend over the years (Ahmad et al., 2012). The residential sector alone was reported to consume 2,875 ktoe, of which 80% were from electricity consumed by household appliances (Energy Commission of Malaysia, 2017). Household electricity consumption per capita has been steadily increasing every year (UNESCAP, 2017). As these represent domestic usages, the sector presents high potential for energy savings through simple behavioural changes in residents' energy consumption (Barbu, Griffiths, & Morton, 2013). Household energy consumption represents an important part of electricity demand because long-term behaviour changes start from the home (Brounen, Kok, & Quigley, 2012; Wang, Zhang, Yin, & Zhang, 2011). In 2016, Tenaga Nasional Berhad (TNB) reported a total of 7.8 million registered consumers in Malaysia of which 82% were domestic users (TNB, 2016). The large population of domestic consumers indicate that improving the efficiency of household energy consumption will provide significant benefits for the environment. However, current literature on energy has largely focussed on energy efficient technologies. There has been little attention on consumer awareness of home energy use. Although the use of energy efficient technology is an effective solution, it does not address the problem of the growing energy consumption (Steg & Vlek, 2009). Thus, it is important to approach the problem with both technical efficiency improvements and behaviour change through raising awareness on energy-saving practices.

## 2. Problem Statement

Rahman, et al. (2017) reported that many people in Malaysia did not know how to increase energy efficiency in their daily energy use. Strategies for increasing energy efficiency in buildings can become ineffective due to residents' energy consumption behaviour (Hussaini & Abdul Majid, 2015). Ahmed, Mohamed, Homod, Shareef, and Khalid, (2017) attributed the problem to poor awareness among residents that prevented behaviour changes from occurring. To raise awareness effectively requires proper knowledge dissemination that is followed by implementation of energy-saving practices (Rahman, et al., 2017). This needs to be administered by energy policies and programs at the same time (Ponniran, Mamat, & Joret, 2012). Initiatives for the residential sector are usually voluntary-based because it is difficult to apply regulations controlling home energy consumption behaviour as these represent independent personal choices (Hori, Kondo, Nogata, & Ben, 2013). 'Softer' forms of strategies focussed on encouraging change in energy consumption behaviour are more feasible for a domestic setting to avoid being intrusive (Cox, Higgins, Gloster, Foley, & Darnton, 2012). One of the efforts the Malaysian government did was to introduce the National Energy Efficiency Master Plan (NEEMP) under the 10th Malaysia Plan that sought to replace all incandescent light bulbs with LED bulbs and to expand energy performance labelling to a wider list of electrical appliances. In addition, tiered electricity tariffs, electricity bill rebates, and the Sustainability Achieved via Energy Efficiency (SAVE) program were also applied (KeTTTHA, 2015). In 2015, Malaysia introduced the Home Energy Report efficiency program, which aimed to advise consumers on their energy usage and provide guidance on energy-saving potentials so that consumers can better

manage their energy bills. After a successful pilot program with 200,000 participants, energy reductions of 13,979 MWh electricity were achieved, equivalent to RM5,386,000 savings and preventing 9,900 metric tonnes of emissions. The second phase of the Home Energy Report was launched in 2017 involving 250,000 more participants and an improvement in information distribution through post, email and a graphical user interface that can be accessed online (Energy Commission, 2017). While these initiatives have shown successful energy savings, it is unclear whether they were also successful in motivating residents' awareness on energy-saving practices. There has been no analysis of feedback from residents about the program.

### **3. Research Questions**

The paper aims to answer the following question:

- How has the experience of using the Home Energy Report program affected residents' awareness on energy-saving practices in domestic usage?

### **4. Purpose of the Study**

The goal of this study was to examine users' feedback on the Home Energy Report strategy and evaluate how the strategy has been effective in raising energy-saving awareness. The study explored the users' experience with all the features included in the Home Energy Report to understand the extent of its effectiveness in raising awareness on energy-saving practices. The study concludes with identifying areas of the user experience that needs to be improved.

