“A review on household energy consumption behavior: how about migrated consumers?”

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ARTICLE INFO	Ebru Acuner and M. Özgür Kayalica (2018). A review on household energy consumption behavior: how about migrated consumers?. *Environmental Economics*, *9*(4), 8-21. doi:10.21511/ee.09(4).2018.02
DOI	http://dx.doi.org/10.21511/ee.09(4).2018.02
RELEASED ON	Tuesday, 18 December 2018
RECEIVED ON	Friday, 09 November 2018
ACCEPTED ON	Wednesday, 12 December 2018

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JOURNAL	"Environmental Economics"
ISSN PRINT	1998-6041
ISSN ONLINE	1998-605X
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
50	4	4

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BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10, Sumy, 40022, Ukraine

www.businessperspectives.org

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A REVIEW ON HOUSEHOLD ENERGY CONSUMPTION BEHAVIOR: HOW ABOUT MIGRATED CONSUMERS?

Abstract

This paper reviews the literature on energy consumption behavior for both domestic and migrated/displaced population and aims to recommend crucial policy measures for creating awareness on the energy efficiency. Consumers' adoption to the efficient usage of energy varies depending on demographic, behavioral and situational dynamics in their households and societies. The regional or national strategies to implement efficient technologies for the consumer engagement are crucial to change their behaviors. Migrants affect the energy usage patterns in the host country due to their different usage behaviors. Any type of measures for migrated population should include available, acceptable, accessible and affordable energy efficiency applications to engage them with the domestic population.

Keywords household energy consumption, consumer behavior, migrated consumer, energy efficiency

JEL Classification R23, R28, R29

Received on: 9th of November, 2018
Accepted on: 12th of December, 2018

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INTRODUCTION

Migration is a phenomenon that has strong effect on economic, social and security aspects touching our daily lives in an era of increasing globalization (IOM, 2018). In 2015, approximately one billion migrants exist in the world. About 258 million people are migrated internationally due to search for better quality of life, more job opportunities and easiness of accessing urban services, like energy, water, health, etc. It is declared that annual international migration will increase two times more than annual population growth in the world (UN, 2017).

Reaching better energy services is one of the main drivers for migration. Also, energy consumption is an important indicator for social and economic development of a country. In other words, high living standards are associated with high per capita energy consumption. According to International Energy Agency (IEA), total final energy consumption in the world rises to 9384 million tons oil equivalent (Mtoe), of which 19.8% and 18.5% is natural gas and electricity, respectively. In addition, approximately 30% of the total natural gas and electricity are consumed in the residential buildings (IEA, 2017). Between 2015 and 2040, it is expected that residential natural gas consumption increases by 20%, whereas the electricity consumption will grow by 2% annually due to rapid urbanization, resulting from domestic and international migration (IEA, 2017). As a result, for the sustainable energy systems, covering availability, acceptability, accessibility and affordability (IEA, 2011), the effect of migration on energy consumption should be investigated.

http://dx.doi.org/10.21511/ee.09(4).2018.02

The main objective of the study is to review the literature regarding household energy consumption behaviors and to analyze the studies concerning migrated consumers. For this purpose, as a background information in section 1, the definitions and relations among value, belief, attitude, behavior and culture were described in order to indicate how they affect the energy consumption. As can be understood from the background information, even in the households with similar physical and technical features, their energy consumption figures can be different from each other, showing the importance of the household behavioral dynamics. Hence, in the following sub-sections, literature on energy consumption behavior and studies aiming to determine the main factors affecting the energy consumption behavior are investigated. Currently, migration can be stated one of the hot topics in the world as migrants affect the energy usage patterns in the host country because of their different usage behaviors. For this reason, section 2 explains the effect of migrated population on the household energy consumption. Then, as a summary, section 3 discusses the main findings with regard to factors affecting the household energy consumption behaviour. Lastly, as a conclusion, key issues derived from the literature analysis and policy recommendations for migrated consumers are listed in the final section.

1. LITERATURE REVIEW

While searching the literature, basic definitions and relations concerning behavioral analysis; recent studies on energy consumption behavior together with the major factors affecting energy consumers and studies on migrated consumers are investigated.

1.1. Value, belief, attitude, behavior and culture

The human-environment interaction has a complex structure, in which behavior is dependent on the person and its environment. There is even more complexity to deal with if one tries to define what are the factors in the person and the environment that influence the behavior. Hence, it is important to define this complex relationship before examining the consumers' behavior and its impact on the energy consumption.

"Values" have commonly been considered as core aspects of the self-concept. Primmer (2018) defines the belief as "the state of mind in which a person thinks something to be the case with or without empirical evidence to prove that something is the case with actual certainty". The most common definition of the attitude by Eagly and Chaiken (1993) is "an internal psychological tendency, which is expressed by the evaluation of some entity with some degree of favour or disfavour".

