
A Sociological Analysis on Sustainable Energy Usage and Electricity Consumption in Suburban Households: A Case Study

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Abstract

The ecological system, system of energy and social systems are interrelated to each other. Electricity is an essential input for all manufacturing systems and a necessity for a majority of households nowadays. Suburbs can be identified as communities, which are having their sub-cultures and ways of life. Sustainable use is about being able to satisfy today's needs, without endangering the capacity of future generations. Hence, it is important to have insights into the above research topic and research problem, 'Is the household electricity usage patterns in suburban households sustainable?' The main objective of this study is to 'evaluate the household electricity usage patterns of suburban households'. This study mainly focused on behavioral patterns connected to their household electricity usage. This was an action research, conducted within a suburban community situated around Colombo metropolitan area. Convenient sampling has been used and the case study method has been used as the method of data collection. An environmental sociological, qualitative analysis has been done regarding the research problem. Inappropriate electricity consumption may cause aggravated impacts on the environment, even though electricity has the capacity to improve lifestyles. To be sustainable, electricity systems must recover operating costs, invest for the future, provide reliable electricity and meet environmental and social objectives. Lifestyle could be defined as a non-technical parameter, which determines a person's consumption of electricity. While more consideration is given to economic and technological strategies; consideration of behavioral aspects is insufficient. However, electricity usage patterns are connected with the 'way of life'.

Keywords: Behavior, Electricity, Energy, Sub-urban, Sustainability

1. Introduction

This was an action research, conducted within a suburban community situated around Colombo metropolitan area. This study mainly focused on behavioral patterns of household electricity usage. The main objective of this research is to 'evaluate the household electricity usage patterns of suburban households'. The sub-objectives of this study are to find out the extent of sustainability, that could be seen in the household electricity usage behavioral patterns and to find out the behavioral aspects of electricity usage patterns of suburban community. Furthermore, this attempted to find out possible alternatives to day-to-day electricity usage patterns of a suburban community. Environmental Sociological analysis has been used to address the research problem. To evaluate the main objective and sub-objectives, below-mentioned research questions are considered,

- 1) What kind of consciousness is there in the selected suburban households, regarding the concept of sustainable electricity usage?
- 2) To what extent do behavioral patterns impact household electricity usage?
- 3) Is the suburban community adequately aware about the alternatives for sustainable household electricity usage?

Sustainable Energy Consumption, Environmental Management and Suburban Community are the principle concepts that are being considered to conduct the analysis of this study. These concepts are further explained in the literature review.

1.1. Research Problem

'Is the household electricity usage patterns in suburban households sustainable?' has been considered as the research problem of the study. An ecological system, energy and social systems are interrelated to each other and these three components cannot exist without the interdependency and interrelation within those. Living in a fossil fuel era with controversial issues such as, global warming, ecological systems are influenced by the social systems (Shiva, 2008). We are currently facing triple ways of crisis in the contemporary world (Shiva,2008) as,

- Climate
- Energy
- Food

Apparently 'energy' is one main aspect that needs attention in contemporary societies. As significant players in rising carbon levels, today's household energy users face increasing pressure to adopt more sustainable practices and technologies (Taylor & Chappells, 2019, p.11). Therefore, it is important to have insights into the above research problem. Nowadays human life is totally based on energy sources and in the absence of energy, there is no life. Electricity could be categorized under non-renewable energy if that is generated from fossil fuel energy. It could also be considered as renewable energy if electricity is generated using solar power, wind power etc. At present, we use fossil, oil, natural gas, coal, hydropower, nuclear power, solar power and wind power to generate electricity (The United States Energy Information Administration, 2020).

It is important to identify the inter-dependent scenario between energy and society, in order to have high quality life and wellbeing of the society. Considering about the capacity of energy, most importantly we have to be concerned about the energy that we are allowed to use; not only about its production, but also about the quality. Here, there is a clear link between consumer culture and the electricity usage patterns of people, when it comes to the use of electrical goods. Countries always promote new technology to minimize the energy consumption. Moreover, they change their behavior in order to cut down the energy consumption. Consumption of less energy due to the use of new technology has changed their behaviors (Harper, 2000). One main issue which could occur due to the inappropriate use of energy is that, it can lead to climatic changes. Transformation of energy creates new forms of society (Adams, 1975). Stock and flow of energy provide people and organizations the ability to exercise social power. In some cases, the inequalities and discriminations with regard to energy supply, its allocation and electricity usage can be noted. This can lead to create social inequalities among the societies. We have to understand how energy is important to social life. Hence, we can perceive the importance of conducting a research on the above mentioned research problem.

