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ELECTRICAL & ELECTRONIC ENGINEERING | RESEARCH ARTICLE

Factors influencing urban consumers on selecting electricity saving home appliances for managing energy consumption in Indonesia

Yusri Syam Akil[1]*, Saiful Mangngenre[2], Sri Mawar Said[1], Kifayah Amar[2] and A. M. Shiddiq Yunus[3]

Abstract: This study aims to analyze vital indicators for urban consumer's behavior regarding electricity saving appliances (ESA) to reduce energy consumption at home in Indonesia. The studied appliances are limited to two, refrigerator and air conditioner, as these appliances are the most dominant in consuming electricity energy. There are two equation models proposed for each appliance by using consumers' perceptions (general and specific perceptions) and external (social environment, weather, and mass media) group variables, usage and habitual behaviors. Using stepwise regression and statistical approaches for 232 surveyed household consumers in Makassar city, the adjusted R^2 value for four composed models is between 52% and 59%. Study findings reveal that specific perception significantly influences the usage of both appliances including the habit of consumers for energy saving. Among the examined external factors, the variable of mass media has significance in almost all models. Implications for policymakers suggest applying a priority approach in promoting energy saving to consumers with low specific perception based on the aspect of installed electric power capacity at home, and giving more information via mass media about attributes of ESA including introducing intervention strategies is essential to support sustainable electricity consumption from the consumer's side.

Subjects: Statistical Theory & Methods; Power Engineering; Energy & Fuels

Keywords: managing energy; urban consumers; home appliances; electricity saving; Indonesia

1. Introduction

It cannot be denied that human activities nowadays are significantly dependent on electricity energy. As an implication of the rapid development of modern technology, the dependency of some modern technologies on consuming electricity energy has become even higher than several decades ago. As a result, world population growth is simultaneously proportional to the electricity consumption growth. Therefore, it is inevitable for the authorities of every nation in the world to consider every effort to balance between electricity supply and demand in their regions.

Many strategies could be applied to maintain the stability between electricity supply and demand, for instance, establishing several power plants and power lines to provide sufficient energy to consumers. However, these strategies are sometimes not economically effective (particularly for the short-term revenue) as to make them available, a massive number of project-financial must be prepared. Moreover, when the newly established power plants are still based on conventional energy sources, they will not be popular in terms of environmental issues and can violate the declared strategic plan of the government in certain places which is more concerned about renewable energy-based power plants. One of the strategies that can be taken into account is efficiency improvement on the consumer's side. For instance, the usage of ESA in residential sector, the utilization of energy management systems or innovating technology, and improvement of user practices for energy saving (Alim et al., 2018; Hanif et al., 2021; Laicane et al., 2015; Matsumoto et al., 2022; Mubdir et al., 2016; Nasab et al., 2021; Reveiu et al., 2015; Silva et al., 2014). In Indonesia, this strategy has actually been promoted by the government on many occasions and legalized via the constitution of the Republic of Indonesia No. 30 Year 2017 about Energy (Ministry of Energy and Mineral Resources, 2017) and Republic of Indonesia Government Regulation No. 70 Year 2009 about Energy Conservation (Ministry of Energy and Mineral Resources, 2019). In general, efficiency improvement of electricity usage not only helps to reduce energy consumption, but also helps to mitigate climate change, reduce the cost of providing electricity energy, ensure the security of future electricity, face scarcity of fuel and or increase people's access to electricity (Kamunda, 2014; Kwakwa, 2018; Mutumbi et al., 2022; Sorrell, 2015; Stoyanov et al., 2021).

To improve the efficiency of use, residential consumers' behaviors could not be ignored. It is one of the pivotal aspects in shaping the trend and the amount of energy consumption in one particular area. Therefore, a study consumer's behavior is important to reduce electricity energy consumption. The study results become essential information for the authorities to take any required procedures to rectify the consumer's habit into efficiency-minded. Of course, this will relatively be more straightforward compared with the efforts to establish more power plants.

In homes, refrigerator and air conditioner (AC) are the two main appliances that consume relatively more electricity. These two appliances are almost possessed by every household in urban areas, particularly for households with a minimum electricity power capacity of 900 VA in Indonesia. To reduce or manage monthly energy consumption, residential households should be directed to use ESA. This action will impact the total urban consumer's consumption as they almost continue to use electricity for these two appliances.

However, reducing household electricity consumption is a challenging task as load drivers are very complex and can be unique in one area including the availability of consumer data. To face the challenge, it is needed to develop a specific model or framework based on the environment of occupant and a procedure for collecting data as a basis in determining consumption drivers, potential of energy saving, and strategies to be implemented. One common approach to obtaining required information from electricity consumers such as ESA ownership and their conservation behaviors is to use a questionnaire (Guo et al., 2018).

Several papers (Afzalan & Jazizadeh, 2019; Hameed & Khan, 2020; Khan et al., 2013; Laicane et al., 2015; Park & Lee, 2013; Podbregar et al., 2021; Ponniran et al., 2012; Sugiura et al., 2013; Waris & Hameed, 2020, 2021) have discussed similar cases. For example (Laicane et al., 2015) studied the impact of home appliances load shifting to regulate characteristics and reduce peak load in Latvia by focusing on the washing machine and dishwasher. The appliance load shifting can decrease peak load by around 24% for washing machine and 13.5% for dishwasher. Park and Lee (2013) performed survey to investigate consumers' perceptions and behaviors related to home appliances in the Michigan, U.S., particularly on the energy saving–based lamp (CFL lamp). They reported that lighting perception is the main indicator of consumers' behaviors. Study (Sugiura et al., 2013) analyzed energy consumption for households in Japan concerning to the increase of used electricity equipment including forecasting. They estimated that improving efficiency mainly for refrigerator and lighting can decrease energy consumption by 16% in 2020. Another study (Khan et al., 2013) looked at variations of electricity consumption for refrigerator under various operating conditions such as frequency of door opening and temperature condition. From the experiment, they claimed that energy consumption would increase from 7% to 30% which depends on the frequency of door opening namely from 12 to 48 times in 6 hours. Meanwhile, increasing for ambient temperature from 20 to 32 °C will increase energy consumption around 15% to 53%. In (Ponniran et al., 2012), conducted survey to analyze the pattern of electricity energy consumption for residential and commercial areas by monitoring the utilization of some appliances. They found that refrigerator and compressor are appliances that highly contributed to the electricity consumption for residential and commercial areas in Malaysia, respectively. The study (Afzalan & Jazizadeh, 2019) investigated the usage patterns of various appliances including AC to see how they affect household electricity load. They reported quantification of electricity consumption for AC contributes around 20% to 50% to the total consumption for summertime in 2016. The study (Hameed & Khan, 2020) performed an online survey to investigate customers' sustainable behavior regarding the usage of inverter air conditioners (IACs) at homes using goal framing theory. From their study, it can be concluded that normative motivation directly affects consumers in purchasing IACs. Waris and Hameed (2020) analyzed the effect of eco-labels and psychographic variables on users' buying intentions for ESA, and in another study (Waris & Hameed, 2021) they developed a framework based on the extension of planned behavior theory to examine the influence of antecedence on buying intention. They reported that environmental concern and knowledge of eco-labels are some main indicators of consumers' buying intention for ESA to reduce energy consumption in Karachi, Pakistan. Study (Podbregar et al., 2021) analyzed the influence of electricity tariff on household electricity consumption level in Serbia using Randomized Control Trials approach. They reported when electricity tariff is very low, energy saving information has no significant effect in changing conservation behaviors of consumers.