An attitude does not happen until the individual responds towards an entity with affect, his/her cognition, or behavior. Therefore, a behavior is the result of person's values, attitudes, and beliefs. Behavior is the action or reaction to a situation, group or person. Between attitudes and behavior, there is a knowledge function, and it can be defined as awareness, or understanding of someone or something based on the information, or descriptions, which is obtained through education and experience by means of discovering, learning and recognizing. Figure 1 represents the relationship among value, belief, attitude and behavior.

It is worth to mention that the self-selection effects can be explained as selecting their employment, residence, and family related choices that affect their life styles (Van Wee, 2009). These choices are attributable to peoples' quality of life, which is inspired by attitude, belief, consciousness and socio-demographic factors. Individuals or households need to purchase the required goods and end uses considering mainly economic factors to

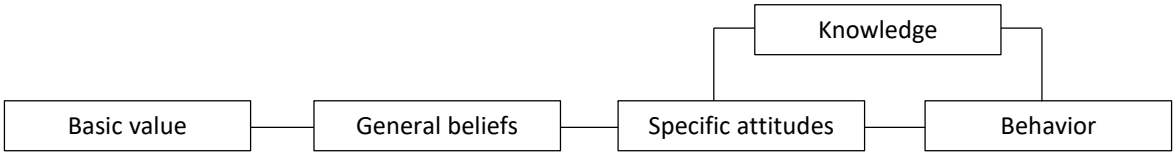

Figure 1. Demonstration of a hierarchical model on values, beliefs, attitudes and behavior

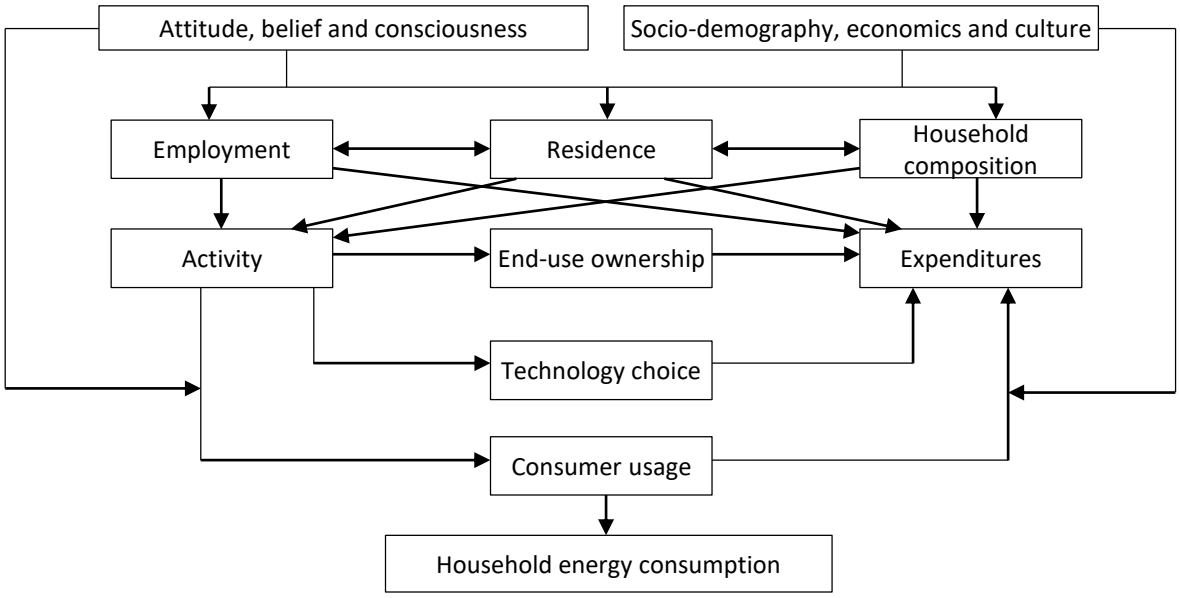

Figure 2. The relation between life choices and energy consumption

support daily activities (Ellegard & Palm, 2011). As a result of purchased goods and end uses, different forms of energy are consumed during not only the usage period at the houses, but also the whole life cycle of materials and services that are chosen (Figure 2).

Additionally, any changes in the life quality indicators, specified in Figure 2, will have derivative effects on both interrelated life choices and the household energy consumption. For instance, by analyzing data obtained from 198 countries for the period between 1990 and 2009, it was found that indicators, such as employment, household composition, end-use ownership, technology choice and related expenditures increase the energy usage, and that it is true for 65% of the countries, investigated in the study. Increase in energy consumption also increases the life quality of 70% of the countries regardless of their different income levels. Consequently, it can be declared that quality of life and the energy consumption are interrelated (Al-mulali, 2016).

