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Energy consumption efficiency knowledge, attitudes and behaviour among the community

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ABSTRACT

The rapid increase of energy consumption for socioeconomic activities has been the main source of the constant rise of greenhouse gases emission, which causes global warming and climate change effects. Several factors including knowledge, attitudes, and behaviour have been reported elsewhere to influence the energy consumption rate globally. To assess the influence of these factors, some theories, models, and approaches were reviewed to provide a theoretical and conceptual framework on the influence of human knowledge, attitudes and behaviours on energy use and saving. This study assessed some parameters including, awareness, motivation factors, moral and normative concerns, environmental norms, knowledge concerns, technology adoption concerns, and contextual factors and habits. This study conducted a comprehensive literature review followed by Seven-Step Model on studies related to this work. This review work found that behavioural change is significant to address the challenges facing humanity in utilizing natural resources including energy. Also, energy consumption efficiency needs multidisciplinary and sectoral approaches. In energy-saving, individuals need to be informed on the new technologies, energy sources, production and use.

Keywords

Energy consumption;
Energy efficiency;
Global warming;
Human attitudes and behaviours.

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1. Introduction

The rapid increase of global carbon dioxide (CO_2) emissions from different sources including energy have increased alarming concerns [1]–[3]. Recent studies have reported an average emission of about 36 million tonnes of CO_2 per annum globally, and the trend is on the increase [4]. While most of the emissions come from the most developed countries, the developing counties account for about 1% of the total global emissions. Despite low levels of emissions, these countries are more vulnerable to the impacts of climate change [4].

Despite high concerns about increased CO2 emissions, energy demand and consumption has been increasing rapidly because of industrial development and population growth [5], [6]. The recent industrial revolution that introduced robotics and artificial intelligence technology has necessitated the rapid increase of global energy consumption at the rate of 2.9% [7]. The rate of energy consumption differs from one country to another, whereas China which is the leading consumer accounts for 23.6%, United States (16.6%), and Africa accounts for only 3.3%, while and the rest of the world accounts for 56.5% consumption [7], [8].

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The major energy-consuming sectors include residential, commercial, industrial and transportation (especially public transit systems) [8]–[10]. The energy in the residential sector is used for various applications including house cooling and heating systems, lighting, refrigeration, televisions and cooking. To optimize residential energy consumption users' skills, attitudes, and behaviours, management need to be considered. Energy consumption optimization is part of a solution to the increasing energy demand, global warming and climate change which will reduce costs and consumption, and improve energy efficiency and therefore minimize CO_2 emissions [12]–[14]. Today, energy use behaviour has attracted the attention of researchers as one of the approaches to address global warming concerns [11]. To address the question of energy use behaviour, studies have recommended that some emphasis should be invested on users to acquire adequate knowledge, attitudes and behaviour change associated with energy demand and consumption [11], [12]. While residential energy consumption is affected by knowledge, attitude, and behaviour, energy users habits and practices such as water heating, lighting, cooking and freezing have not been adequately considered in current energy consumption efficient analysis tools [11]. There is a need for energy practitioners, researchers, planners and analysts to incorporate individual knowledge, attitudes and behaviour in modelling, planning and calculating energy consumption efficiency [13]. The reduction of total energy consumption at an individual level could transform current energy dynamics in the world [14].

Behavioural matters are required in all aspects of energy development, from the increase of awareness on the necessities of energy efficiency and renewable energies, to ensure technologies are easy to apply and that financial decisions are done in a well-informed manner [15]. Behavioural change must include both short and long term strategic plan and implementation actions [16]. Human behaviour is a complex and dynamic ideal that changes according to time, place, generation and environment [17].