Comparing to the previous studies as explained above and mainly for (Afzalan & Jazizadeh, 2019; Hameed & Khan, 2020; Khan et al., 2013; Ponniran et al., 2012) which analyzed refrigerator and or AC as well, basically they presented a different framework for analyzing the appliances to get potential energy saving in the related countries, for example (Khan et al., 2013) performed experiment to investigate consumption level of refrigerator under various operating condition, meanwhile (Ponniran et al., 2012) analyzed electricity consumption for refrigerator and some other appliances based on the measurement process. This current study proposed regression equation models which aims to understand Indonesian consumers' conservation behaviors for specific home appliances based on the survey to reduce energy consumption by taking Makassar as a case study. To get detail information, firstly, this work analyzed the perception level of consumers towards energy saving. Secondly, we analyze factors affecting the usage and habitual behaviors of consumers for two specific ESA (refrigerator and AC) by composing regression models. Finally, we summarize policy implications from the study and future research to get more information concerning energy conservation behaviors. To our knowledge, studies on consumers' behaviors concerning ESA for urban households in Indonesia are very limited. Besides to reduce consumption or to avoid overconsumption, improving electricity saving actions among Indonesian households are also meaningful to dealing with resource scarcity and environmental issues as the contribution of energy consumption from the residential sector is relatively high (42.25% in year 2019 with consumers' number of 91.96%) and power supply is still dominated by thermal power plants, namely around 87% in the same year (PLN, 2019). Previous studies on electricity consumption for Indonesian households on many different issues can be seen in (Batih & Sorapipatana, 2016, 2017; Pratiwi et al., 2021; Rasyid & Kristina, 2021; Santosa et al., 2019; Tanoto & Praptiningsih, 2013; Wijaya & Tezuka, 2013).

For the case study, Makassar is typically classified as one of the metro cities in Indonesia, with more than one and a half million people located in South Sulawesi province. With a population of around 17% of the total population of South Sulawesi, Makassar is placed as the 4th most crowded

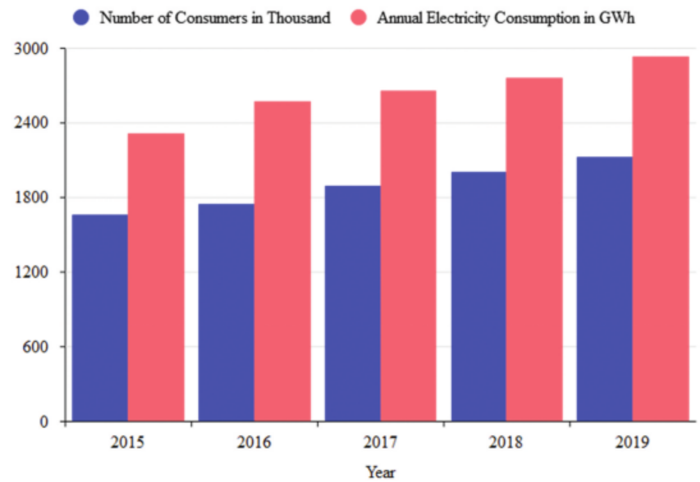


Figure 1. Number of residential consumers and electricity consumption in South Sulawesi province (PLN, 2015-2019).

city in Indonesia. Therefore, Makassar is enough to be taken as a location for conducting the survey. Typical residential consumers and electricity energy consumption in South Sulawesi for five consecutive years can be seen in Figure 1. As demonstrated in the figure, the number of consumers tends to increase over time. In 2015, there were approximately 1.65 million consumers, which increased to 2.12 million in 2019. A similar tendency for the annual volume of electricity consumption, which was around 2.315 GWh in 2015 and increased to 2.929 GWh in 2019. This trend indicates that consumption will likely rise even further in the near future. There are three residential consumer group classifications according to the installed electricity power capacity (IPC); R1, R2, and R3. Group R1 is divided into consumers with an IPC of 900 VA, 1,300 VA, and 2,200 VA. Group R2 is for consumers with 3,500–5,500 VA, and Group R3 is for consumers with 6,600 VA or higher. Among the groups, group R1 has the highest number of consumers and on the contrary for group R3. The residential consumers include residential houses, groups of rented houses, individually owned flats, flats owned by *Perumnas*, private company employee family dormitories, and student dormitories (PLN, 2022).

This paper is structured into five sections. Section 1 presents the general background including the research aim. Section 2 presents a literature review and a conceptual framework. The research methodology is described in detail in Section 3. Section 4 provides obtained results. Finally, Section 5 discusses the contribution, policy implications, limitations, and future research.

2. Literature review and conceptual framework

One variable that reflects household electricity load profile in one area is consumer's behavior (Guo et al., 2018). To control the usage of electricity, knowing the factors affecting energy conservation behaviors is important. This is in line with (Bedir & Kara, 2017; Ouyang & Hokao, 2009; Wood & Newborough, 2003) that improving user's behavior can increase energy saving. Consumers' conservation behaviors consist of two main types, namely usage behavior and habitual behavior (Ali et al., 2021; Barr et al., 2005). Basically, usage behavior refers to ESA as a priority to be used at home (technology choices) (Ali et al., 2021; Barr et al., 2005). This type of user's behavior includes things such as purchasing electricity saving AC. Meanwhile, for habitual behavior, it focuses on reducing energy usage based on daily activities at home such as turning off the air conditioner in an unused room (Ali et al., 2021; Barr et al., 2005).

Based on the literature, a conceptual framework as seen in Figure 2 is proposed. From the figure, five independent variables in the framework model are assumed to influence consumers'

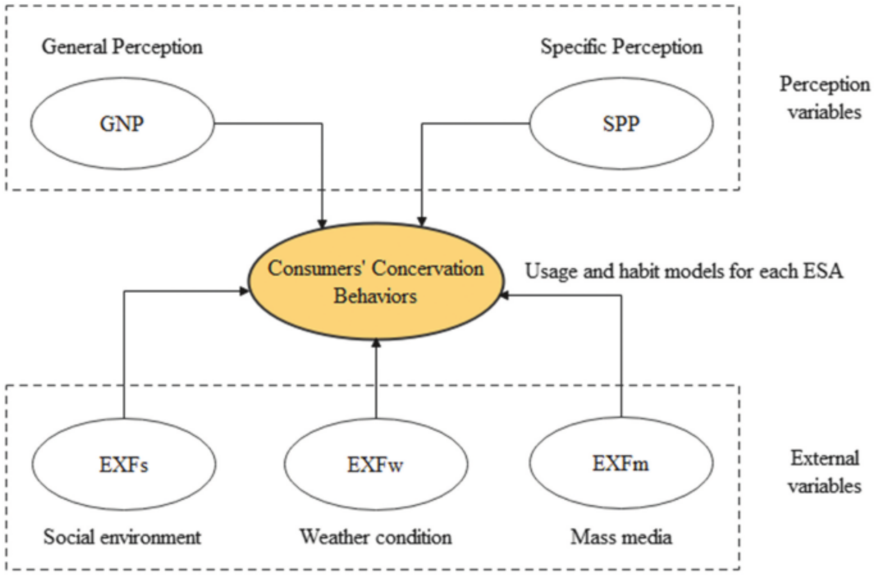


Figure 2. Conceptual framework.

behaviors in using electricity saving refrigerator (ESRef) and electricity saving AC (ESAC), and their habits towards energy saving at home. The five independent variables which are divided into two group variables are explained below.