Lutzenhiser (1992) proposes that the energy consumption behavior is also associated with the cultural practices. Individual or household energy consumption behavior can be understood by observing the interaction among the belief or understanding as a cognitive norm, the technology as a material culture and energy related activities. Especially, the material culture has robust effects on the cognitive norm and an influence on the individuals' energy behaviors. Moreover, the energy related activities determine how the material culture (technology) is utilized in order to partly form individuals' cognitive norms as beliefs and understandings. On top of these relations, a concept of "energy culture" is able to be built (Stephenson et al., 2010). In the energy culture framework, stabilization of behavior occurs, where cognitive norms, material culture and the energy activities are dynamically stable. For example, the importance of efficient usage of energy can be emphasized by considering all three components (these are cognitive norm, material culture and energy related activities) both as the barriers and key challenges to change of the individuals' behavior in the desired direction (Lutzenhiser, 1992). Therefore, the following subsections explain the studies on individuals' energy behavior (hereafter energy consumption behavior) along with the studies investigating interrelated drivers, affecting this energy consumption behavior.

1.2. Literature on energy consumption behaviors

Although the literature on energy consumption behaviors provides numerous works, bulk of them are concentrated on the European issues and/or originated in the European region. While our re-

http://dx.doi.org/10.21511/ee.09(4).2018.02

view is somewhat constrained with this fact, there are also other studies around the world supporting the literature, which this review captures.

A consumer is defined as a rationally acting individual who is willing and talented to take decisions in any field (Micklitz et al., 2011). Considering this definition, in the concept of energy culture, the role of the consumer where all the potential energy actions are surrounded by equitable rights and responsibilities through the society should be improved for dealing with the energy consumption and its consequences (Huijts et al., 2012). In particular, energy consumers interact with their physical and social environment by means of sharing what they know, together with learning from one another (Bale & Varga, 2015). This relation establishes energy consumption behaviors, which can vary over time due to the factors, such as newly introduced policies, existing institutions and new and efficient technologies. Therefore, to promote the sustainable behavioral change towards efficient usage of energy, conventional devices, such as laws, taxes and subsidies, may not be satisfactory (Kolk, 2012). Thus, adding more variety by antecedent (demonstrations, commitment/goal setting, etc.) and consequence (feedbacks, rewards, etc.) interventions can increase perceptibility for increasing consumer engagement with the energy market (Ofgem, 2016). Researches in the literature are revealed that other important constraints for the consumer preferences are social and cultural interests. For example, a study on consumers' attitudes regarding their willingness to buy green electricity in China verifies that motivations are related to energy security and savings through efficient usage (Hast et al., 2015). In the similar type of studies, it is indicated that consumers in the United States (US) are worried about the effect of the energy consumption on the environment realizing that feedback on this matter is valuable to generate changes in behaviors regarding efficient usage (DeCicco et al., 2015). Moreover, a meaningful correlation between pro-consumer and/or pro-environmental behaviors and the knowledge about real consequences of the energy efficiency activities is identified (Pothitou et al., 2016). More recent researches, with regard to progresses in technology as the material culture, show that smart energy production and consumption system practices can be constituted by relationships between different household members, as well as between households and the energy service providers (i.e. energy suppliers).

Numerous studies and projects, including survey analysis, have been realized to understand the attitudes, beliefs and consciousness drivers for the behavior analysis of European consumers. For example, the FP7-Advanced project targets to analyze the relationship between consumers and technology based on the level of awareness and attitudes towards energy consumption. E-balance project, on the other hand, aims to integrate the energy customers into the future smart-grids based on information communication technologies (ICT) and consumption behaviors under real conditions. USmartConsumer project has a main objective of enhancing European households by means of informing and involving them in the innovative services to consume energy more efficiently. A summary information concerning these projects is given in Table 1. It is mentioned that member states that are undertaken in the project scope were selected to provide valuable data on the general trends occurring in the European Union (EU) by means of representing diverse geographical areas and cultural conditions. As an analysis method, quantitative research tools (i.e. interviews, questionnaires, etc.) were applied to investigate different characteristics of energy consumption behaviors. Furthermore, quantitative tools, such as semi-structured and/or open interviews for the specified focus groups, has been utilized to truly understand the main drivers that can create behavioral change with regard to the energy consumption.

Besides these projects, in the EU Joint Research Center (JRC) catalogue, 65 projects have consumer engagement related studies. Their main objectives can be listed as observing/understanding and engaging the energy consumers. The former objective aims to gather information on the consumption trends on the basis of consumers' needs and experiences. Moreover, it is also intended to investigate consumers' response to newly introduced regulatory, technical and market improvements for the sustainable consumption and to classify early adopters to this new improvements and other consumer segments, while the latter objective deals with giving information to consum-

Table 1. Summary of projects on surveying energy consumer behaviors

Country	Advanced, 2015	USmartConsumer, 2015	E-balance, 2015
Scope	Behavior analysis concerning energy demand	Attitudes and awareness on smart metering	Attitudes and behaviors regarding energy demand and efficient usage
Research tool		Interviews and questionnaires	
Survey scope			
Germany	1,000	496	–
Spain	1,000	173	–
Finland	–	138	–
France	1,000	–	–
Italy	1,000	315	–
The Netherlands	1,000	1,647	1,647
Poland	1,000	154	1,632
Portugal	–	–	1,661
Sweden	1,000	–	–
United Kingdom	1,000	270	–
TOTAL	8,000	1,546	4,940
Overall results	In terms of efficient energy usage, one of the most important factor concerning the acceptance of the efficient technological improvement can be identified as the reduction of the utility bills. Energy consumers' concerns are mainly the engagement to use the new and efficient system and also privacy of the collected information.		

ers concerning new and efficient technologies and examining strategies regarding sustainable behavioral change (Mengolini, 2017).