### **5. Research Methods**

Qualitative interviews with 30 residents in Penang on the Home Energy Report program were approached using purposive sampling. Included in the study were 1 person aged below 20 years (3%), 23 persons aged between 20 and 39 years (77%), 5 persons aged between 40 and 59 years (17%), and 1 person aged beyond 59 years (3%). Emails were sent to the participants with information about the study prior to the interview. Each session took from 20 to 60 minutes and were audio-taped using a voice recorder. The majority of the participants (80%) had households with 2 to 4 occupants, while four others (13%) had 5 to 8 occupants and two had only 1 occupant. Please replace this text with context of your paper.

### **6. Findings**

The Home Energy Report is designed to allow consumers access to information about their energy usage details and to track patterns in their energy bills. The first feature of Energy Usage Details shows a graph of the user's month-to-month energy consumption. Nearly half of the participants (47%) found this feature helpful in developing a better understanding about their energy consumption, while many others (43%) were doubtful about whether this has had any impact, and some (10%) felt that the feature did not help at all. While the feature aimed to create awareness about the user's consumption behaviour, it was not necessarily helpful in changing consumption behaviour. When asked about how the feature has helped

increase their awareness on efficient energy consumption, most of the participants explained that it helped keep their consumption behaviour in check. However, consumption behaviour was dependent on various factors such as the weather and that month's household activity, which may fluctuate from time to time. *"Sometimes it can't be helped. If it so happens that that month is very hot, you will surely switch on the AC (air-conditioner) longer than you usually do. Or if you have guests staying over, you will surely want to make them as comfortable as possible"* (Participant 11).

Based on the collective users' database, the Home Energy Report also allows users to compare their energy consumption with the average consumption of other similar households. Many participants (47%) really liked this feature, whereas more than a third (40%) were indifferent and a few people (13%) thought it was of no use. The participants were all aware about the existence of this information but there were contrasting opinions about how this information could help them manage their energy use. Participant 2 stated, *"So my consumption is slightly higher than other people. I have three kids. I need to do laundry every day. My kids come home and switch on the air-con every day. What do you want me to do?"* While some users admitted to having high energy bills, they felt that they had no control over their household energy consumption because of the household environment. Being in a warm climate country, it was difficult to avoid using air conditioning especially for children who just came home from a long and hot day at school. However, users who reported having benefitted from this feature expressed that the similar homes comparison motivated them to save more energy. Users felt that the function created a competitive environment to keep improving their energy consumption performance based on the feedback given, which tells them how they are performing against other homes.

Another feature in the Home Energy Report is the Home Energy Analysis, which requires users to complete a simple survey on their domestic energy usages. Upon completion, a chart is generated showing the distribution of their annual energy usage. 47% of participants found this especially helpful because it provided a breakdown of their energy consumption based on appliances, lighting, cooling, water heater, and others. The breakdown helped them make informed choices about which electrical source they should watch out for and which devices to invest in high energy efficient ones. However, 40% of respondents were impartial on the idea and 13% felt critical of it. Participant 8 argued, *"You can give all the information about the electrical things but at the end of the day, it all comes down to what you want and what you can afford. If the analysis tells you your washing machine is using too much electricity, you wouldn't go out and buy a new washing machine immediately."* The analysis was helpful to users thinking about long-term investments in energy efficient appliances but did not affect daily consumption behaviour. Nevertheless, the participants agreed that it did raise awareness of energy-saving practices at an information level.

Finally, the Home Energy Report also provides tips on how to cut back on energy bills. There are 14 categories of tips. Users can view these tips and keep track of which tips they have followed through. The tips are tailored to the user's energy consumption records and aims to help users reduce energy consumption in the specific electrical appliances that consume the most energy in their home. Many participants (47%) supported the feature and had tried exploring the tips provided. Participant 21 and 27 shared that the tips had helped them achieve significant energy savings. Participant 21 had replaced some incandescent light bulbs in his home with LED ones and managed to gain 11% in energy savings in his next bill. Participant 27 started using his air-conditioner on the eco mode and set a timer which helped to reduce his energy consumption by 20%. However, many more (53%) either knew about the feature but were not