2.1. Consumers' perceptions

Consumers with a good perception of energy saving may be more easily able to identify actions to save more energy in their daily lives (Lesic et al., 2018). Therefore, Lesic et al. (2018) further affirmed that measuring and understanding better consumers' perceptions of energy use is valuable as it can become a basis in designing a more realistic strategy for improving behavior in energy saving. A study (Park & Lee, 2013) measured or divided consumers' perceptions into two categories, namely general and specific perceptions. It measured the users' beliefs and attitudes toward energy conservation and environmental issues in general for the general perception. Meanwhile for the specific perception focus on home appliance attributes that can be measured such as from perspective of cost or technological aspects. Based on this, it is assumed that general and specific perceptions can affect the use of ESA and daily habits of consumers. Within the framework of this study, it is hypothesized that H1A, H1B, H1C, H1D, H1E, H1F, H1G, and H1H as follows:

H1A: There is a significant relationship between general perception and usage behavior for ESRef.

H1B: There is a significant relationship between specific perception and usage behavior for ESRef.

H1C: There is a significant relationship between general perception and habitual behavior for ESRef.

H1D: There is a significant relationship between specific perception and habitual behavior for ESRef.

H1E: There is a significant relationship between general perception and usage behavior for ESAC.

H1F: There is a significant relationship between specific perception and usage behavior for ESAC.

H1G: There is a significant relationship between general perception and habitual behavior for ESAC.

H1H: There is a significant relationship between specific perception and habitual behavior for ESAC.

2.2. Social environment

Interaction in a community and social environment can affect the behaviors of people (Bohdanowicz et al., 2021; Gadenne et al., 2011). In line with (Wang et al., 2018) for the domain of energy consumption, even though invisible, some factors including the living environment have a role in changing energy saving behaviors of consumers. Study in (Jager, 2006) affirmed a consumer who has contact for example with their friends or neighbours who successfully installed a PV system at their homes contributed for exchanging of information which can minimize the barrier of the consumer in decision for adoption. The social influence can be strong and has a positive effect on the development of the consumers' values which is needed for the change of various behaviors (Gadenne et al., 2011). A previous study in the field of smart technologies discovered that relatives and friends have strong ties for the adoption of smart energy consumption behavior (Perri et al., 2020; Wangpattarapong et al., 2008). Based on this, it is assumed that the social environment can affect the behaviors of electricity consumers in terms of selecting ESA and their daily habits. Therefore, it is hypothesized that H2A, H2B, H2C, and H2D are as follows.

H2A: There is a significant relationship between social environment and usage behavior for ESRef.

H2B: There is a significant relationship between social environment and habitual behavior for ESRef.

H2C: There is a significant relationship between social environment and usage behavior for ESAC.

H2D: There is a significant relationship between social environment and habitual behavior for ESAC.

2.3. Weather condition

Weather, as it is commonly known, refers to the state of the atmosphere by means of daily temperature, precipitation, and other conditions of atmospheric. In different countries, weather conditions in terms of temperature and or humidity variability at different seasons are confirmed to have a significant role in the pattern and volume of household electricity consumption (Akara et al., 2021; Akil & Miyauchi, 2010; Cawthorne et al., 2021; Du et al., 2021; Mirasgedis et al., 2006; Wangpattarapong et al., 2008). This is in line with our previous work which found a positive relationship between meteorological parameters and daily energy consumption from all electricity sectors in some areas in Indonesia (Akil et al., 2014). Besides as a basis to manage energy usage, understanding electricity consumption sensitivity to weather which can be unique to one location can support the better operation of a power system (Akara et al., 2021; Akil et al., 2014). Based on this, there is enough support to assume that weather conditions experienced by consumers can affect the use of certain appliances and their daily habits of using electricity equipments. Hence, it is hypothesized that H3A, H3B, H3C, and H3D are as follows.

H3A: There is a significant relationship between weather condition and usage behavior for ESRef.

H3B: There is a significant relationship between weather condition and habitual behavior for ESRef.

H3C: There is a significant relationship between weather condition and usage behavior for ESAC.

H3D: There is a significant relationship between weather condition and habitual behavior for ESAC.

2.4. Mass media

Public knowledge in many aspects regarding energy saving such as the advantages of energy saving, how to practice energy saving for certain appliances, and information about low watt products is important to reduce electricity consumption. Past studies (Alam et al., 2014; Waris & Hameed, 2020) support this argument, confirming that users with more knowledge about low watt products will be easier to use such products (influencing purchase decision). To increase consumers' knowledge including awareness of energy efficiency, mass media is usually used as a source of information. A study done by Zyadin et al. (2014) found the importance of traditional mass media in elevating energy saving for the domestic sector. Based on this, it can be assumed that promoting energy saving through the mass media can affect the use of certain appliances and their daily habits. Therefore, we hypothesized H4A, H4B, H4C, and H4D as follows.

H4A: There is a significant relationship between promotion of electricity saving from mass media and usage behavior for ESRef.

H4B: There is a significant relationship between promotion of electricity saving from mass media and habitual behavior for ESRef.

H4C: There is a significant relationship between promotion of electricity saving from mass media and usage behavior for ESAC.

H4D: There is a significant relationship between promotion of electricity saving from mass media and habitual behavior for ESAC.

Hypotheses concerning the relationship between the variables are given above. Next, four regression models are composed based on the proposed framework to address the objectives of this study, namely the refrigerator usage model, the refrigerator habit model, the AC usage model, and the AC habit model. Each composed model is explained in the next section.

3. Method

3.1. Questionnaire design

Two different questionnaires were developed in this study to collect the required data for analysis. The questionnaires were designed based on the information from prior works on refrigerators and AC or related studies (Khan et al., 2013; Park & Lee, 2013; Paul et al., 2012), and modifications were made to fit the Indonesian context. Besides measuring consumers' perceptions towards energy saving, the developed questions are used to investigate driving variables or factors that influence the usage of observed ESA and habits of residential consumers as introduced in (Park & Lee, 2013). For more detailed analysis, a group of variables is added to the models namely external factors which are assumed to effect the behaviors of observed consumers. Data was collected by conducting a survey using a purposive sampling technique for 232 household residents ($n = 112$ for the refrigerator, and $n = 120$ for the AC). The target of potential respondents was a householder or family member with an IPC of at least 900 VA and located in Makassar city.