2. Literature Review

Electricity has become one of the main energy sources in contemporary life. Electricity is created when electrons flow through a conducting material, such as copper or aluminum used in power lines. Electrons are tiny particulars that are part of all matter and they can move through wires (The United States Energy Information Administration, 2020). As an energy resource that has been generating through the use of natural resources, it is important to consider the possible ways of using this energy source in a sustainable way. When considering, what is sustainable development, there are three aspects involved with sustainable development as,

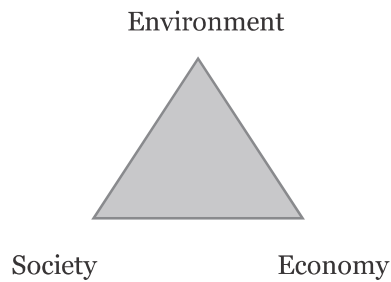


Figure 1: Main Aspects of Sustainability

“Sustainable Development is the management of the human use of biosphere, so that it may yield the greatest sustainable benefit to present the generations while maintaining its potential to meet the needs and aspirations of future generations” (World Conservation Strategy, 1980 extracts by Joseph & Nagendran, 2004, p. 104).

The overall objective of ‘Environmental Management’ is to maintain and improve environmental quality such as the most beneficial use of that environment is not adversely affected (Joseph, 2004, p. 298). This includes three basic steps such as,

- Development and enforcement of environmental standards, through the use of improving efficiency,
- Implementation of the same through legislation,
- Through the adaption of cleaner policies related to specific industries or other tools including economic incentives, information and education and so on (Joseph & Nagendran, 2004, p. 298).

Environment management seeks to steer the development process to take advantage of opportunities, try to avoid hazards, mitigate problems, and prepare people for unavoidable difficulties by improving adaptability and resilience (Erickson & King, 1999; accessed January 2005 extracts by Barrow, 2006, p. 5). Environmental management is an approach which goes beyond natural resource management to encompass the political and social as well as the natural environment. It is concerned with questions of value and distribution, with the nature of regulatory mechanisms and with interpersonal, geographic and intergenerational equity (R. Clarke, Birkbeck College, University of London: personal communication extracts by Barrow, 2006, p.6). Moreover, this has been defined as the process of allocating natural and artificial resources so as to make optimum use of the environment is satisfying basic human needs at the minimum, and more if possible, on a sustainable basis (Jolly, 1978 extracts by Barrow, 2006, p.6).

As this study mainly focused on suburban communities, it is important to understand what is a suburb and its characteristics. A suburb is identified as a region, which consists of middle-class people and which is being subjected to social mobility (Burgess, 1925 extracts by Niriella, 2014, p. 53). Characteristics of a suburb and its people are as follows:

- 1) Suburban people have upward social mobility
- 2) Mainly consists of youths
- 3) Well educated
- 4) Their social life is active
- 5) The maximum level of equal interests
- 6) No clearly identified diverse social classes. Only one social class exists, probably the middle class
- 7) Their common interest is to take care well about their children and keep them in a higher social status
- 8) Basically, they are the ones who go to work in a city on a daily basis
- 9) They are motivated in order to claim their votes or willingness towards the rights

Source: Burgess, 1925 extracts by Niriella, 2014, p. 53



Figure 2: Structure of a City Mentioned by Burgess

3. Methods

3.1. Research Field

A suburban community situated around Colombo metropolitan area, located under Homagama Divisional Secretariat and Kithulahena Grama Niladhari division has been selected as the research field. Action research has been conducted regarding the research problem. The

research field is consisting of a homogeneous group mainly by profession and the education level.