There are various theories and approaches which describe human behavioural changes [18], [19]. These are derived from disciplines such as psychology, economy, sociology, technology, political science, and communication. The main focus may be at individual, interpersonal, community or environmental levels. In energy use, human behaviour is considered as the driving factor which can influence energy efficiency and costs [20]. The change of social norms can be done through holistic and multi-prolonged approaches. These approaches may involve education, modelling, incentives, environmental restructuring, persuasion, and enabling [21]. Only a single approach is less likely to create successful changes.

While various theoretical perspectives have emerged in the literature, there is no single theory, approach, model, or conceptual framework that is universally accepted by scholars as providing an all-inclusive explanation of energy consumption and conservation to predict individual differences in behaviours [22]. This is because there are diverse human contexts such as populations, economic and cultures that need a clear and open theory approach to deal with them [23]. The use of an open theory approach allows the assessment of a range of human issues [19].

Thus, this review intends to explore various previously and recent studies on the theories and practical issues related to the factors that influence personal knowledge, attitudes and behaviour toward energy consumption efficiency.

2. Methodology

This paper explores the most common factors that influence personal knowledge, attitudes, and behaviour on energy consumption efficiency, that have been published in academic journals through systematic literature review (SLR). SLR refers to the strict approach used to pinpoint relevant studies that address the study topic with an established inclusion or exclusion criteria and a well-defined methodological analysis and dissemination of the themes from the selected studies [24]. SLR has used précised and standardized methods to identify and critically appraise the previous relevant studies [25] relating to individual knowledge, attitudes and behaviour on energy consumption efficiency.

To date, few review papers have been published regarding factors influencing energy consumption efficiency knowledge, attitudes, and behaviour among the community [11]. The authors recommend clear and more SLR papers to be carried out in this field to bridge the gap in the previous literature. Thus, this paper aims at presenting the SLR of some journal papers that exist in several academic databases regarding factors influencing personal knowledge, attitudes and behaviour on energy consumption efficiency from 2010 to 2020. These dates were selected to ensure that findings are relevant and up-to-date.

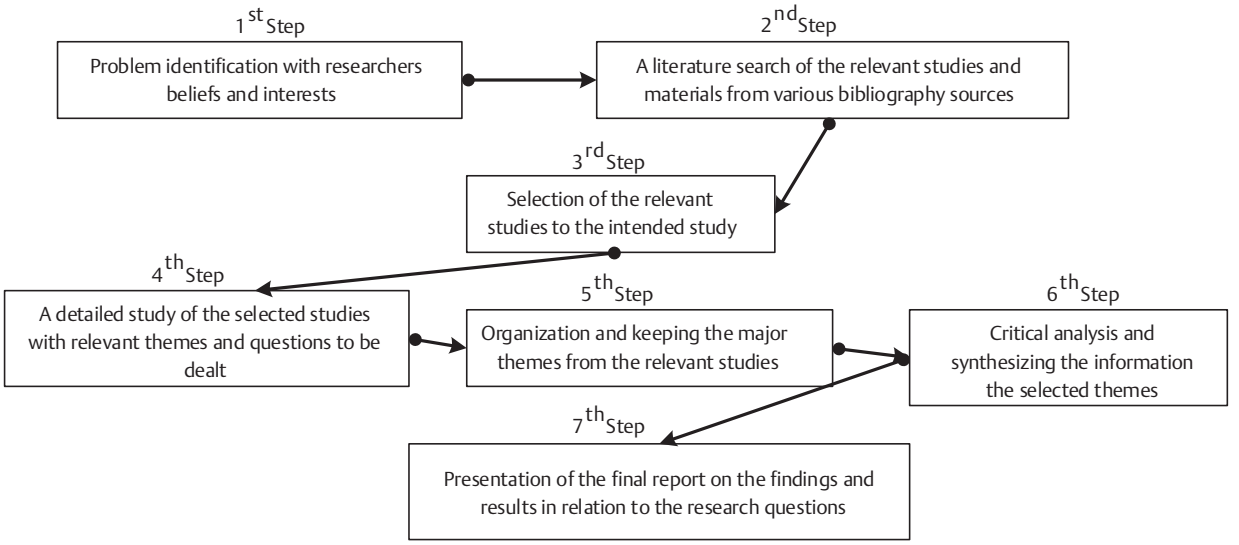

Figure 1: The Seven-Step Model used in the study.