Systematic questions in both questionnaires can be divided into four main parts, that is general information of participant in Part 1, general perception-related saving of energy and factors of external in Part 2, specific perception related to attribute of observed ESA in Part 3, and usage behavior and habit of consumers in Part 4. For questions in Part 1 and Part 2, most of the questions were similar for both questionnaires.

For example, questions in Part 1 include such as gender, education, age participant, house size, and lenght of using ESRef or ESAC. In Part 2, the questions include statements such as "The usage of ESA is important to support energy conservation program", "Energy saving behavior supports in reducing environmental issue", and for external factors include "The usage of electricity saving home appliances is affected by factor of social (neighbors, relatives, and/or friends)", "The usage of ESA is affected by weather condition (temperature, rainy season, dry season, etc.)", and"The usage of ESA is influenced by mass media (television advertisement, newspaper, etc.). In Part 3, questions for specific perception concerning on attribute of observed electricity saving appliances (by means of aesthetic, technology, and cost attribute) include some statements such as "Shape and design of ESRef is attractive" for refrigerator, and "Shape and design of ESAC is attractive" for AC. Here, each item in the questionnaires is assessed using seven point Likert scale which scale 1 represents "strongly disagree" meanwhile scale 7 represents "strongly agree". Part 2 to Part 4 for both questionnaires can be completely seen in APPENDIX A.

Level of consumer's perception is assessed by using mean score analysis. Meanwhile, reliability of the designed questionnaire is determined by a common approach namely Cronbach's alpha (α) value as formulated in Eq. (1) (Amirrudin et al., 2021; Bland & Altman, 1997).

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\Sigma S_i^2}{S_T^2}\right) \quad (1)$$

where k is number of statement or question (items). Meanwhile S_i^2 and S_T^2 are variance for i^{th} item and for all items, respectively.

3.2. Proposed models for ESRef and ESAC

To investigate the typical relationship between variables from conceptual model, two regression equations for each appliance, namely the usage model and the habit model as discussed in (Park & Lee, 2013) were built by using various variables. The equation models for refrigerator are shown in Eqs. (2) and (3), whereas equation models for AC are shown in Eqs. (4) and (5).

$$REFU_m = \delta_0 + \delta_1 GNP + \delta_2 SPP + \delta_3 EXFs + \delta_4 EXFw + \delta_5 EXFm + e_t \quad (2)$$

$$REFH_m = \gamma_0 + \gamma_1 GNP + \gamma_2 SPP + \gamma_3 EXFs + \gamma_4 EXFw + \gamma_5 EXFm + e_t \quad (3)$$

$$ACU_m = \lambda_0 + \lambda_1 GNP + \lambda_2 SPP + \lambda_3 EXFs + \lambda_4 EXFw + \lambda_5 EXFm + e_t \quad (4)$$

$$ACH_m = \xi_0 + \xi_1 GNP + \xi_2 SPP + \xi_3 EXFs + \xi_4 EXFw + \xi_5 EXFm + e_t \quad (5)$$

where $REFU_m$ and $REFH_m$ are usage and habitual behavior of residential consumers concerning ESRef, respectively. Variable GNP is general perception and SPP is specific perception. Meanwhile others are factors of external which consist of three variables, namely EXFs (social variable), EXFw (weather variable), and EXFm (mass media variable). e_t is error term, δ_0 and γ_0 are regression model intercepts and others are regression coefficients. For AC models, ACU_m is usage behavior and ACH_m is habitual behavior of consumers. Remaining variables are similar as in Equations (2) and (3).

When a number of independent variables are considered in a composed model, their contributions to the analyzed dependent variable can be different. Therefore, if we have an interest in getting more detailed information regarding the big of each variable's contribution including their significance, an especial procedure is needed. One way that can be used for this task is the application of stepwise regression analysis as in Wangpattarapong et al. (2008). In this process, after a new variable or group of variables is added at each stage, testing is done to assess if certain variables can be removed. With regard to this, in this study, a stepwise regression procedure with a forward selection process is applied to get final models. Each model includes the perception variables group at the first step. Next in the second step, external factors are added in the models to observe how these variables influence the consumer in the selection of ESA in the residential sector and the consumer's habit towards energy saving. Non-significance variables in the first step are removed from the model in the second step for simplification. To validate and to determine the best models, some other statistical tests are applied including the involving an autoregressive structure (first order) in the error term (e_t) of models to reduce autocorrelation as in Eq. (6) (Mirasgedis et al., 2006; Taylor & Buizza, 2003).

$$e_t = \phi_1 e_{t-1} + \phi_2 e_{t-2} + \ldots + \phi_p e_{t-p} + \varepsilon_t \quad (6)$$

where $\o_p$ is constant, p is autoregressive structure order, meanwhile ε_t means white noise.

4. Resuts and analysis

4.1. Reliability and validity

To know the internal consistency for items in the same dimensions in the questionnaires, Cronbach's alpha values were examined for each of the 40 respondents as a pilot survey. All items in the pre-test questionnaires (refrigerator and AC) were reliable, confirming their appropriateness for further analysis. It is shown by Cronbach's alpha value for all tested dimensions in each questionnaire reaching an acceptable value of 0.6 (Griethuijsen et al., 2014; Park & Lee, 2013). For validation, the content validity method is adopted (Taherdoost, 2016).

4.2. Characteristic of respondents

Table 1 shows collected data from the main survey concerning the characteristics of respondents for each appliance and their distribution percentages. From the table, a number of important information for both surveys can be obtained. For example, majority of respondents are males with educational backgrounds mainly have bachelor's degrees. Most of them have a house size of about 60 m^2 and dominantly with IPC of 1,300 VA. For the length of using ESA, the majority of respondents have been using ESRef and ESAC in their homes for 1 to 3 years.

4.3. Perception level of residential consumers

The next step is the measurement of general and specific perceptions of consumers by using mean score analysis based on the used 7-point Likert scale. Similar to (Amar, 2010), a score of 1 means none (not good), a score of 2 and 3 means low, a score of 4 and 5 means medium (good enough), and a score of 6 and 7 means high (good). Data analysis for all respondents ($n = 232$) revealed that consumers' perceptions-related energy saving are good enough, as evidenced by the obtained mean average values for general perception (MAV-GNP) and specific perception (MAV-SPP) which are 5.86 and 5.49, respectively.

To analyze further, perception level is observed from demographic characteristics particularly based on the aspect of IPC as shown in Table 2. From the table for general perception, group R1 has a more positive perception of energy saving than two other consumer groups (R2 and R3). However, for consumers categorized into group R1, the consumer with 900 VA has the highest perception (MVA-GNP = 6.18) and is followed by consumers with 1,300 VA and 2,200 VA. A similar tendency to general perception is found for specific perception (MAV-SPP = 5.63).

