Increasing Social Awareness of Consumer Behaviors on Smart Grids Energy Systems

Bekir Buluc*, Halil Ibrahim Bulbul**

*Department of Primary Education, Faculty of Education, Gazi University, Ankara, Turkey

**Department of Computer and Instructional Technologies Education, Faculty of Education, Gazi University, Ankara, Turkey

(buluc@gazi.edu.tr, bhalil@gazi.edu.tr)

Corresponding Author; Bekir Buluc, Gazi University, Faculty of Education, Department of Primary Education, Besevler-Ankara, Turkey, Tel: +90 312 2021724

Fax: +90312 2213202

Received: 08.09.2016 Accepted:01.11.2016

Abstract- The aim of this study is to increase social awareness on consumer behaviors towards smart grid energy system and find out emotional effects of power outages. The participants of this study consist of 58 people living in different regions of Turkey. The participants were identified through the use of random sampling technique. The data of the study were collected through a questionnaire, which consisted of five items and aimed to determine of participants views and behaviors towards social awareness to smart grid energy systems. While analyzing the data, frequency and percentages were used. The main findings of the study indicated that many customers had bad opinions about their service providers in terms of infrastructure of service provider before.

Keywords Smart Grid, Blackout, Social awareness, Consumer behaviors.

1. Introduction

Currently many energy systems are serviced and stored within the smart grids systems in terms of serving quality service. With the smart energy systems, the traditional paradigm of passive distribution and one way communication and flow between suppliers and consumers is going to be replaced by a new paradigm of active distribution that can dramatically change the role of the consumer [1].

New technologies are developing very faster than before and also technologies changed rapidly needs of people according to the use of technology. To understand the meaning of the benefits that smart grids can bring we must firstly establish our understanding of the concept [2].

Smart grid generally refers to a class of technology people are using to bring any type of energy systems and their computer-supported distances control and automation services [3]. As it is known the term "Smart Grid" refers to the computerization of the traditional distribution grid [4].

Smart grid used advanced information and communication technology that provide improving efficiency, reliability, security and quality of service [5].

Using smart grids systems can be increased the connectivity, automation and coordination between suppliers, consumers and network by modernizing grid features like demand side management, generation, real-time pricing, and automated meter activation and reading. Good smart grid can be delivered power from generation points to consumers. Transmission system and distribution system are the main process of smart grids systems smart grid technology is progressing worldwide. Many countries are investing to shift their old system to smart grid system. They have started realigning their organization to support a Smart grid vision [6].

Smart grid is intended to take advantage of all available new technologies in turn into the current grid to one that functions more smartly to facilitate:

. Functional situational awareness and operator assistance;

. Efficiency enhancement by promoting asset utilization;

• Integration of all types of energy storage and other resources such as plug-in electric vehicles (PEVs) to counter the variability of renewable resources and demand;

• Integration of renewable resources including solar and wind at levels from consumer premises to centralized plants to advance global energy sustainability;

. Improved market efficiency via innovative bundled products of energy, ancillary services, risks, etc., made available to consumers and other market participants;

. Two-way communication between the consumer and utility so that end users can actively participate and tailor their energy consumption based on individual preferences (price, environmental concerns, etc.);

. Improved resiliency against malicious attacks through better physical security and state-of-the-art cybersecurity to maintain data integrity, confidentiality, and authenticity, and to facilitate nonrepudiation even in the presence of adversaries in parts of the system;

. Higher quality of service—free of voltage sags and spikes as well as other disturbances and interruptions—to power an increasingly digital economy [5].

The future of the developed and developing countries in the world depends on the availability and transport of energy. It can be said that the consumption of energy will continuously grow in the near future. Security and sustainability have become other major priorities to both customers and electric companies. Deployment of sustainable / renewable energy sources is crucial to a healthy relationship of society and the environment [7].

During the last decades numbers of power plants are built to correspond the needs of energy. Still today, most of the policy attention, the financial needs, and advanced planning are on building enormous new plants. Unfortunately, it is unexpected disturbances, usually on the wires, that cause almost every energy blackout. Storms, droughts, and fires knock out whole sections of the system; control errors and flubbed operations trigger shutdowns; coordination failures cause overloads [8].

It has been more than 80 years people are get used to live with electricity and they are not remember any more before the electricity. Most know only an artificial darkness that is fogged with electric light [9].