This review applied a Seven-Step Model (Figure 1) which is used to conduct a comprehensive literature review [26]. First, researchers initiated the identification of the problem of the study whereby major themes such as 'awareness', 'knowledge', 'attitudes', 'human behaviour', 'human behavioural change', 'energy consumption', 'energy efficiency', 'energy use', and 'energy savings' were selected. Second, researchers prepared an initial list of relevant studies that were identified through different bibliographic sources such as Google Scholar, Web of Science, and Scopus, and government and non-government reports. Researchers combined the pairs of words from personal knowledge, attitudes and behaviour and energy consumption efficiency. Each keyword search resulted in a large number of hits. Each of the hits were filtered down to relevant studies in the form of journal articles, working papers or book chapters, containing keywords regarding energy consumption efficiency and personal behaviour. All hits in each list were scrutinized and the resulting list was then explored for potential selection. In the second screening, the list was filtered down to 99 out of 136 studies. The selection process revealed the unsuitability of some studies mostly due to a lack of clear information about personal knowledge, attitudes and behaviour and energy consumption efficiency. Thus, out of 99 studies, 69 studies were finally selected, as shown in Table 1. Out of 69 studies, 61 were research papers and the remaining (8) were review papers.

Table 1: Potential studies relevant to this study.

No.	Variable	Number of relevant studies	Per cent
1	Awareness	6	8.7
2	Motivation factors	30	43.5
3	Moral and normative concerns	10	14.5
4	Environmental norms, concerns and knowledge	03	4.3
5	Technology adoption norms and concerns	06	8.7
6	Contextual factors	10	14.5
7	Habits	04	5.8
	Total	**69**	**100**

The selection of relevant studies allowed the identification of major themes that were in line with the study rationale. To ensure the reliability and validity of the data, comprehensive reading, analyzing and synthesizing were conducted to establish the relationship between the emerged themes from the relevant studies. Then, systematic writing and compiling of the summaries of the themes using descriptive means to avoid plagiarism were conducted. Finally, results and findings were disseminated.

3. Results and Discussion

The study of energy users' behaviours and energy efficiency is complex and influenced by multifactorial rea-

sons, both personal and situational [27]. The complexity is observed since the decision making of this study involves fragmented and different disciplines such as psychology, economics, environment, engineering, sociology, and technology [15]. These factors differ among individuals, households, organizations, generations, regions, and nations. This study revealed seven major factors that influence personal knowledge, attitudes and behaviour towards energy consumption efficiency, as indicated in Table 2.

3.1. Awareness

In energy-saving, awareness is considered among the determinants of human behaviour towards energy use [28], [29]. If the country wants to save energy, the citizens must become aware of the energy that they are responsible for and have the power to control. The increased awareness of society may increase simple changes in people's behaviour that can quickly lead to significant energy savings [30]. Individuals need to acquire energy awareness on - (i) how much energy they use directly or indirectly, (ii) what energy is used for, (iii) where the energy used comes from, (iv) the negative impacts of the energy use (for example, depletion of energy resources, environmental changes, and pollution) [32], and (v) what can they do to minimize the energy consumption and its related negatives impacts.

Different energy technologies aimed at saving energy consumption [31]. Society should be aware of these technologies which include smart metering, solar photovoltaic or solar panels, LED lighting, reflective roofing, solar batteries, home automation, more efficient clothes dryers and smart glasses [74]. Energy users should have awareness which may help them to change their behaviours on reporting leaks and equipment failures on the energy transmission systems, changes in equipment use at both home and working places, and choosing various modes of transport that can save energy.