3.2. Sampling Method

Convenient sampling under non-probability sampling has been used. Further, sampling without replacement has been used. Out of 57 of total families of the study population; 25 households have been selected from the Grama Niladhari list and 17 has participated in the research. One member from a selected household has been included in the sample. Therefore, 30% of households of the area have participated in the study.

3.3. Data Collection

Case study method has been used as the main data collection method. Therefore, the case is considered to be the research field. Furthermore, as the main awareness intervention, leaflets were distributed and after one month of intervention semi structured interviews were conducted evaluating 17 respondents. A structured interview has been conducted with an officer of the electricity board as a key informant. Semi-structured interviews have been conducted with the intention of receiving responses to specific themes related to the research problem as well as with the intention of giving the opportunity for the respondents to discuss their own special issues that they have known regarding the research problem than strictly focusing on the structured themes. A structured interview with the officer of the electricity board has been conducted with the intention of gathering technical consultancy regarding the research problem. Mainly this study is an action research with 2 stages as mentioned below,

- 1st stage – A leaflet has been distributed to each household, who are participating in the sample, as the intervention with an awareness discussion regarding the research problem.
- 2nd stage – After a month of the intervention, semi-structured interviews have been conducted to evaluate the intervention.

Also, literature related to the research problem has been used as secondary data.

3.4. Data Analysis

The main focus of the data analysis has been done relevant to the Environmental Sociology which is a sub-discipline of Sociology. According to that discipline, a qualitative analysis has been conducted. Thematic analysis has been used as the analysis method which comes under

qualitative analysis approach. Moreover, the secondary data relevant to the research problem have been used in data analysis.

4. Results and Discussion

Electricity is an essential input for all manufacturing systems and a necessity for a majority of households today (Cheng, 2017). Efficient end-use of energy became a matter of public interest in 1973, as a result of the OPEC oil embargo, well before today's strong public interest in environmental protection or climate change (Rosenfield, Chen & Gadgil, 1998, p. 19). The United Nations 'Sustainable Development Goals' also emphasize the importance of sustainable energy usage by its 7th goal, which is termed as the need to ensure access to the affordable and clean energy (United Nations Organization, 2020). Even though electricity has the capacity to improve lifestyles, due to inappropriate electricity consumption, the impacts on the environment could be aggravated. As the electricity consumption in the residential sector accounts for about one-third of the total electricity consumption in the world, this implies that the electricity consumption characteristics in the residential sector should be focused on (Chen, 2017, p. 2). The rapid growth in residential electricity consumption has resulted in a great concern regarding the exhaustion of energy resources. Higher rates of electricity usage improve higher rates of coal usage, which has adverse effects on global warming and greenhouse gas emission. Inappropriate electricity consumption may cause aggravated impacts on the environment, even though electricity has the capacity to improve lifestyles. Energy resource management needs to be better integrated with overall economic planning exercises (Jamil & Ahamad extracts by Cheng, 2017, p. 3).

4.1. Sustainability and Domestic Electricity Usage

Sustainable use is about being able to satisfy today's needs, without endangering the capacity of future generations. It comprises 3 basic elements that must complement one another; environmental, economic and social sustainability. To be sustainable, electricity systems must recover operating costs, invest for the future, provide reliable electricity and meet environmental and social objectives. Renewable electricity generation is an essential part of a sustainable energy future.

Sustainable energy usage is a choice that can have a significant impact on the environment, economy, and on individual's independence and freedom. Renewable electricity generation is an essential part of a sustainable energy future. Using less amount of environmental resources and avoiding unnecessary usage could prevent the waste of energy, waste of money. Furthermore, promoting environmental friendliness for sustainable usage of electricity is

important. Moreover, it is important to consider the alternatives of energy formation that enhance environmental friendliness such as solar power etc.

It is important to consider ways that we can practice sustainable electricity usage as below,

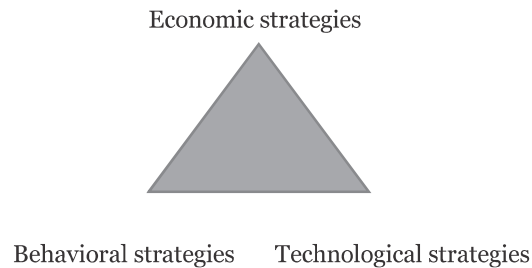


Figure 4: Strategies of Energy Usage.