4.4. Regression analysis results

Tables 3 to 10 present regression results of the best usage and habit models for each appliance using a stepwise procedure. Selection of the best among the model choices is based on the smallest AIC and SC values, and the largest adjusted R^2 (adj. R^2) value of the composed models (Akil & Miyauchi, 2010; Mirasgedis et al., 2006). All models are statistically validated. Non-significant variables in the 1st step are deleted from the model in the 2nd step. From the results, the probability of the F-statistic value for each model is 0. This indicates at least one of the variables in the models affects the usage behavior and habit of consumers (Wangpattarapong et al., 2008). Durbin-Watson Statistics tests obtained nearly two indications that an

Table 1. Characteristic of respondent for each appliance

No	Demographic Characteristics		Percentage		Total of Respondent	
			ESRef	ESAC	ESRef (112)	ESAC (120)
1	Gender	Female	42.9%	48.3%	100%	100%
		Male	57.1%	51.7%		
2	Education	Junior/Senior High School	40.2%	25.8%	100%	100%
		Bachelor	40.2%	62.5%		
		Master/Doctoral Degree	11.6%	9.2%		
		Others	8%	2.5%		
3	Age	20–30 Years	29.5%	35%	100%	100%
		31–40 Years	25.9%	20.8%		
		41–50 Years	25.9%	26.7%		
		Over 51 Years	18.8%	17.5%		
4	House size	45 m^2	29.5%	32.5%	100%	100%
		60 m^2	40.2%	36.7%		
		120 m^2	21.4%	16.7%		
		Others	8.9%	14.2%		
5	Income (per month)	Less than 2,500,000 IDR	44.6%	15%	100%	100%
		2,500,000–5,000,000 IDR	38.4%	40.8%		
		Over 5,000,000–7,500,000 IDR	10.7%	27.5%		
		Over 7,500,000 IDR	6.3%	16.7%		
6	IPC	900 VA	42.9%	12.5%	100%	100%
		1,300 VA	46.4%	63.3%		
		2,200 VA	8.9%	22.5%		
		3,500–5,500 VA	1.8%	1.7%		
		6,600 VA or higher	0%	0%		
7	Length of using ESRef or ESAC	Less than 1 Year	32.1%	23.3%	100%	100%
		1–3 Years	56.3%	53.3%		
		Over 3 Years	11.6%	23.3%		

Note: 1 USD is approximately 14,890 IDR

Table 2. Value of consumer's perception based on IPC

Category	IPC				
	Group R1			Group R2	Group R3
	900 VA	1,300 VA	2,200 VA	3,500–5,500 VA	6,600 VA or Higher
Resp. (%)	27.16%	55.17%	15.95%	1.72%	0%
MAV-GNP	6.18	5.88	5.65	4.51	-
MAV-SPP	5.63	5.47	5.36	4.71	-

autocorrelation problem does not exist in models. For handling heteroskedasticity, corrected standard error regression is applied (Startz, 2007). Next, the summary of hypotheses assessment regarding significant relationships between variables in related models from conceptual framework is shown in the form of table (Table 11). Acceptance and rejection of the formulated

Table 3. Results for the 1st step refrigerator usage model

Variable	$REFU_m$ model			
	Coefficient	*p*-value	Standard error	*t*-statistic
δ_0	1.5966	0.0002	0.4089	3.9041
GNP	0.0945	0.4270[a]	0.1186	0.7972
SPP	0.5909	0.0000*	0.1199	4.9282
R^2	0.4745			
Adj. R^2	0.4649			
Std. E. Reg.	0.5460			
Prob. (*F*-Stat.)	0.0000			
AIC	1.6543			
SC	1.7271			
D-W Statistic	1.8483			

Notes: *significant at 1%, [a]not significant at 5% level

Table 4. Results for the 2nd step refrigerator usage model

Variable	$REFU_m$ model			
	Coefficent	*p*-value	Standard error	*t*-statistic
δ_0	1.5440	0.0001	0.3694	4.1792
SPP	0.5329	0.0000*	0.0972	5.4793
EXFs	0.0446	0.4132[a]	0.0542	0.8214
EXFw	0.0021	0.9660[a]	0.0513	0.0427
EXFm	0.1303	0.0193**	0.0548	2.3747
R^2	0.5373			
Adj. R^2	0.5200			
Std. E. Reg.	0.5171			
Prob. (*F*-Stat.)	0.0000			
AIC	1.5628			
SC	1.6841			
D-W Statistic	1.9255			

Notes: *significant at 1%, **significant at 5%, [a]not significant at 5% level

hypotheses are based on the statistical test (*p*-value), which refers to statistically significant and not significant, respectively (Aris et al., 2018).

Regarding results for the usage model of refrigerator, the adj. R^2 value in the 1st step is 46.49% (Table 3) and increased to around 52% in the 2nd step (Table 4). The addition of external factors in the 2nd step made the fitness degree of the $REFU_m$ model much better. At the 5% significance level, variables SPP and EXFm are significant (hypotheses H1B and H4A are accepted) in the model as indicated by their *p*-values below 0.05. Meanwhile, for the $REFH_m$ model, the obtained adj. R^2 value is 39.73% and 53.61% in the 1st step (Table 5) and the 2nd step (Table 6), respectively. Similar to $REFU_m$ model, by adding external factors in the 2nd step, the fitness degree of the $REFH_m$ model is increased. Variables of SPP, EXFw, and EXFm have significance in the model at the same significance level (hypotheses H1D, H3B, and H4B are accepted) as shown in Table 6.

For AC, the adj. R^2 value for the usage model (UAC_m model) in the 1st step is 54.88% and around 58.23% in the 2nd step (Tables 7 and 8). The best ACU_m model is specified with autoregressive order one (AR(1)). In the 2nd step, variables of GNP, SPP and EXFs have significance at the 5% level

Table 5. Results for the 1st step refrigerator habit model

Variable	$REFH_m$ model			
	Coefficient	***p*-value**	**Standard error**	***t*-statistic**
γ_0	1.0084	0.0137	0.4024	2.5057
GNP	0.2822	0.0242**	0.1234	2.2865
SPP	0.5015	0.0000*	0.1113	4.5049
R^2	0.4081			
Adj. R^2	0.3973			
Std. E. Reg.	0.6930			
Prob. (*F*-Stat.)	0.0000			
AIC	2.1311			
SC	2.2039			
D-W Statistic	1.9401			

Notes: *significant at 1%, **significant at 5%

Table 6. Results for the 2nd step refrigerator habit model

Variable	$REFH_m$ model			
	Coefficient	***p*-value**	**Standard error**	***t*-statistic**
γ_0	0.6487	0.0451	0.3199	2.0277
GNP	0.1957	0.0785[a,***]	0.1101	1.7764
SPP	0.3623	0.0042*	0.1238	2.9245
EXFs	−0.0816	0.1195[a]	0.0520	−1.5693
EXFw	0.1922	0.0013*	0.0582	3.3029
EXFm	0.1911	0.0000*	0.0409	4.6669
R^2	0.5570			
Adj. R^2	0.5361			
Std. E. Reg.	0.6080			
Prob. (*F*-Stat.)	0.0000			
AIC	1.8949			
SC	2.0406			
D-W Statistic	2.0038			

Notes: *significant at 1%, ***significant at 10%, [a]not significant at 5% level

(hypotheses H1E, H1F and H2C are accepted). For the ACH_m model, the adj. R^2 value in the 1st step is 49.06% and around 53.07% in the 2nd step (Tables 9 and 10). By using the same significance level, the variables SPP and EXFm have significance in the final ACH_m model (hypotheses H1H and H4D are accepted). Figure 3 shows variables that have significance and their regression coefficient values for all composed models in the 2nd step.