3.2. Motivation factors

Motivation is an urge to behave or act in a way that will satisfy certain conditions, such as wishes, desires, or goals. It is simply defined as an enthusiasm for doing something [75]. It is the driving force behind a person's actions. There are two types of personal motivation. First, personal's extrinsic motivation occurs when a person is motivated to perform a behaviour or engage in an activity to earn a reward or avoid punishment [76]. In this case, the person engages in behaviour not because he/she enjoys it or because he/she finds it satisfying, but to get something in return or avoid something unpleasant. Secondly, personal's intrinsic motivation exists when a person involves in behaviour because it is personally rewarding; basically, performing an activity for his/her own sake rather than the desire for some external reward [77]. Here, the behaviour itself is a reward. The *Cognitive Evaluation Theory* explains that a person's intrinsic motivation can be influenced by both internal and external events [37].

Various scholars have explained motivation through different theories. For instance *Abraham Maslow's theory of the hierarchy of needs* anybody [78] by which

Table 2: Main themes identified after a CRL.

No.	Factor	References	Countries
1	Awareness	[28]–[32]	Tanzania, Greece, Portugal, Bangladesh and Macau, China
2	Motivation factors	[33], [34], [43]–[47], [35]–[42]	China, Qatar, Italy, The Netherlands, Australia and Spain
3	Moral and normative concerns	[5], [32], [48]–[54]	The United States of America, Denmark, Germany, The Netherlands, Ghana, Kenya, South Africa, Turkey and Tanzania
4	Environmental norms, concerns and knowledge	[55], [56]	China and Portugal
5	Technology adoption norms and concerns	[57]–[61]	Malaysia, The United States of America, Nigeria and China
6	Contextual factors	[32], [47], [62]–[69]	The United States of America, Burundi, The United Kingdom, Tanzania, China, Australia,
7	Habits	[70]–[73]	The United States of America, The United Kingdom, The Netherlands and Spain

a person is motivated to fulfil the satisfaction. According to Maslow's theory, human need is developed on five different levels in a hierarchical order that are physiological, safety, emotional, esteem needs and self-actualization [79]. The study conducted by Cheung et al [80] in Southern China on "*the effect of self-determined motivation on household energy consumption behaviour in a metropolitan area*" revealed that intrinsic and extrinsic motivations of an individual are vital predictors of pro-environmental energy consumption behaviour.

Moreover, Maslow's theory of the hierarchy of needs is extended by *Alderfer's existence, relatedness, and growth theory* which takes the need premise of need categories a bit further [81]. In this theory, it is assumed that when lower needs are satisfied, they occupy less of the human attention, but when higher needs tend to become more important, the more humans pursue them [82]. This theory is applicable when energy demand is low, human intention becomes low too, but when the energy demand becomes high, more people tend to pursue the demand. Motivating factors include achievement, advancement, autonomy, personal growth, recognition, and responsibility, as presented in Table 3.

Table 3: The influence of motivating factors in energy-saving behaviours.