As a result, from the outcomes of these 65 projects, it can be stated that consumers' adoption to energy efficiency interventions changes depending on demographic, behavioral and situational dynamics in their societies, and also on the strategies to adopt new technologies for the consumer engagement. For example, it is indicated that energy consumption in similar households can differ up to 250-300%, specifying that the household energy consumer behaviors have intense effect on the energy usage (Karlin et al., 2015).

1.3. Studies investigating the factors affecting energy consumption behaviors

In a household, there is usually more than one member, consuming energy on the basis of personal attributes as a micro-level determinant. The key contributing dynamics on the consumer be-

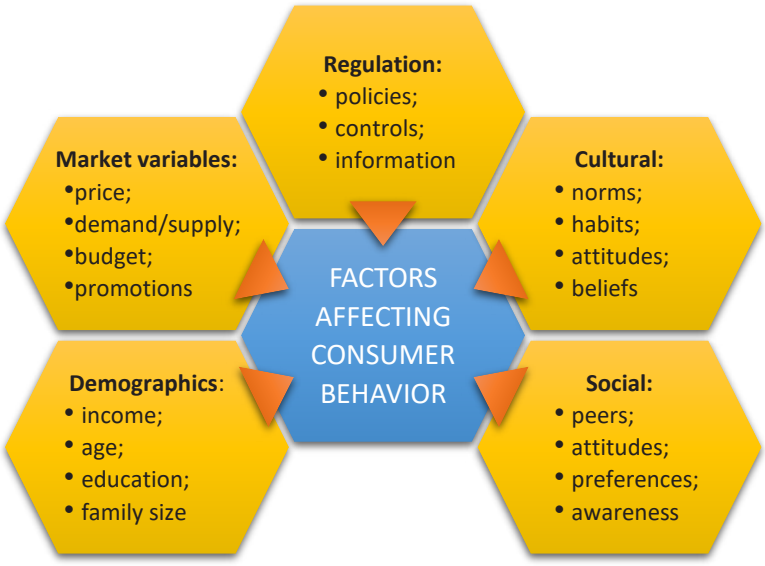

Figure 3. Factors affecting consumer behaviors

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haviors are summarized in Figure 3, which can be classified under meso-level determinants such as demographic, cultural and social factors, as well as macro-level determinants like regulatory and market driven factors (Pothitou et al., 2014).

Either a top-down or a bottom-up approach is used to determine the effects of these dynamics containing various factors. A top-down methodology at the national level generally concerns the energy consumption of the stock of the households, whereas a bottom-up methodology considers individual household level in order to determine relationships between household characteristics and the energy consumption and then to extrapolate the outcomes to the entire housing stock. While analyzing these issues, statistical and econometric methods are preferred with common data collection methods as national household surveys conducted by the statistical institutions of the country, questionnaires, phone surveys, personal interviews, household electricity monitoring and gas or electricity bills from the energy suppliers.

In the literature, more attention is given to evaluate the effect of social/economic, house related and electric appliances factors on the energy consumption. The main findings together with intervention related studies were summarized as follows:

1.3.1. Household social/economic factors

The searched reports and studies classified the social/economic factors, affecting the household energy consumption as: (1) total household income; (2) household size; (3) family structure (number of children, teenagers, adults, and elderly (i.e., over 65 years old); and (4) features of responsible person of the household (RP) (age, employment status, education level) (Jones et al., 2015). Table 2 presents total number of citation including these factors together with the number of studies, showing a significant positive effect on the household energy consumption.

1.3.2. Household related factors

Several household related factors have been reviewed in the literature as: (1) features of a house (age, number of rooms, total floor area); and (2) presence of various active energy consuming systems (air conditioning, electric space heating, water heating, lighting). A summary of these factors that have been identified as main household drivers affecting the electricity consumption is presented in Table 2.