5. Discussions and conclusions

This paper analyzed vital indicators for urban consumers' behaviors related to the utilization of ESA in the residential sector particularly for refrigerator and AC. The questionnaires are reliable, and the developed model equations using a stepwise regression procedure for each appliance are effective enough to identify the drivers of usage and habitual behaviors of consumers. From analysis, it is found that the general perception of consumers regarding energy saving is good enough. Other main findings for regression analysis showed that considered variables in each model affected usage and habitual behaviors of consumers differently with adj. R^2 value between 52% and 59%.

Table 7. Results for the 1st step AC usage model

Variable	ACU_m model			
	Coefficient	*p*-value	Standard error	*t*-statistic
λ_0	1.0004	0.0654	0.5377	1.8602
GNP	0.3190	0.0005*	0.0889	3.5867
SPP	0.4812	0.0000*	0.0790	6.0896
AR(1)	0.4174	0.0000	0.0866	4.8151
R^2	0.5603			
Adj. R^2	0.5488			
Std. E. Reg.	0.5545			
Prob. (*F*-Stat.)	0.0000			
AIC	1.6918			
SC	1.7582			
D-W Statistic	2.1050			

Note: *significant at 1%

Table 8. Results for the 2nd step AC usage model

Variable	ACU_m model			
	Coefficient	*p*-value	Standard error	*t*-statistic
λ_0	1.1262	0.0483	0.5640	1.9969
GNP	0.2876	0.0009*	0.0843	3.4097
SPP	0.3828	0.0000*	0.0828	4.6218
EXFs	0.1134	0.0134**	0.0451	2.5122
EXFw	−0.0092	0.8555^a	0.0504	−0.1825
EXFm	0.0194	0.7098^a	0.0520	0.3731
AR(1)	0.4228	0.0000	0.0993	4.2555
R^2	0.6035			
Adj. R^2	0.5823			
Std. E. Reg.	0.5336			
Prob. (*F*-Stat.)	0.0000			
AIC	1.6387			
SC	1.8021			
D-W Statistic	2.1553			

Notes: *significant at 1%, **significant at 5%, ^{a}not significant at 5% level

Based on the results, some of the proposed hypotheses are accepted as in Table 11. In terms of general perception and social environment, these two factors are significant only in the usage AC model. And similar to the weather condition, it is also significant only for the habit refrigerator model. For two other factors, namely specific perception and mass media, they have significance in almost all models as seen in Figure 3. Next, the last two factors (specific perception and mass media) are further investigated. In terms of specific perception regarding the attribute of ESA, it has a positive effect as shown by regression coefficient value for each model has positive sign and it has highest influence among of the observed variables which is significant in all final usage and habitual behavior models. It is in line with findings from a past study (Park & Lee, 2013). It implies that in selecting and practicing energy saving, observed consumers pay attention to the attributes of appliances such as the used technology (for example, power consumption level) and design. In terms of mass media, results show it has significance in most final models. Basically, this matches with findings in Waris

Table 9. Results for the 1st step AC habit model

Variable	ACH_m model			
	Coefficient	*p*-value	Standard error	*t*-statistic
ξ_0	1.7273	0.0003	0.4592	3.7616
GNP	0.0483	0.4553[a]	0.0645	0.7491
SPP	0.6451	0.0000*	0.0838	7.6957
R^2	0.4992			
Adj. R^2	0.4906			
Std. E. Reg.	0.5131			
Prob. (*F*-Stat.)	0.0000			
AIC	1.5281			
SC	1.5978			
D-W Statistic	1.8554			

Notes: *significant at 1%, [a]not significant at 5% level

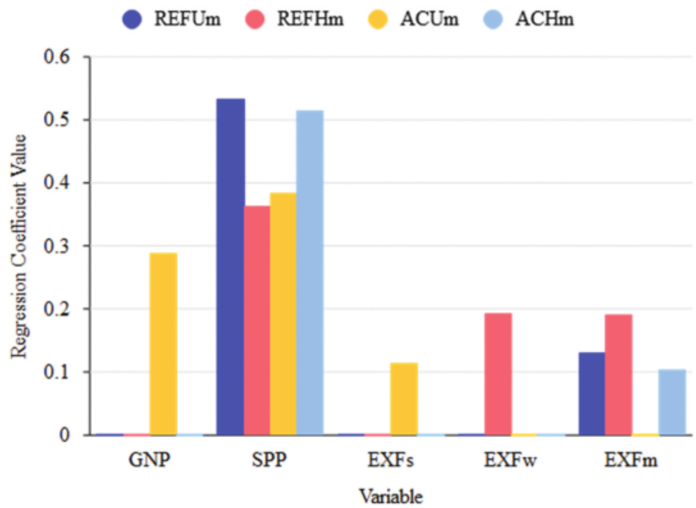
Table 10. Results for the 2nd step AC habit model

Variable	ACH_m model			
	Coefficient	*p*-value	Standard error	*t*-statistic
ξ_0	1.8534	0.0000	0.4287	4.3520
SPP	0.5145	0.0000*	0.0841	6.1142
EXFs	−0.0092	0.8178[a]	0.0398	−0.2308
EXFw	0.0730	0.0531[a,***]	0.0373	1.9538
EXFm	0.1024	0.0271**	0.0457	2.2383
R^2	0.5465			
Adj. R^2	0.5307			
Std. E. Reg.	0.4924			
Prob. (*F*-Stat.)	0.0000			
AIC	1.4621			
SC	1.5782			
D-W Statistic	2.0104			

Notes: *significant at 1%, **significant at 5%, ***significant at 10%, [a]not significant at 5% level

and Hameed (2020) regarding the important role of knowledge related energy saving to support further sustainable consumption, as it can increase, for example, technological insight and reduce misconceptions of users. Doney et al. (1998) affirmed that knowledge can increase consumers' trust which is a contributor to many exchanges including using a new technological product. Hence, more information campaigns or advocating energy saving (such as information and advantages of low watt products and how to practice energy saving for different equipment) through mass media in many forms is required both to increase awareness of practicing energy saving for specific equipment and to maximize the switch rate of a technology (Guo et al., 2018; Reveiu et al., 2015). Furthermore, priority approach in advocating energy saving should be given more to the group of residential consumers based on the IPC classification with low perception mainly for specific perception. Besides knowledge publicizing, other ways known as intervention strategies can be formulated and introduced to the public to encourage consumers to save energy (Guo et al., 2018). It includes such as giving an amount of incentive (rewards) to consumers who successfully reduce consumption (Handgraaf et al., 2013). This is in line in (Jacobsen, 2019), giving an energy-efficient incentive can encourage consumers to use low-watt products. For us, the research findings are important because volume of consumption and number of consumers are high and tend to rise over time. The findings

Figure 3. Significance variables and regression coefficient values for each final model (the 2nd step model).



can be used by the authority to take any necessary actions such as developing more realistic conservation programs to change the habits of urban residential consumers in Indonesia for sustainable electricity consumption from consumer's side.