No.	Motivating factor	Implications for energy saving	References
1.	Achievement	According to the *Achievement Motivation Theory*, the achievement of the people can change their behaviours on doing things including energy use. The theory explains that the needs of the individual alter over a while with changes in his/her behaviour. It further explains that every individual's motivation is driven by achievement, power, and affiliation regardless of sociocultural beliefs, age or gender.	[83] [84]
		Achievement motivation can be considered as behaviours toward dedication and demonstration of higher abilities.	
		The higher the abilities of the person, the more the influence on the energy use behaviour change. Socioeconomic achievement among society usually increases energy demand. The increased demand leads to an increase in energy consumption.	
2.	Advancement	Advancement is more associated with the social-cultural and economic progress of an individual, group of people, organization or nations. Human advancement usually influences behaviour toward doing something. Humans have been developing through advancements in technologies since the birth of the human species to improve humans' lives. These technologies have been changing over time with an influence on energy consumption.	[35]
		The most advanced individual, society or nation tends to demand more energy for use. For instance, the study conducted by Jin et al. [34], revealed that technological advancement and innovation lead to the increase of energy use in China but at the same time they can be used to achieve sustainability via improvement of energy efficiency and development of energy structure for developing countries.	[34]
3.	Autonomy	In developmental psychology and moral, political, and bioethical philosophy, autonomy is the capacity to make an informed, and uncoerced decision. The concept of autonomy is explained in the *Self-determination Theory* which argues that a person has basic psychological needs to experience autonomy, competence, or relatedness to other people, depending on the social environment	[36], [37]
		Self-determined motivations are necessary predictors of pro-environmental intentions and behaviours. Thus, self-determined motivation on pro-environmental behaviours has a strong relationship with household energy consumption.	[33]
		However, it is believed that personal intrinsic motivation is the most effective and long-lasting way to enhance personal intention to adopt energy-saving behaviour and thus reduce greenhouse gas emissions.	[38]
		In general, individuals are either extrinsically or intrinsically motivated to behave in specific ways that may encourage energy-saving and conservation through sustainable consumption.	[39]

4.	Personal growth	The idea of personal growth is explained in the optimistic theories developed by Carl Rogers and Abraham Maslow. Both theories emphasize the opportunities, capacities and inborn course of human beings toward personal growth and psychological wellbeing.	[85] [86]
		Personal growth entails happiness that is brought to widespread attention with moral philosophy.	
		Energy consumption has significant positive direct and indirect impacts on happiness among the communities.	[40]
		People tend to use their large part of their income the improvement of their lives by purchasing energy-consuming facilities such as houses, transport facilities like cars and motorcycles, mobile telephones, radios and televisions. This increases the energy demand and thus, the increase in energy consumption	[41]
5.	Recognition	Recognition refers to the identification of something or someone from previous encounters or knowledge. It facilitates social interaction and the formation of identity.	[87]
		Recognition has both normative and psychological dimensions. In *Axel Honneth's Theory of Recognition*, recognition is classified into love, respect and social norms. The theory emphasizes the idea of self-realization as the concern and effort to mobilize subjects of struggles for intersubjective recognition.	[88]
		People tend to behave according to how they recognize themselves. This situation influences personal behaviour on energy use.	[42]
		An individual should recognize the level of sorting and capable of handling whatever is thrown to save energy. However, they are some individuals who recognize what they are doing but still don't behave positively in saving energy.	[43]
6.	Responsibility	Every individual has things in charge. In real life, personal or individual responsibility is what is considered the idea that human beings choose, instigate, or otherwise cause their actions. Responsibility is related to accountability.	[44]
		In most cases, being accountable accounts for both being responsible and ultimately being answerable for the actions. The human being is responsible or accountable for those things within control, power, or management.	[45]
		In energy consumption efficiency, there is a near connection between personal responsibility and energy saving. Personal actions to minimize energy use enhance the beliefs about responsibility for the mitigation of climate change.	[46]
		This responsibility towards energy saving and climate change differs according to age, sex, education level, or cultural differences. For instance, Boto-García and Bucciol [46] argued that females, elderly and highly educated people are more likely to feel responsible for climate change through practicing energy saving.	
		Elderly people not only physically protect energy, but also exercise inspiration for the younger generation.	[47]
		The individuals' responsibility should generate national ethical responsibilities. Here, according to Dernbach [89], countries should ethically have responsibilities to improve the quality of life of their citizens with prodigious insurance of access to modern energy and enhance greater energy efficiency use and conservation	

3.3. Moral and normative concerns

Moral values and principles determine how people should act and live in society [48]. Anything happening in society is whether morally good or bad and/or right or wrong [49]. In energy efficiency, ethical and moral issues can raise on a wide range in energy production and use. Globally, four general questions may arise to explain ethical and moral concerns [50]: - (i) the world can continue relying primarily on the use of fossil fuels that accounts for over 80% of the global energy use, (ii) the world might shift to greater dependency on the nuclear energy, (iii) the world should develop and expand the use of renewable energy sources such as hydro, solar, wind, wave and tidal, and geothermal power and, (iv) the world should focus on the energy efficiency and conservation and pursues to reduce the overall demand for energy.