4.2. Importance of the Behavioral Aspect of Domestic Electricity Usage

There are numerous ways to practice sustainable electricity usage. As shown in the above diagram, it could be varied as economic, technological and behavioral strategies. In most instances, we are much concerned with economic and technological ways such as,

- Keeping windows open and ventilating
- Using less air conditioning and using only when it is necessary
- Unplugging things you are not in use (mobile chargers, laptop charges etc.) or using power strips
- Choosing LED or low consumption light bulbs etc.

While more consideration has been given to economic and technological strategies; consideration of behavioral aspects is lacking. Symptoms of approaching or exceeding limitations are appearing every day at an increasing rate. It is needed to have a dramatic change in the course of technological, economic and behavioral development as compared to the development dominating the last two centuries that equalizes with industrialization. The economic development has been dominated by a perception of the world blessed with unlimited options for extracting resources and depositing waste. In the real world, all the other systems are subsystems of the ecological system and are totally dependent on it. High-quality energy and raw materials are extracted from this ecological system and low-grade energy while other waste and pollution are emitted into it. Today, as the development is not sustainable, we encounter environmental catastrophes showing the need for a gentle and well-planned transition (Norgard, 1998, p. 1).

When considering behavioral strategies in order to have sustainable electricity usage, we have to be concerned with the following factors.

- Our responsibilities and duties towards the environment
- Beliefs about electricity usage
- Norms that we have to protect towards the environment
- Ways to control non-environmental friendly behaviors
- Ways to create awareness and develop attitudes towards energy conservation

Presently, electricity can be seen as the most widespread primary energy sources as well as the most polluting form of secondary energy. It is important to think about other aspects of development rather than only thinking about economic and technological aspects. It is decisive to redirect the course of the way we organize our societies and daily lives. We have to redefine the targets for the development towards a better and more direct satisfaction of all people's need within an environmentally sustainable economy. Considering the energy chain, electricity consumption should not be considered end in itself, but rather as a means to obtain energy services. Somehow, we should be able to agree that the ultimate end, the objective of the development should be a high quality of life for all human beings in a just and environmentally sustainable world.

Obviously, energy services can contribute to a better life, but only to a certain extent. Standard of living and lifestyles have links to the energy chain. We can interpret the lifestyle as a whole set or a pattern of human behavior. As far as electricity consumption is concerned, lifestyle could be defined as non-technical parameters, which determine a person's consumption of electricity. This is a 'soft' issue and often it makes little sense to ask for them. However, more consideration in this regard is important (Norgard, 1998, p. 287). A high degree of satisfaction should be the ultimate goal of our development, not just as much energy serves as possible (Rosenfield, Chen & Gadgil, 1998, p. 19).

As seen from the evidence from the field, living environments of people have an impact on their household electricity consumption.

"In my home, we use air conditioners frequently especially when my children are at home. There are many reasons for that. Some days it is very warm. Several times we have seen snakes from the surroundings. After that incident, I was reluctant to open even windows thinking about the safety of my children. My children are going to urban schools they asked me to have such, as their colleagues having those in their homes" (Semi-Structured Interview no 3, A 36 years old lady Lawyer, 2020).

Moreover, the built environments in suburban areas have effects on their household electricity usage patterns. Gross domestic product, employment rates and residential space provide significant impacts on residential electricity consumption (Chen, 2017). Housing regulations, house types, generational preferences, land-tenure and living arrangements have effects on the household electricity choices.

Also, consumerist life patterns of respondents have impacted their electricity usage patterns, which is evident from the following quotes.

“Two out of my 3 children are living in abroad. So frequently on a daily basis, we are connecting with them online. Because of that, we are using mobile phones and our laptop for hours. So we have to charge those, and when we are calling to them at night we can't switch off lights. There is a large time gap. We often don't use electricity for watching television and other activities” (Semi-Structured Interview 5, A 56 years old House Wife, 2020).