interested or had not seen the feature before. Operative barriers were often encountered with the online interface, which dissuaded participants from exploring the report further. The Home Energy Report was not something that participants were particularly interested in spending time exploring. Only a third of the participants (30%) reported accessing the Home Energy Report regularly at least once every month. Most of the participants (70%) reported that they checked the Home Energy Report intermittently and usually spent less than ten minutes looking at the report just to see how their energy bills were getting on. They expressed that an application that allowed them to access the report using their mobile phone was attractive as it was easier to use on the go. Almost all the participants stated that they dealt with their bills in one sitting every month so they only spent a limited time scrutinising their energy bill. As this was a mundane task, there was no reason for participants to spend more time than was necessary to settle their bills unless there was something interesting that warranted more attention.

Further study focussed on understanding the Home Energy Report's relation to individual factors such as personality traits can provide valuable insight to help improve strategies for energy-saving behaviour change. A European study involving over 20 countries found that energy reporting strategies were vulnerable to various contextual factors, which had a direct impact on the effectiveness of the strategy. Thus, a similar study should be emulated for Malaysia to identify the underlying factors affecting users' experience with the Home Energy Report (Umit, Poortinga, Jokinen, & Pohjolainen, 2019).

## 7. Conclusion

The results of the study revealed that the effectiveness of the Home Energy Report was affected by two things i.e. orientation to the Home Energy Report, and design operability. Participants did not have a consistent level of awareness about the use of the Home Energy Report and many were not sure about the features available. This explains the conflicting responses received from a large number of participants. Nearly half the participants had a full positive experience with using the Home Energy Report, while the rest had limited experience that they found was unrewarding and unconvincing. It can be deduced that the Home Energy Report has not been properly introduced to users to provide enough awareness on its usability. While the participants all had access to the Home Energy Report, many were unfamiliar with the features. Users who benefitted from the Home Energy Report had taken it upon themselves to explore the online interface. A large number of others remained sceptical and disinterested as there was no orientation provided to using the Home Energy Report. In effect, the participants' did not feel that their level of awareness on energy-saving practices had improved from the Home Energy Report. Reiterated in all the interviews were the challenges in accessing the online interface. Although the interface seemed simple enough, the inconvenience of having to access it through an internet browser deterred participants from checking their accounts regularly. A mobile application that allowed participants to have instant access to energy information was highly desirable. Upgrading the design operability would improve the users' experience and allow more people to benefit from the Home Energy Report. This would stimulate higher energy-saving awareness as the information can now be easily accessed and shared across a wider audience.

The findings disagree with Fatmawati, Dharmmesta, Purwanto, and Nugroho, (2019) who stated that message framing had a low impact on consumer attitudes. It was discovered that the communication of information to consumers was important to inform and influence consumer behaviour. Consumers who

had more interaction with the Home Energy Report displayed better energy-saving behaviour by applying changes in their energy consumption practice. Thus, differences in the home energy consumption behaviour were influenced by differences in the consumer's experience with the Home Energy Report. There were differing experiences with the Home Energy Report that allowed inconsistent provisions of information due to the message framing of the online interface. The study concluded that an improvement in the design communication of the Home Energy Report would improve the consumer's energy-saving awareness at an information level, and consequently encourage better energy-saving behaviour. Energy managers should look into the way energy information is assimilated by home users and how it can be framed to persuade change in consumption practices. We recommend that future research examine the format of information transfer affected by the Home Energy Report and how different types of participants assimilate information.