5.1. Contributions and policy implications

The scientific contribution of this study is indicators for efficiency improvement of electricity energy usage from consumers' side concerning ESA in the residential sector that are formed into two equation models for both usage and habit of electricity saving refrigerator and AC. There are some potential practical implications for policymakers in Indonesia that can be derived from this study as follows:

(1) To stimulate or to rectify consumers' behaviors into efficiency-minded, designing more realistic strategies based on the characteristics of consumers in promoting electricity saving is needed. As perception influences urban consumer's behavior concerning energy saving practices generally, giving priority based on perception level of consumers as a strategy is important. That is from the aspect of IPC, consumers with 3,500 VA show the lowest perceptions regarding energy saving, followed by 2,200 VA, 1,300 VA, and 900 VA as in Table 2. Therefore, more focus should be given to the category of consumers with low perception mainly for specific perception such as in promoting the benefits (education) of using ESA. Providing a more complete database that contains a number of information about consumers such as their locations, IPC, etcetera will be helpful in the implementation.

(2) Besides the priority approach as in point 1, continuing the campaign for electricity saving including providing more information regarding ESA specifically about the attributes of the products via mass media to increase people's knowledge is important. This can be done in many forms of media, such as via television, newspapers, radio, and social media. The combination of using various communication media in providing information to consumers and on a regular basis can give better outcomes. In line with studies in the domain of energy efficiency for industrial consumers (Sweeny et al., 2013, Prukvilailert & Wangskarn, 2011), obstacles to increasing energy efficiency practice such as a lack of information can be reduced by implementing more suitable energy conservation programs for related consumers.

(3) Implementation of intervention strategies is also recommended to encourage people further to manage their consumption. Besides providing information, the potential strategies that can be adopted include giving rewards (economic and or social rewards) to consumers who successfully reduce consumption, goal setting (consumption reduction value or target

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Table 11. Summary of results and hypotheses assessment

Refrigerator Usage Model (Equation 2)				
Hypothesis	*p*-value	*t*-statistic	Decision	Stepwise
GNP ➔ REFU	0.4270[a]	0.7972	H1A: Rejected (Not Significant)	1st Step
SPP ➔ REFU	0.0000	4.9282		
SPP ➔ REFU	0.0000	5.4793	H1B: Accepted (Significant)	2nd Step#
EXFs ➔ REFU	0.4132[a]	0.8214	H2A: Rejected (Not Significant)	
EXFw ➔ REFU	0.9660[a]	0.0427	H3A: Rejected (Not Significant)	
EXFm ➔ REFU	0.0193	2.3747	H4A: Accepted (Significant)	
Refrigerator Habit Model (Equation 3)				
GNP ➔ REFH	0.0242	2.2865		1st Step
SPP ➔ REFH	0.0000	4.5049		
GNP ➔ REFH	0.0785[a]	1.7764	H1C: Rejected (Not Significant)	2nd Step#
SPP ➔ REFH	0.0042	2.9245	H1D: Accepted (Significant)	
EXFs ➔ REFH	0.1195[a]	−1.5693	H2B: Rejected (Not Significant)	
EXFw ➔ REFH	0.0013	3.3029	H3B: Accepted (Significant)	
EXFm ➔ REFH	0.0000	4.6669	H4B: Accepted (Significant)	
AC Usage Model (Equation 4)				
GNP ➔ ACU	0.0005	3.5867		1st Step
SPP ➔ ACU	0.0000	6.0896		
GNP ➔ ACU	0.0009	3.4097	H1E: Accepted (Significant)	2nd Step#
SPP ➔ ACU	0.0000	4.6218	H1F: Accepted (Significant)	
EXFs ➔ ACU	0.0134	2.5122	H2C: Accepted (Significant)	
EXFw ➔ ACU	0.8555[a]	−0.1825	H3C: Rejected (Not Significant)	
EXFm ➔ ACU	0.7098[a]	0.3731	H4C: Rejected (Not Significant)	
AC Habit Model (Equation 5)				
GNP ➔ ACH	0.4553[a]	0.7491	H1G: Rejected (Not Significant)	1st Step
SPP ➔ ACH	0.0000	7.6957		
SPP ➔ ACH	0.0000	6.1142	H1H: Accepted (Significant)	2nd Step#
EXFs ➔ ACH	0.8178[a]	−0.2308	H2D: Rejected (Not Significant)	
EXFw ➔ ACH	0.0531[a]	1.9538	H3D: Rejected (Not Significant)	
EXFm ➔ ACH	0.0271	2.2383	H4D: Accepted (Significant)	

Notes: [a]not significant at 5% level, variable has significance at the first step (grey column), #final step can be set by policymakers or consumer itself for example 5%, 10%, or 15%), and or through a commitment scheme, which is done by oral or written contract to consumers who commit to increasing the efficiency of their energy usage (Guo *et al.*, 2018; Handgraaf et al., 2013; Katzev & Johnson, 1983). In general, combination of the strategies in the implementation gives optimal results (Guo *et al.*, 2018). However, a specific study is required to determine or to develop the most effective strategy for studied consumers.

5.2. Limitations and future research

For a comprehensive result, there are some limitations in the current study. First, ESA analyzed is focused on the refrigerator and AC. As volume and characteristics of household load are determined by the use of many different appliances, this study can be expanded by incorporating other common ESA such as washing machine and television into the analysis. As in (Laicane et al., 2015), observing appliance load is important in reducing and regulating load characteristics in one place. Second, the study's limitation stems from the groups of variables involved in the current models which are focused on perception and external factor variables. Next study can look at other groups of variables, for example, demographic variables of consumers. Third, this work applied a multiple regression approach which can show or handle only one directional influence of the observed variables. As a part of the methodology to extend the analysis, it may use structural equation modelling (SEM) to get bidirectional influence for analyzed variables and latent constructs. Therefore, future research will apply the SEM approach to reveal complex relationships between variables that affect the usage and habitual behaviors of residential consumers in relation to efficient technology equipment. Besides that, an in-depth study in terms of analyzing other appliances and introducing new potential variables will give more information for a better understanding of consumers' behaviors to support reducing electricity usage at home in Indonesia.