“As my wife and I are having busy schedules and high responsibilities regarding our jobs, we don't have much time to involve in household work. With the intention to save time and to be easier, we are compelled to use any electrical device such as oven, blender, rice cooker and washing machine etc.” (Semi-Structured Interview 16, A 37 years Bank Manager, 2020).

Household electricity practices are influenced by social patterns of work, leisure and mobility beyond its walls (Taylor & Chappells, 2019, p. 12). Air conditioners, refrigerators and electrical tools such as rice cookers, blenders, and washing machines consume the largest portion of electricity. The fluorescent lamp is the first energy-consuming household product to be regulated for energy efficiency standards. After that, many household appliances, such as refrigerators, freezers, air conditioners etc. have been regulated. The study by Jamil and Ahmad (Extracts by Chen, 2017, p. 7) claimed that the growth in private expenditure causes the rising of electricity consumption in residential sectors. Yoo (Extracts by Chen, 2017, p. 7) investigated the casual relationship between electricity consumption and economic growth using the data of four countries – namely Indonesia, Malaysia, Singapore and Thailand- for the period of 1971-2002 and found that economic growth may affect electricity consumption directly in these countries. The variable of employment rates is also found to have a positive impact on per capita electricity consumption. Gurgul & Lach (Extracts by Chen, 2017, p. 7) have found that a causal relationship exists between total electricity consumption and GDP (Gross Domestic Product), as well as between total electricity consumption and employment. Many researchers have confirmed that the variable of employment is also an important factor to affect energy consumption. The variable of space is also found to have a positive influence on per capita consumption. Bigger family sizes and electricity demand for air-conditions, cooking, and cleaning are higher. (Chen, 2017, p. 8).

Harvey (1989, p. 122) has characterized suburbanization as the means by which capitalism ensures a market for consumer products and the nourishment of an anti-communitarian ideology of ‘competitive individualism’ (Harvey 1989 extracts by Vaughan., Griffiths & Haklay edited by Vaughan et al, 2009). In a consumer society; commodities that prevail in the market, are merely not identified as objects. Those have become ‘commodities’ which are having symbolic value attached to those objects. Those symbols have a social value. Therefore, consumers not only buy those objects, but they also buy symbolic value attached to those as they think that, it helps to locate them in a certain position within the social hierarchy (Doshi edited by De Silva & Attanayake, 2016, p. 296)

It is also important to consider the environmental responsibilities and duties. More consideration with regard to policy-making involving green labelling, energy standards and electrical prices are needed. The results of Dintchev et al (Extracts by Chen, 2017, p. 1) showed that the education of electricity savings has a significant influence on the energy-efficient behavior and awareness. Relevant energy policies are required to induce efficient electricity consumption in the residential sector in many countries, due to global warming effects and the security of the energy supply. Examining household electricity usage behavioral patterns and sustainable usage of electricity as an energy source, it is significant to consider about few aspects as below,

- Tension between consumers and suppliers.
- Tension between consumers and developer’s visions of the actual behavior.
- Differentiations in user’s experience of energy over time.
- Resistance of energy users

Then it would make a clear path to reflect on the challenges which could emerge a sustainable future (Taylor & Chappells, 2019, p. 12). Diversified energy services aligned to people’s every day ambitions for better lives offer more realistic prospects for sustainable transitions (Taylor & Chappells, 2019, p. 20).

O’ Doherty *et al* (Extracts by Chen, 2017, p. 2) found that the explanatory variables of income have a significant impact on electricity consumption. McLoughlin *et al* incorporated variables of disposable income, dwelling type and a number of bedrooms that are used for residential space to explain the electricity consumption in the household. Runa (Extracts by Chen, 2017, p. 3) analyzed the impacts of energy prices on energy consumption and finds that energy price sensitivity in residential energy consumption is higher for high-income households than low-income households. Electricity production and the price of electricity are important factors which affect electricity consumption (Zhang & Peng, Rahman & Miah extracts by Cheng, 2017, p. 3). Santos et al (Extracts by Cheng, 2017, p. 3) indicates that the energy policies are important

tools to improve the utilization efficiency of energy. The potential for future savings through energy efficiency is even larger than the second factor of two, through the implementation of proven strategies such as revising utility mandates and profit rules to allow utilities to diversify into selling “energy services” and helping customers to become more efficient. Since 1973, U.S. gains in the efficient use of energy have saved a remarkable amount of energy and money for consumers and industry, and the potential for future savings is even larger. Each one percent gained in efficiency means one percent drops in the need to supply energy; it reduces the need to strip-mine or build dams and power plants. This furthermore means when one percent drops in the combustion of fossil fuel burned, longer the delay in the threat of global warming, and less the pollution by acid precipitation and smog (Rosenfield, Chen & Gadgil, 1998, p. 19).