All of these concerns face ethical and moral challenges if the world wants to address them for ensuring energy efficiency. For instance, to continue relying on fossil fuels as the major source of energy will be detrimental for future generations since fossil fuels are depleted, but also they contribute much to greenhouse gas emission and climate change [5], [51].

Secondly, nuclear power generates a lot of toxic wastes that remain hazardous for thousands of future generations [90]. There is also high management of nuclear power because if they are not well handled they cause death to the people. Besides, nuclear power brings concerns of international peace and security [52].

Thirdly, investment in alternative or renewable energy technologies requires high costs and a lot of government subsidies and incentives [53], [91]. Only developed countries and rich individuals will be able to afford these energies. The developing countries and poor individuals will still rely on fossil fuel sources. This will result in the rise of equality, freedom, and fairness concerns.

Finally, the noteworthy decrease in energy consumption is conceivable in two ways that are either a significant decrease in energy demand or a decrease in the population of the people. Either option raises major questions concerning values such as individual freedom of choice, property rights, fairness, and equal opportunity, as well as ethical issues regarding population policy, standards of living, and quality of life [54].

3.4. Environmental norms, concerns, and knowledge

According to Mohr [92], environmental norms refer to "*rules which restrict environmentally harmful behaviour or which prescribe ecologically friendly actions, seem to be on the advance everywhere*". Norms govern individual behaviour and ensure the survival of the commune. Individuals with certain environmental knowledge and concerns have positive attitudes toward environmental behaviour and are strongly willing to take action on issues related to environmental conservation including energy savings. This is supported by the study conducted by Li et al. [55] which revealed that residents with high environmental knowledge and concerns have high attitudes and willingness to purchase and use energy-efficient appliances such as energy saver bulbs, and booster and solar water heaters in Shanxi Province, China.

Alternatively, it is reported by Paço and Lavrador [56] that "*a higher level of environmental knowledge does not necessarily lead to more positive attitudes and behaviours regarding energy saving*". Their study revealed that students with higher environmental knowledge levels did not differ in their attitudes with those with lower levels of environmental knowledge and there were slight differences in their behaviours towards energy savings in Portugal.

3.5. Technology adoption norms and concerns

Technology adoption refers to the extent to which a certain technology is accepted, approved and incorporated into social practices [57]. Technology adoption is clearly described through the *Technology Acceptance Model* (TAM) which was proposed by Davis [93]. The TAM is applied to predict and explain various technologies that are accepted by users. It suggests that when new technology is presented to the users, several factors can occur to influence users' decisions on how and when they can utilize it. These factors include: - (i) perceived usefulness as "*a degree to which a person believes that using a particular system would enhance his or her working performance*"; (ii) Perceived ease-of-use as "*the degree to which a person believes that using a particular system would be free from effort*". The application of new technology depends on how easy can be used. For instance, it is not easy to use new technology if it is complicated in its applications. (iii) External variables such as cultural beliefs and social influence are necessary factors to determine the user's attitude to use new technology. When these three things are in place, people may have the attitude and intention to use the technology. However, the perception may change depending on age and gender because individual differs [58].

The adoption of energy technologies is influenced by users' behaviours and acceptance levels. For instance, the study conducted by Wojuola and Alant [59] revealed that perceived usefulness and ease-of-use are positively associated to use the of new renewable energy technologies such as hydro, solar, and wind power in Nigeria. Moreover, the study conducted by Chen et al [60] in the United States revealed that usefulness and risk to privacy (the perceived technology attributes) have direct effects on adoption intention to smart meter technology and use of smart meters. Smart meters are advanced electronic devices that are used to record detailed electricity use at certain time intervals through the feature of two-way communication, allowing utility companies to respond to the data [61]. The use of smart meters helps in energy consumption efficiency.