Table 2. Overview of the studies concerning social/economic, households and factors on the energy consumption

Features	Citation (number) (with positive effect)
SOCIO-ECONOMIC	
Household income	25 (18)
Number of occupants	23 (19)
Family composition	
Children/teenagers presence	15 (8)
Adults presence	03 (all of them)
Elderly people presence	04 (none)
Total	22 (11)
Features of RP	
Age	08 (all of them)
Employment status	02 (none)
Education level	05 (2)
Total	15 (10)
HOUSEHOLD RELATED	
Features of a house	
House type	12 (all of them)
House age	15 (7)
Number of rooms	06 (4)
Total floor area	22 (19)
Total	55 (42)
Presence of active energy consuming systems	
Air-conditioning	9 (6)
Electric space heating	9 (8)
Electric water heating	9 (7)
Lighting	3 (none)
Total	21 (15)
ELECTRIC APPLIANCES RELATED	
Total number of appliances	05 (all of them)
Ownership status	
TV	13 (10)
Computer	06 (5)
HVAC	05 (1)
Cooking appliances	08 (7)
Refrigerator	09 (7)
Washing machine	07 (4)
Dishwasher	07 (6)
Tumble dryer	11 (8)
Vacuum cleaner	01 (1)
Iron	01 (1)
Microwave	01 (none)
Kettle	02 (none)
Total	71 (50)
Power demand	05 (5)

1.3.3. Electric appliances factors

Presence of electrical appliances are significant for their contribution especially to household's electricity consumption, although it can be classified as external factors contributing the energy consumption behaviors (Pothitou et al., 2014). Their ownership effects are related both to the number and to the power demand depending on the frequency of usage. The main factors under this category are: (1) total number; (2) ownership (TV, computer, heating-air-conditioning-ventilation – HVAC systems, cooking appliances, refrigerator, washing machine, dishwasher, tumble dryer, vacuum cleaner, iron, microwave, kettle); and (3) power demand of appliances (Table 2)

1.3.4. Intervention studies

In order to affect energy consumption behaviors and support energy efficiency, intervention studies are very essential. Commonly, interventions can be classified as structural (e.g. price policies and subsidies), antecedence (such as goal-setting, informing and commitment), and consequence related (like feedbacks and rewards) (Han et al., 2013), as shown in Figure 4.

In the literature concerning energy consumption behaviors changes towards sustainable and efficient usage, it is claimed that antecedent interventions have successful results (Abrahamse & Steg, 2005). Consumers mainly follow the information when they are relevant, meaningful and easily understandable. Furthermore, commitment strategies cover an agreement to change behaviors. It is important whether the commitment targets to only activate a personal norm or targets public social norms (Lucas et al., 2008). The commitment to reduce the energy consumption can involve a specific goal, for example, reduction of energy usage by 10% in 5 years.

Another promising consequence intervention is the feedback to the consumer or to the public about their energy consumption patterns (Table 3). Feedback primarily indicates the process of providing information about energy consumption behaviors, which may modify the future behaviors towards efficient usage (Hargreaves et al., 2013). In a study, comprising a meta-analysis on the impacts of feedback on energy efficiency, it was discovered that feedback is a successful intervention, specifically, once it is merged with commitment or incentive interventions (Karlin et al., 2015).

Literature review, summarized above, concerns mainly the domestic consumers. On the contrary, there exist vulnerable consumers, which are defined as "consumers, having difficulties in accessing products and services that suit their needs due to their specific conditions" (INSIGHT_E, 2015).

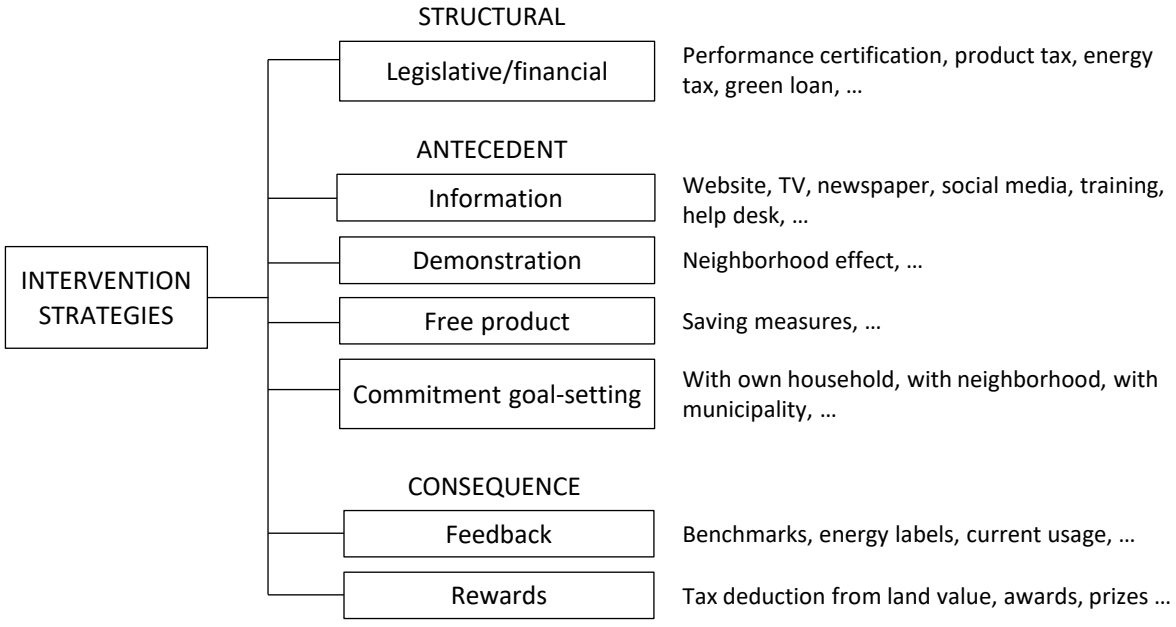

Figure 4. Major intervention strategies

http://dx.doi.org/10.21511/ee.09(4).2018.02

Table 3. Summary of findings from European surveys and projects on feedback intervention