Environmental management is important for more sectors of human activity and plays a crucial role in establishing sustainable development (Barrow, 2006, p. 3). The satisfactory resolution demands a level of forwarding vision and monitoring beyond that of many disciplines. Clearly, unpredictable natural disasters and human fickleness mean that even the best prediction and most careful observation would sometime provide little or no warning of problems; environmental management must, therefore, address such issues as human vulnerability and seek adaptable and flexible strategies. Environmental management generally demands a multi-disciplinary approach (Barrow, 2006, p. 4). It is difficult to separate environmental management from the process of development (Barrow, 2006, p. 5). There is a rapid increase in human population placing more stress on environment, so even if there are no challenges caused by nature but some are caused by the development. Environmental management must assess threats accordingly to seek avoidance, mitigation or adaption (Barrow, 2006, p. 6).

4.3. Impacts of the Intervention

The main impact of the intervention of this action research is that the awareness of sustainability-related to electricity is enhanced and the sample population decided to change their behavior to save energy, which could have a long-term, lasting impact on sustainability. Furthermore, they were enlightened regarding the concept of ‘sustainability’ which they were not aware of earlier. Below quote by a respondent provides evidence as to how much they became aware of the aforementioned factors.

“I have heard about energy ‘conservation’ before. However, I didn’t know much about the word ‘sustainability’. This leaflet gave me an idea about what it would be. With our lifestyle we are more engaged with electric devices which are very useful in our everyday lives, one main thing is communication. Including my house, one person has more than a mobile phone, especially youths. The reason is that they always wanted to have the latest models than thinking about real need. Therefore, it’s needed to be charged continuously, which consumes an extra amount

of electricity” (Semi-Structured Interview 5, A 18 years old girl). In addition, respondents have given suggestions regarding the upgrading awareness on this issue.

5. Conclusion

Mostly people concentrate on technological and economic strategies while adequately not focusing on behavioral strategies with regard to household electricity usage. To have more sustainable usage in this regard, more education and awareness about the importance of ‘sustainability’ and ‘environmental management’ are considered to be necessary. When linking the two concepts, ‘sustainable development’ and ‘energy development’ are raising potential resources, sustainable development of renewable natural resources. This implies imposing limits to the development process, even though these limits are adjustable by technology or judged to clarify the increase of production, but retains environmental and other limits” (Holdgate, 1993 extracts by Josheph & Nagendra, 2004, p. 106).

Usage patterns are connected with their ways of life and sub-culture. Therefore, a reproduction of culture can be noticed with the use of more electricity consuming devices. The community’s living environment has compelled/influenced them to use more devices, which consume high rates of electricity on a daily basis. Consuming culture has an impact on unsustainable usage practices of electricity. People are already following electricity conservation methods mostly for economic benefits, yet they do not have much knowledge about sustainable household electricity usage. Furthermore, there is no adequate knowledge about the alternatives in this regard, only a few have recognized the alternatives with regard to sustainable electricity usage.

It is important to enhance consideration regarding human aspects combined with electricity usage as well as technical aspects. Therefore, needed more analytical studies based on what information may help people to make better, more efficient and sustainable energy decisions. Enhancing knowledge and chances to use possible alternative electricity sources which could product household wise (such as solar power) have the potentiality to make the transition of households from being passive electricity consumers to producer consumers. There is a challenge to change negative behaviors using more sustainable, efficient, innovative and creative strategies. While considering how to motivate behavior change, researchers are needed to look at the messages presented to consumers about energy. If people are assisted to make better decisions, huge energy savings can be realized.

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