3.6. Contextual factors

Contextual factors are special characteristics that reflect a particular context and unique to an individual, a particular group of people, community, and society [62]. In general, the factors or characteristics of the environment that influence the behaviour of human being or society are referred to as contextual factors [63]. In real life, a context shapes the effectiveness of knowledge implementation and influences human development through behaviour changes from visual perceptions to social interactions [64]. Everything the human being does is influenced by the situation in which it is done. Contextual factors usually help to make sense of other situations and determine the decision of whether a human being is to do a certain action or not.

In energy consumption efficiency, contextual factors that influence human being include energy-related policies, laws and regulations, scientific and technical capability, biospheric value, institutional capability, energy concerns; climate change, technology conditions, access to information, financial support and incentives, risk, the role of models, and social support. These factors together with psychological and socio-demographic variables influence individuals' or societal behaviours towards energy saving. For instance, the study conducted by Sun and Feng [47] revealed that biospheric value, climate change, and energy concerns, money-saving, and personal norm have high predicting power for residential energy use behaviour in China.

Energy-related policies, laws, and regulations play an important role to influence human behaviour on energy use. Currently, most countries are formulating energy-saving policies and programs. For instance, according to Zhou et al [67], China adopted energy-saving policies and programs during the 11th Five Year Plan which have to strengthen enforcement of building energy efficiency codes, reformation of presence building heat systems and adoption of renewable energy technologies to the citizens. Moreover, Hall et al [68] report that Australia established the EnergySavers energy behaviour change program for low-income households. The program resulted in the adoption of positive actions towards energy change among the local communities. The participation of local communities in the program increase their energy-saving actions, their control over energy use and they acquired new knowledge through social networks [32], [66], [94].

Social interactions influence energy-saving behaviours among individuals. For instance, the study conducted by Du et al [69] shows that the influence of an individual on energy saving is related to the connectivity and node to node weights of the social network. This study furthermore recommends that the use of a mathematical model to select nodes in the social networks provides the achievement of the necessary amount of extra energy saving in a very short time.

3.7. Habits

Habits are forms of automatic and routine behaviours. People usually repeat behaviours due to different reasons including easiness, cheapness, rewarding or comfort of the behaviours [70]. The change in the situation usually initiates habits automatically. Individuals usually do something by habits and sometimes without reasoning why they are repeating the same actions or doing them. Repeating of executing actions in the same context becomes automatized and thus difficult to control [71].

Habits are efficient, uncontrollable as wells as independent of intention and awareness [71], as presented in Figure 2.

Habits have been considered as among the determinants of human behaviours in *The Theory of Interpersonal Behaviour* [72]. The consequent repetition of actions influences the change in individuals' behaviours.

In energy consumption, individuals have the day to day habits of using energy such as cooking, ironing clothes, lightening the houses, using air conditioning, heat water for taking showers, or use transport. Basing on the need to save energy, individuals can adopt energy-saving habits such as (i) switching off lights in the rooms with no person (s) at night, (ii) defrosting the fridge regularly, (iii) switching off the air conditioning when it is not very hot, (iv) changing light bulbs to