But, according to the history that there are so many big power outages within the last 50 years based on many different reasons. Some of important energy outages are shown in Table 1

Table 1. Important energy outages

(1) November 9, 1965 Northeast U.S. and Ontario	(8) August 28, 2003 London
(2) July 13, 1977 New York City	(9) September 8, 2011 California-Arizona
(3) December 22, 1982 West Coast	(10) October 2011 Northeast U.S
(4) August 10, 1996 West Coast	(11) June 2012 Derecho
(5) July 2-3, 1996 West Coast	(12) July 30 and 31, 2012 Northern India
(6) June 25, 1998 Ontario and North Central U.S	(13) October 2012 Hurricane Sandy
(7) August 14, 2003 Northeastern US and Ontario	

Source: [8].

Consumers are getting used to receive quality service from their energy service suppliers and whenever receive some interruptions they can complaint or feel unsafe situations about their service suppliers. Many developed countries share their duties on energy service with special companies or transfer their role to them with regard to provide quality service.

Electric power transmission systems are a key infrastructure and blackouts of these systems have major direct and indirect consequences on the economy and national security. In particular, electric power blackouts have cascading effects on other vital infrastructure [10].

There is a psychological effect on people that often occurs during extended power outages. As time passes without electricity, people who depend on their ability to communicate or move freely get agitated, worried, and sometimes panic [11].

It is called this the "power outage panic response". They are worry about it. They can get irritable. And they can act in ways they normally would not act. This is when normal people do abnormal things. Some lose control and begin stealing from others. Some do much worse. This makes safety and security an issue to those who intend to remain and "tough it out." And it doesn't have to be a power outage that causes society to become unruly and disruptive. It seems our whole national infrastructure is falling apart and many people react [11]).

Aim of the Study

The aim of this study is to increase social awareness on consumer behaviors towards smart grid energy system and find out emotional effects of power outages. In parallel to this aim, the study tries to answer the following research questions:

1. In recent years have you ever experienced with long time power outage (energy, water, internet, etc.) that affected your daily life?

2. What did you do when you first encounter with one of the outage?

3. What could be the cause of the outage happened?

4. The Power outage has created what kind of negative effects on you?

2. Method

The participants of this study consist of 58 people living in different regions of Turkey. The participants were identified through the use of random sampling technique. Demographical characteristics of the participants are as follows 69% male (40 person), 31% female (18 person); With regard to the age groups, the participants' characteristics are as follows: 24.1% 18-25 years (14 person), 48.3% 26-33 years (28 person), 19 % 34-41 years (11 person), 6.9 % 42-49 years (4 person), and 1.7% 50 years and older (1 person).

Data Collection Tool

The data of the study were collected through a questionnaire, which consisted of five items and aimed to determine of participants views and behaviors towards social awareness to smart grid energy systems. While analyzing the data, frequency and percentages were used.

3. Results

First question of questionnaire; in recent years have you ever experienced with long time power outage (energy, water, internet, etc.) that affected your daily life? The results of regarding the first question of the questionnaire are shown in Table 2.

Table 2. Power outage status of the participants

In recent years have you ever experienced with long time power outage (energy, water, internet, etc.) that affected your daily life?	Yes	
	f	%
Total	58	100

Findings of the study indicated that the participants of study experienced with power outages in recent years. After this question we asked to participants; what kind of power outage you encountered? The results of regarding the second question of the questionnaire are shown in Table 3.

Table 3. Types of power outages

What kind of power outage you encountered?		
Outages	f	%
Electricity	38	65.5
Water	26	44.8
Internet	25	43.1
Natural Gas	-	-
Other	4	6.9

In this question we requested from participants, they can mark two options. It means every participant marked two items related to this question. Findings of regarding this question indicated that participants were most experienced with electricity outage (65.5%) and water outage (44.8%). These were followed by Internet outage (43.1%). None of the participants had experienced with natural gas outages during the recent years.

Third question of questionnaire is that what did you do when you first encounter with one of the outage? The results of regarding the third question of the questionnaire are shown in Table 4.

Table 4. Behaviors of the participants in the time of outage

What did you do when you first encounter with one of the outage?	f	%
I called my service provider.	30	51.7
I called Competent Authority as Governorship, The Office of the Mayor etc.	10	17.3
I tried to get information from people that living my neighbors.	9	15.5
I waited for the solution of problem itself.	9	15.5
Total	58	100.0

Findings of the study indicated that, in the outage process participants firstly called their service provider. The other case mostly observed in the outage process people called their Competent Authorities as Governorship, The office of Mayor etc. The other common types of behavior for participants, getting information from other people like their neighbors. In addition to that some people did not do anything related to outages and they expected the problem solved itself.