Feedbacks	Surveys		Projects	
	Concerns	Results	Concerns	Recommendations
Information provided	Monetary, social responsibility	Monetary saving through the bills is the most important factor	Feedbacks are needed to support consumer engagement. Feedbacks can be adapted according to expectations and common behaviors	The new and efficient technologies require to easily engage consumers. They can contain playful challenges like gaming interfaces
Methods used	Web pages, portals, smart phones/ tablets	High interest in web pages and portals, as well as smart applications in phones and tablets	Adapt the information strategies to different consumers' segment	Investigate multiple benefits and added value for the consumers
Visualization tools	Tables and figures	Obtained data should be presented for better understanding	Lack of observed validation on how feedbacks from visualization methods will affect consumption behaviors	Comparing with the previous feedbacks is effective. Keep the information unique, simple and attractive for the different consumers' segments

For instance, Safety Net initiative in the United Kingdom (UK) defines a vulnerable consumer who is unable to protect his/her personal welfare due to age, health problem, disability, serious financial problems and/or displacement and promises to this type of consumers to able to connect the energy network continuously without any interruption (INSIGHT_E, 2015).

2. GENERALIZATION OF THE MAIN STATEMENT

One of the vulnerable consumers can be considered as migrated or displaced people due to various driving factors from their homes to other settlements. Migrated people mostly prefer to settle in cities in the destination country. For example, 92% of migrants in the US, 95% in the United Kingdom (UK), and 99% in Australia live in urban areas. In Turkey, which hosts the world's largest refugee population, more than 90% tend to settle in the urban areas (CARI, 2017). It can be stated that about one in five internationally migrated people live in 21 cities, involving Berlin, Buenos Aires, Chicago, Hong Kong, Istanbul, Los Angeles, Moscow, Paris, Seoul, Sydney, Tokyo, Toronto, Vienna, and Washington DC (CARI, 2017). Recent literature identifies that this type of people usually faces the energy poverty, caused by low income, but high utility bills and deprived energy efficiency conditions together with poor quality of energy supply (Thomson & Snell, 2013). To address the energy vulnerability and poverty challenges, for migrated consumers, measures should be based on legislative, financial, technical, and social factors, which affect the energy consumption. For this reason, literature was surveyed to find the studies on the energy consumption behaviors of the migrated consumers and the major findings were summarized in Table 4.

Shrestha et al. (2008) examine the energy consumption trends comprising slum-dwellers, living in Bangkok and Khon Kaen, two cities of Thailand, depending on the expenses for energy, and the important factors affecting the access of electricity and other energy carriers. The first survey was conducted, including 100 households in Bangkok, between January and February 2007 asking their socio-economic and household status, accessibility to electricity together with the required demand, energy consumption patterns for cooking, and the other energy sources, they have been using. Additionally, the second survey with 100 households was made in Khon Kaen between September and October 2007. After the study, it was seen that nearly all of the households have an access to electricity in both cities. About 86% of the targeted group in Bangkok, as well as in Khon Kaen, use liquified petroleum gas (LPG) to cook. They own TV, refrigerator, washing machine, rice cooker and fan in their houses and in Bangkok, slum-dwellers spend approximately 16% of their monthly income for the energy expenditures and it is about 26% in Khon Kaen. On this basis, the study proposes the electrification program for these areas, price subsidy for the slum-dwellers and a decrease in the service charge regarding the households with low amount of electricity con-

sumption to increase the affordability of the energy services.

In more recent study, the principal objective is to assess the potential impacts of migration (urban to urban, rural to urban) on household energy usage and carbon dioxide (CO2) emissions in one city in Vietnam, Hanoi (Komatsu et al., 2013). The importance of Hanoi is due to being a city in which both urbanization and migration are happening concurrently. Using the propensity score matching method by Rosenbaum and Rubin (1983), migrated and domestic consumers were analyzed by using economic, demographic and household related factors as the drivers of the energy consumption pattern. Then, the migrated consumers were matched considering their correspondence to domestic consumers.

The typical effects of a migrated consumer were quantified in terms of the amount of energy usage and CO2 emissions. Results indicate that there is no statistically significant impact of urban to urban migration on both energy usage and CO2 emissions per capita, indicating the rise of the population of Hanoi by means of migration in urban areas and domestic population growth has no statistically significant differences. Conversely, migration from rural to urban areas has implied a meaningful negative impact on the household energy usage and CO2 emissions. In other words, population growth due to migration from rural to urban areas results in lowering the energy consumption than domestic population growth. These obtained findings have critical policy consequences for urban cities under development with regard to the relationship between any type of the population growth and the energy consumption pattern. For example, policy makers can realize that the impacts of migration are statistically significant on the domestic energy consumption patterns of the host city or country, hence, policy makers must consider such population dynamics while making short-, medium- or long-term household energy demand analysis.