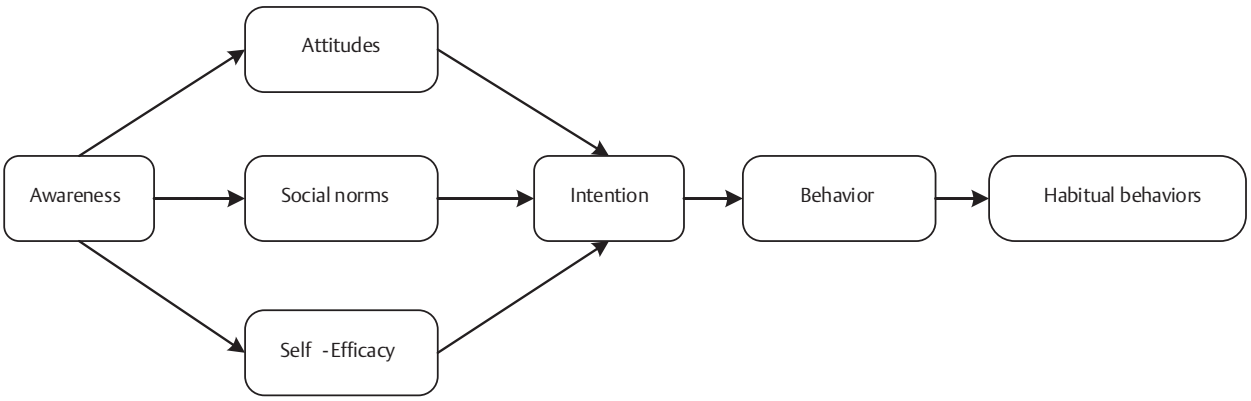

Figure 2: The mechanism of habitual behaviour.

LEDs, (v) unplug appliances that are not in use, (vi) getting rid of old technology, (vii) doing chores at night, (viii) avoid using hot heated water during the hot season, (ix) maintain air conditioning and heating systems, and (x) eating together as much as possible to avoid using lights at different times [73]. Repetition of these actions may help in energy-saving and thus lead to energy consumption efficiency.

4. The Implication of this Study

Achievement of energy consumption efficiency requires a multidisciplinary and multifactorial basis among the energy- producers, suppliers and users. However, energy-users are considered a more targeted group to sustain energy-saving [95], [96]. The study of energy-users knowledge, attitudes and behaviours can help to understand better how energy consumption efficiency can be achieved [97], [98]. There are limited reviews that provide detailed and comprehensive factors that influence personal and community behavioural change on energy use [99]. Thus, this review provides a comprehensive analysis of the factors that influence personal behaviour on energy use. It offers a detailed overview of how human behaviour can change to address the challenges facing energy consumption efficiency. Moreover, it adds more knowledge on existing information about the factors that influence human behaviour on energy consumption efficiency.

5. Conclusion, Limitations and Remarks

Behavioural change is significant to addressing the challenges facing human in utilizing the natural resources including energy. Thus, this review provides a critical discussion concerning the overall energy consumption efficiency behaviours among individuals. It is important to address the individuals' behaviours toward energy use and saving to realize sustainable development. From this study, it is shown that the idea of energy consumption efficiency needs multidisciplinary and sectoral approaches. Effective energy consumption efficiency depends on individuals' behaviours, and different disciplines such as psychology, economy, sociology, technology, political science, and communication. It clear that the change of human behaviours at individual, family, organization and national levels influences and determines energy-saving capacity.

In energy-saving, individuals need to be informed on the new technologies on energy sources, production and use. It is through awareness individuals will increase their knowledge, change their attitudes, appreciate their self-value and social norms, and then acquire intention towards behavioural change. The awareness should consider the culture of the relevant individuals or society.

There are a lot of other factors influencing individual behaviour towards energy consumption efficiency. Thus, there is a need for further and single studies on every factor in providing a deep discussion of their impacts on energy consumption efficiency. For instance, some studies can be conducted to evaluate the influence of costs and benefits of energy consumption efficiency. Further studies should focus directly on major energy-consuming sectors such as residential, commercial, industries and transportation on an independent basis.

It is recommended that one's should incorporate energy-saving behaviour in the cultural activities of the relevant society because energy is a social good and its uses are strongly anchored cultural practices such as light, cook, and communicate that often happen in the society.

The establishment of energy-saving culture means the creation of environmental for bright ideas, increased energy efficiency and reduction of operating costs for energy services.

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