In the fourth question we asked to participants; what could be the reasons of the outages did happen? The results of regarding the fourth question of the questionnaire are shown in Table 5.

Table 5. Reasons of outages

What could be the reasons of the outages happened?	f	%
Deficiency in infrastructure of service providers.	48	82.8
The lack of effective control by the state for service providers.	18	31.0
Unforeseen circumstances as natural disaster, etc.	6	10.3
Inadequate human resources of service providers.	5	8.6
Cyber attacks	5	8.6
Others	4	6.9

In this question we said to participants, they can mark two options. This means every participant marked two items related to question. Findings of regarding this question indicated that participants were thought most important reason of outages, "Deficiency in infrastructure of service providers (82.8%)" and "the lack of effective control by the state for service providers (31%)".

In the last question of questionnaire, we tried to find out "what are the negative effects of power outages on the behaviors of participants. The results of regarding this question of the questionnaire are shown in Table 6.

Table 6. Negative effects of power outages

The power outage has created what kind of negative effects on you?	f	%
I had stress.	33	56.9
I felt that lock of management and control.	19	32.8
My confidence was shaken to my service provider.	18	31.0
I thought I should change my supplier company.	13	22.4
I felt very unsafe situation.	9	15.5

In this last question we requested to participants, they can mark two options. It means every participant marked two items related to question. Findings of regarding this question indicated that stress is the most common type of negative effect of power outages (56.9%). Second negative effect of power outages on the participants, sense of lock of management and control (32.8%). Other negative effects are confidence shaken to service providers (31%), changing of service providers (22.4%) and feeling yourself unsafe of people (15.5%).

4. Conclusion

Smart grids are providing good infrastructure for customer that people receive uninterrupted service and they can query their usage easily through the systems. Many customers had bad opinions about their service providers in terms of infrastructure of service provider before. Now things is changing by the positive effect of using smart grids technologies. As it is explained in findings many customer behaviors need to change positively. The only way to change this situation we should increase the level of social awareness of customers.

References

[1] A. Mengolini, J. Vasiljevska. "The social dimension of Smart Grids. Consumer, community, society". Luxembourg: EU Commission, JRC Scientific and Policy Reports. pp.6. 2013.

[2] I. Mikalauskas. "Economic, social and environmental benefits of smart grids". European Journal of Interdisciplinary Studies, Vol. 7, No.2, pp. 19-28. 2015.

[3] Smart Grid. (2016, March 2). www.energy.gov. Retrieved from http://energy.gov/oe/services/technology-development/smart-grid.

[4] Smart grid economic and environmental benefits. A Review and synthesis of research on smart grid benefits and costs. 11-2013, Smart Grid Consumer Collaborative, 2013.

[5] K. Moslehi, R. Kumar, R. "A reliability perspective of the smart grid". IEEE Transactıons On Smart Grıd. Vol. 1, No.1, pp, 57-65. 2010.

[6] A. Singhal, R.P. Saxena. "Software models for smart grid". Software Engineering for the Smart Grid (SE4SG), International Workshop on, pp. 42-45. 3 March 2012, IEEExplore.

[7] P. Ribeiro, H. Polinder and M.J. Verkerk. "Philosophical considerations on the design of smart grids". Power and Energy Society General Meeting, pp. 1-3, 22-26 July 2012. IEEExplore.

[8] M. Jacobs. (2016 March 2) "13 of the Largest Power Outages in History — and What They Tell Us About the 2003 Northeast Blackout". Retrieved from http://blog.ucsusa.org/mike-jacobs/2003-northeast-blackout-and-13-of-the-largest-power-outages-in-history-199.

[9] D.E. Nye. When The Lights Went Out. A History of Blackouts in America. The MIT Press, Cambridge, Massachusetts, London, England, 2010, pp.9.

[10] I. Dobson, B.A. Carreras, V.E. Lynch,and D.E. Newman. "An initial model fo complex dynamics in electric power system blackouts". Proceedings of the 34th Annual Hawaii International Conference on pp. 710-718. January 2001. IEEE Conference Publications .

[11] R. Brenner. (2016, March 05). *Thee emotional effects of power outage.* Retrieved from http://survivallife.com/emotional-effects-power-outage.