Muye et al. (2015) present the findings from an investigation based on household energy consumption of low-skilled migrants from rural to urban areas in Beijing, China. When the migrated consumers moved to the host city, they have immediately replaced biomass with coal, electricity, and LPG. It is worth to mention that energy used by migrants from rural to urban areas were not similar to the domestic consumers, though the total quantities were similar. By means of changing from biomass to coal, the migrated consumers produced 14% more CO2 than urban domestic

Table 4. Summary of energy consumption behaviors studies concerning migrated/displaced people

Study	Objective	Method	Results
Lehne et al. (2016)	Present preliminary estimations for the energy poverty and 3 sophisticated scenarios to improve energy access particularly for cooking and lighting	Modelling energy requirement with an end-use accounting method from household energy usage patterns related data	Usage of basic solar lanterns and efficient cooking appliances and will save 303 million dollar/year demanding 334 million dollar investment cost
Muye et al. (2014)	Present survey results about household energy usage of low-skilled migrants coming from rural areas in Beijing	Statistical analysis of 1,300 questionnaires	Household energy usage of the migrants doesn't change Too much migrants use different energy mix than residents, but the overall usage amount is similar
Komatsu et al. (2013)	Evaluate impacts of migration on household energy usage and also CO2 emissions in Hanoi	Empirical research, propensity score matching	Policy suggestions concerning energy usage differ urbanization is driven either by migration or by population growth
Shrestha et al. (2008)	Study energy usage habits belonging slum-dwellers in Bangkok and Khon Kaen, as well as associated energy costs, and factors affecting accessing electricity and other energy forms	A survey consisting 100 households between January and February 2007 in Bangkok and the same number of households in Khon Kaen between September and October 2007	Slum-dwellers spend 16% of monthly income for energy expenditures in Bangkok and 26% in Khon Kaen Recommend electrification program for slum-dwellers comprising price subsidy and a decrease in the service charge to increase the affordability
Fuguitt et al. (1991)	Extend sociological outlook through adding energy consumption behavior analysis	Regression analysis	Metropolitan migrants insert heterogeneity among rural population, due to high energy consumption

http://dx.doi.org/10.21511/ee.09(4).2018.02

consumers and 2.4 times more than rural domestic consumers. After the instant shift, patterns of migrated household energy consumption show no change over years, as understood from the national household registration system. In terms of the electricity consumption, the migrated consumers' patterns depend mainly on the number of electric appliances, positively correlated with the number of people living in a household and the duration that the migrants had lived in Beijing. Moreover, the number of electric appliances and household size were not related, implying the share of the appliances among household members. On the contrary, more electric appliances were purchased by the household with more members. Therefore, a negative direct relationship between the electricity consumption per capita and the size of the household was recognized. In addition, it was indicated that large households should consume less energy for lighting, cooking, and heating, meaning efficient usage, due to owing more and diversified appliances. When the length of stay is considered, it is found that no relationship between the duration of stay and the electricity usage was identified, though the number of electric appliances, was positively correlated with the duration of stay.

Lehne et al. (2016) present the results with regard to the energy consumption by displaced populations and also what is obtained by three different scenarios with regard to improving the accessibility to energy for cooking and lighting. In order to estimate the household energy consumption patterns by displaced consumers, the end-use accounting approach was used. Necessary data were obtained from national statistics for domestic consumers; interviews, field surveys, researches on camps for displaced populations. Then, on top of the findings, scenarios were developed. In the initial scenario, emigrant households maintain their conventional energy consumption patterns for cooking (they continue to use the fuels that they had consumed previously), but in more efficient manner, while for the lighting energy usage, households, which are formerly reliant on kerosene and torches, have adopted plain solar lanterns and diesel generators. In the subsequent scenario, households using solid biomass for cooking have shifted about 66% of their consumption to biomass briquettes. In terms of lighting, households have utilized a fifty-fifty separation between solar lanterns and mini-grids. In the last scenario, all emigrant households have used LPG for cooking and as similar to the previous scenario adopted a fifty-fifty separation between solar lanterns and mini-grid solutions for the lighting. When these three alternative scenarios were compared, it was claimed that the first scenario is the simplest to realize, since the upfront costs of these new and efficient technologies are comparatively low and also annual fuel savings for emigrant consumers would be significant. The second scenario would cost more regarding both capital investment and fuel costs. On the other hand, it was shown that the last scenario is the most expensive, but would produce more welfares for the sustainable energy market generation. As a result, key findings of this study suggested that for almost 7 million displaced consumers in the camps, electricity could be supplied for less than 4 hour in a day. Consequently, the widespread usage of efficient cooking appliances and solar lanterns will bring 303 million dollars in one year demanding capital investment of 334 million dollars.