Nomenclature

Abbreviation or Symbol	Description	Abbreviation or Symbol	Description
ESA	electricity saving appliances	S_i^2	variance for i[th] items
AC	air conditioner	S_T^2	variance for all items
ESRef	electricity saving refrigerator	δ	regression coefficients for $REFU_m$ model
ESAC	electricity saving AC	γ	regression coefficients for $REFH_m$ model
IPC	installed electricity power capacity at home	λ	regression coefficients for ACU_m model
MAV-GNP	mean average value for general perception	ξ	regression coefficients for ACH_m model
MAV-SPP	mean average value for specific perception	e_t	error term
$REFU_m$ model	refrigerator usage model	$\o_p$	constant
$REFH_m$ model	refrigerator habit model	p	autoregressive structure order
ACU_m model	AC usage model	ε_t	white noise
ACH_m model	AC habit model	R^2	coefficient of determination
GNP	general perception variable	adj. R^2	adjusted R^2
SPP	specific perception variable	std. E. Reg.	standard error regression
EXFs	social environment variable	prob. (F-Stat.)	probability of *F*-statistic
EXFw	weather condition variable	AIC	Akaike information criterion
EXFm	mass media variable	SC	Schwarz criterion
α	Cronbach's alpha value	D-W statistic	Durbin-Watson statistic
k	number of statement or question (items)		

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Dataset that support the findings of this research are provided.

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APPENDIX A: ASSESSMENT SCALE FOR PART 2 TO PART 4

We used seven point Likert scale: 1 represents “strongly disagree” meanwhile scale 7 represents “strongly agree”.

Electricity saving refrigerator (ESRef)

Part 2:

(1) The usage of ESA is important to support energy conservation program;
(2) Energy saving lifestyle can reduce electricity cost;
(3) Energy saving behavior supports sustainable consumption;
(4) Energy saving behavior supports in reducing environmental issue;
(5) The usage of ESA is affected by factor of social (neighbors, relatives, and or friends);
(6) The usage of ESA is affected by weather condition (temperature, rainy season, dry season, etc.);
(7) The usage of ESA is influenced by mass media;

Part 3.

(1) Shape and design of ESRef is attractive;
(2) ESRef has many choices in terms of type and size;
(3) ESRef is relatively more expensive than ordinary refrigerator;
(4) ESRef cools food faster (has a direct cooling system or something similar);
(5) ESRef prevents food from spoiling quickly (has an anti-bacterial system or something similar);
(6) ESRef is relatively quiet and the compressor lasts longer;
(7) ESRef has a defrost function;
(8) ESRef is more resistant to voltage fluctuations;
(9) Material of ESRef is relatively better such as bacteria-free;

Part 4.

(1) I select ESRef to support energy saving program;
(2) I select ESRef to reduce electricity cost;
(3) I select ESRef as it supports the availability of electricity energy in the future;
(4) I select ESRef because eco-friendly;
(5) I select ESRef because the influence of social environment;
(6) I select ESRef because the influence of mass media;
(7) I select ESRef because the influence of weather condition;
(8) I select ESRef because it can cool food faster;
(9) I select ESRef because it can make food last longer;
(10) I select ESRef because the shape looks attractive;
(11) I select ESRef because it has many choices;
(12) Although more expensive, I select ESRef because its capability to save energy;
(13) I select ESRef because it is not noisy and is relatively more durable;
(14) I select ESRef because it has a defrost feature;
(15) I select ESRef because it is more resistant to voltage fluctuations;
(16) I select ESRef because the material is better;
(17) I follow use instructions of ESRef for optimal support of energy-saving program;
(18) I do not put hot food into refrigerator to minimize compressor work which will reduce energy consumption;
(19) I do not put hot food into refrigerator for minimizing electricity use to support sustainable consumption;
(20) Although eco-friendly, I turn off refrigerator when unused for a long time;
(21) I use the ESRef according to the instructions for use without influenced by factor of social;

(22) I use the ESRef as suggested in the mass media;
(23) I do not open refrigerator door too often and for a long time;
(24) I put unheated food in the refrigerator although the ESRef can cool food faster;
(25) I keep a moderate amount of food in the ESRef although it can prevent food from spoiling quickly;
(26) I will replace the ESRef when its life-cycle has achieved although the shape is still attractive;
(27) I choose ESRef that meets the needs and size of the room;
(28) I open ESRef door only when needed although energy saving;
(29) I followed the instructions for use although the ESRef compressor lasts longer and is quieter;
(30) If it is not urgent, I defrost outside the refrigerator;
(31) I unplug the refrigerator for a while when the power goes out frequently;
(32) I regularly clean the ESRef although it has better material;

Electricity saving AC (ESAC)

Part 2. Similar to ESRef

Part 3.

(1) Shape and design of ESAC is attractive;
(2) ESAC looks more sophisticated or modern (such as the use of white LED lamps and others);
(3) ESAC is relatively more expensive than ordinary AC;
(4) ESAC can cool the room faster than ordinary AC;
(5) The air released by ESAC is cleaner (such as having an active plasma feature or something similar);
(6) ESAC is relatively quiet or low noise;
(7) The spread of ESAC air flow throughout the room is better than ordinary AC;
(8) The cold stability of the ESAC is better (has an auto-cleaning function or something similar);

Part 4.

(1) I select ESAC to support energy saving program;
(2) I select ESAC to reduce electricity cost;
(3) I select ESAC as it supports the availability of electrical energy in the future;
(4) I select ESAC because eco-friendly;
(5) I select ESAC because the influence of factor of social;
(6) I select ESAC because the influence of mass media;
(7) I select ESAC because the influence weather condition;
(8) I select ESAC because it can cool the room faster than ordinary AC;
(9) I select ESAC because the released air is cleaner;
(10) I select ESAC because attractive;
(11) I select ESAC because it looks more sophisticated or modern;
(12) Although more expensive, I select ESAC because it can save electricity use;
(13) I select ESAC because not noisy;
(14) I select ESAC because better in spreading of air flow throughout the room;
(15) I select ESAC because better cold stability;
(16) I turn off ESAC when not needed as a commitment to support energy-saving program;
(17) I turn off ESAC when not needed because its support sustainable consumption;
(18) I turn off ESAC when not needed for reducing electricity cost;
(19) Although eco-friendly, I turn off ESAC when not in use;
(20) I always turn off AC when not needed without being influenced by other parties;
(21) I turn off AC when it is not needed as suggested in the mass media;
(22) I turn off AC when it is not needed without affected by the weather condition outside the house;
(23) I turn on ESAC just when I need it because it cools the room faster;

(24) I turn off ESAC when not needed although the air that is released is cleaner;
(25) I turn off ESAC when not needed although it is more attractive when used;
(26) I turn off ESAC when I leave the room although it looks more modern when used;
(27) I turn off ESAC when it is not needed for long-term use;
(28) I turn off ESAC when it is not needed although not noisy when in use;
(29) I always turn on ESAC when I am in the room because the spread of air flow is faster;
(30) I always turn on ESAC when it is needed as it has better cold stability;

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