## Acknowledgments

The paper acknowledges the time and facility support provided by Northumbria University, Universiti Sains Malaysia, International University of Malaya-Wales, and Universiti Teknologi MARA in conducting this research

## References

- Ahmad, A. S., Hassan, M. Y., Abdullah, H., Rahman, H. A., Majid, M. S., & Bandi, M. (2012, December). Energy efficiency measurements in a Malaysian public university. In *2012 IEEE International Conference on Power and Energy (PECon)* (pp. 582-587). IEEE.
- Ahmed, M. S., Mohamed, A., Homod, R. Z., Shareef, H., & Khalid, K. (2017). Awareness on energy management in residential buildings: a case study in kajang and putrajaya. *Journal of Engineering Science and Technology*, *12*(5), 1280-1294.
- Barbu, A. D., Griffiths, N., & Morton, G. (2013). Achieving energy efficiency through behaviour change: what does it take. *European Environment Agency (EEA), Copenhagen*.
- Brounen, D., Kok, N., & Quigley, J. M. (2012). Residential energy use and conservation: Economics and demographics. *European Economic Review*, *56*(5), 931-945.
- Cox, A., Higgins, T., Gloster, R., Foley, B., & Darnton, A. (2012). The impact of workplace initiatives on low carbon behaviours. *Scottish Government Social Research*.
- Energy Commission (2017). Smarter Consumers: Energy Efficiency and Conservation By the People, For the people. *Energy Malaysia, Volume 11*. Retrieved September 5, 2019, from <https://www.st.gov.my/ms/contents/publications/energyMalaysia/Energy%20Malaysia%20Volume%20%2011.pdf>
- Energy Commission of Malaysia. (2017). *Malaysia Energy Statistics Handbook*.
- Fatmawati, I., Dharmmesta, B. S., Purwanto, B. M., & Nugroho, S. S. (2018). Promoting Young Adults to Perform Energy Saving Behavior through Message Framing: A Lesson Learned from Indonesia. *Academy of Strategic Management Journal*, *17*(5), 1-20.
- Hori, S., Kondo, K., Nogata, D., & Ben, H. (2013). The determinants of household energy-saving behavior: Survey and comparison in five major Asian cities. *Energy Policy*, *52*, 354-362.
- Hussaini, I. U., & Abdul Majid, N. H. (2015). Energy development in Nigeria and the need for strategic energy efficiency practice scheme for the residential building sector. *Management of Environmental Quality: An International Journal*, *26*(1), 21-36.
- KeTTHA. (2015). *National Energy Efficiency Action Plan*. Ministry of Energy, Green Technology and Water. Retrieved from <https://www.mestec.gov.my/web/wp-content/uploads/2019/04/13.-National-Energy-Efficiency-Action-Plan-english-only.pdf>

- Mohammad, S. N., Zakaria, R., Omar, W., Majid, A., Zaimi, M., Saleh, A. L., ... & Jainudin, N. A. (2014). *Potential of Solar Farm Development at UTM Campus for Generating Green Energy* (Vol. 479, pp. 553-558). Trans Tech Publications.
- Ponniran, A., Mamat, N. A., & Joret, A. (2012). Electricity profile study for domestic and commercial sectors. *International Journal of Integrated Engineering*, 4(3).
- Rahman, K. A., Leman, A. M., Mubin, M. F., Yusof, M. Z. M., Hariri, A., & Salleh, M. N. M. (2017). Energy Consumption Analysis Based on Energy Efficiency Approach: A Case of Suburban Area. In *MATEC Web of Conferences* (Vol. 87, p. 02003). EDP Sciences.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of environmental psychology*, 29(3), 309-317.
- TNB. (2016). *Electricity Tariff*. Retrieved September 5, 2019, from Tenaga Nasional Berhad: <https://www.tnb.com.my/residential/pricing-tariffs/>
- UNESCAP. (November 5, 2017). Household electricity consumption per capita in Malaysia from 2000 to 2015 (in kilowatt hours) [Graph]. In Statista. Retrieved September 05, 2019, from <https://www.statista.com/statistics/597964/household-consumption-of-electricity-per-capita-in-malaysia/>
- Umit, R., Poortinga, W., Jokinen, P., & Pohjolainen, P. (2019). The role of income in energy efficiency and curtailment behaviours: Findings from 22 European countries. *Energy Research & Social Science*, 53, 206–214. <https://doi.org/10.1016/j.erss.2019.02.025>
- Wang, Z., Zhang, B., Yin, J., & Zhang, Y. (2011). Determinants and policy implications for household electricity-saving behaviour: evidence from Beijing, China. *Energy Policy*, 39(6), 3550-3557.