3. RESULTS AND DISCUSSION

Existing studies on the household energy consumption towards more efficient usage for both domestic and vulnerable (i.e. migrated/displaced) consumers are based on diversified concepts from behavioral economics, psychology and sociology. These can be classified as the features of (1) the household itself and its members, (2) new and efficient technologies, (3) the energy market and (4) information diffusion and interventions, as well as their relations.

In the literature, most of the studies indicate that the higher household income is positively correlated with energy efficiency applications for different countries, such as United States, Canada, Germany and Greece (Dillman et al., 1983; Walsh, 1989; Sardianou, 2007; Schleich & Mills, 2008). In other words, it is stated that households with high level of income can more easily replace the older electric appliances with the new and energy efficient ones (Young, 2008). In case of the educational level of the household members, especially the household responsible person, econometric analyses conducted by Hirst and Goeltz (1982) for

the US and by Scott (1997) for Ireland verify that upper levels of education cause more energy efficiency applications. Additionally, it is found that the positive relation exists between the housing size and the energy saving activities (Walsh, 1983; Schleich & Mills, 2008). Consistently, if the number of household members is high, it is expected to purchase energy-efficient appliances. Moreover, it is expected that existing houses should have more possibilities for cost-effective energy efficiency applications. Accordingly, as the age of a house increases, the implementation opportunities of profitable energy-efficient measures increases as well (OECD, 2002). In addition, location of a household can be listed as a factor for the easiness of the energy efficiency applications. Especially, households in the urban areas have a more chance to access to these technologies because of the presence of active energy markets. Also, energy efficiency awareness in larger urban areas can be promoted easily. Nonetheless, the relation may be ambiguous in smaller urban places, because consumers may have stronger tendency to protect their environment than that of larger urban areas (Scott, 1997).

Within the energy market, it can be obvious that energy-efficient measures are either no/low cost measures, requiring no/little capital investment and can be easily handled by means of behavioral change, or high cost measures that need a considerable capital investment mainly due to the requirement of technological change in the house. Additionally, clear and detailed information about the type of energy efficiency measures and the cost-benefit analysis of new and efficient technologies is crucial for the penetration to the community. For example, the energy performance of electric appliances can be learned by the help of energy labels. More explanatory labels mean more understandable benefits of the new and efficient appliances and, as a result, consumers can prefer to purchase. Information with regard to other types of energy efficiency measures can be diffused by means of domestic, regional and/or national campaigns through the government, energy agencies, if any, technology producers and suppliers, energy distributors and/or consumer associations. For example, households in New York, US perceive that the information about an energy efficiency measure can be more reliable if it is provided by the government rather than by the energy producers, distributers and suppliers (Stern & Aronson, 1984). Similarly, the reliability of the information increases if it can be verified by different sources (Wilhite & Ling, 1995). On the contrary, while reliable and clearly understandable information concerning energy efficient measures may help to increase both the level and the quality of the knowledge, this not always results in continuous/sustainable energy efficiency concerns by the consumers. Specifically, behavioral changes towards energy efficiency cannot be permanent if the required strategies and policies are continuously updated according to the needs of the consumers (Abrahamse et al., 2005).

CONCLUSION

The following issues can be concluded from this literature survey on the energy consumer behavior analysis:

- efficient energy consumption is significantly correlated with the household income;
- the effect of education level, age and the number of the household members are rather ambiguous;
- the correlation between the household size and the penetration of energy efficiency applications can be stated as positive;
- the age of an existing household is also positively correlated to the profitable applications of energy efficient technologies due to high energy-saving potential;
- urban households can easily reach to variety of information about the energy saving technologies and related compatible energy markets for cost-effective purchasing than rural households;

http://dx.doi.org/10.21511/ee.09(4).2018.02

- transparency in terms of energy utility costs, bills, appliances, etc. is positively interrelated with behavioral change concerning energy efficiency;

- the reactions of consumers to the information on energy efficiency measures depend on its source. If the information is provided by the government, the positive response is more probable;

- energy prices of the utilities are positively correlated with efficient energy consumption, meaning that higher prices result in more concern on energy efficient measures, hence, changing behaviors to become more energy efficient.

Additionally, the below-stated recommendations can be drawn for migrated energy consumer, by considering the main findings as listed above:

- it is important to analyze the main needs of the migrated consumer in terms of energy poverty, security and sustainability points of views. By this way, specific measures can be developed to alter their behaviors for the sake of efficient energy consumption;

- migrated consumers may be vulnerable due to their socio-economic situations, such as having low income and being un employed, or due to their structural situations concerning presence/absence of energy systems and appliances and related purchasing capacities. Therefore, any type of measures for migrated population should include affordability, easiness of access to support their participation;

- developing data gathering, reporting, monitoring and analyzing methods to determine the current situation, as well as the effect of the measures migrated consumer protection in terms of energy consumption, are needed to explore the policy implications in the market, in other words, powerful measures on the basis of energy policy, social policy, environmental policy or mix of the policies can be identified.

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