Section: Research Paper

Short-Term Prediction of Electricity Consumption: The case of per household setting

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Abstract Having knowledge of electricity consumption per household is an advantage in the ever-changing technology and the goals of achieving electricity conservation. This study assesses the electricity consumption among households in Bliss San Isidro Calape, Bohol, as a basis for energy conservation measures. The survey contained three sections: Section 1 contained demographic details, responses, and energy usage of the households; Section 2 contained attitudes on reducing energy consumption; and Section 3 contained practices on reducing energy consumption. There were approximately 50 households living at Bliss San Isidro Calape who served as the target respondents; an established 30% of the population served as the baseline of the respondents. The samples included people from a wide range of socioeconomic statuses, household sizes and compositions, levels of education, job statuses, and vocations. Results have shown that the highest of the latest electricity bills paid by the respondents was 3,189 pesos, with nine members earning above ten thousand pesos monthly and using 15 units of appliances. This is followed by 3,085 pesos spent on the electricity bill by the household size of six members earning 2,500 to 5,000 pesos monthly and using five units of appliances, and 1,512 pesos by the household composed of six members earning above ten thousand pesos per month and using 12 units of appliances. The lowest paid electricity bill was Php 42.75 by the household with six members earning 5,000–7,500 pesos with no appliances in their house; Php 109 by the household comprising five members earning 2,500–5,000 pesos using low-energy bulbs and television; and Php 180.00 by the household of four members earning below 2,500 using low-energy light bulbs and television only. The data reveals that the amount of energy usage is a result of the number of users within the household, the monthly income, and the quantity and kind of appliances used by the energy consumers. Most of the adaptation measures being practiced by the respondents involve simply unplugging and turning off the appliances. Very few of the respondents resorted to buying gadgets to save electricity. The lowest paid electricity bill was Php 42.75 by the household with six members earning 5,000–7,500 pesos with no appliances in their house; Php 109 by the household comprising five members earning 2,500–5,000 pesos using low-energy bulbs and television; and Php 180.00 by the household of four members earning below 2,500 using low-energy light bulbs and television only. The data reveals that the amount of energy usage is a result of the number of users within the household, the monthly income, and the quantity and kind of appliances used by the energy consumers. Most of the adaptation measures being practiced by the respondents involve simply unplugging and turning off the appliances. Very few of the respondents resorted to buying gadgets to save electricity.

Keywords: consumption, electricity, per household, prediction

Introduction

Electricity distribution and consumption per household play an important role in the realization of adaptation measures for climate change. Furthermore, electricity generation in the Philippines context utilizes energy sources like coal power, hydro, wind, and recently solar energy which are renewable energy sources. These are known to be environmentally friendly and sustainable. The last stage is electricity distribution to the end users such as customers whether for residential or commercial use.

For residential like for instance, the demand for electricity varies. There are periods or seasons in which electricity consumption is too high or low. Among the contributing factors include uncertainties like population growth, the changing technology in which people might be more attracted to buy gadgets for convenience and home use, economic conditions among people, prevailing weather conditions in which the impact of climate change is becoming intense, and the general randomness inherent in individual usage.

According to the article found in the Manila Bulletin (EHL, Feb. 23, 2011), the Philippines has been reportedly having the most expensive electricity price in Asia. The study revealed that the Philippines has surpassed Japan as the country with the most expensive power in Asia, with an average retail rate of 18.1 US cents per kilowatt-hour. Electricity prices in Japan were 17.9 US cents per kilowatt-hour as of the same month last year.

The utility firms in Thailand, Malaysia, South Korea, Taiwan, Singapore, and Indonesia were also included in the study, in addition to Japan. According to a similar analysis conducted by MERALCO using data from the final quarter of 2008, the Philippines' electric tariffs had lagged behind Japan's up to that point. With the exception of Japan and Singapore, the rates between the Philippines and most of the rest of Asia were so drastically different that what customers pay in other countries only comes close to matching the generation fees that consumers in the Philippines pay. These cost P5 on average per kWh. The group attributed the high price of electricity in the Philippines to the fact that all costs—from power production to distribution and taxes—are passed along to consumers.

Menelao Carlos, chairman of the Federation of Philippine Industries (FPI), responded to the new record by saying that the country's prohibitive electricity costs must be the main reason why foreign investment has been declining in the Philippines while it has been increasing in other countries in the region. According to the survey, household users in the Philippines spend the most for electricity—on average P10 per kilowatt-hour—and bear the heaviest financial burden. The greatest rates for business establishments are in other Asian nations.

Additionally, according to Dillon et al. (2006), the economic expansion that followed the recovery from the Asian financial crisis has been accompanied by an increase in energy consumption and the greenhouse gas emissions that go along with it. Local resources like coal, natural gas, hydropower, and traditional biomass energy help to partially meet the need for energy. One of the few places in the world, the Philippines, has the biggest proportion of renewable energy (RE) in its entire primary energy supply (35% RE and 2% hydro). Natural gas has been used more frequently recently to generate electricity. With around 142 million tons of carbon dioxide equivalent (MtCO2e), excluding emissions, the Philippines was ranked 39th in the world in terms of overall greenhouse gas (GHG) emissions in 2005. Based on the situation

mentioned, there is a need to monitor the electricity distribution and demand in relation to climate change; therefore, this study is deemed to be realized.

Objectives

The study aims to assess the electricity distribution and consumption per household in Bliss San Isidro Calape, Bohol, as a basis for energy conservation in the face of climate change. Specifically, it aims to answer the following indices: demographic details, responses, and energy usage of the households; attitudes toward reducing energy consumption based on the perception of the respondents; and present practices on reducing energy consumption towards climate change adaptation measures.

Methodology

The survey questions were formulated using a variety of numerical response (Likert) scales, check boxes, and a method known as best-worst scaling (Auger, Devinney, & Louviere, 2007) to evaluate preferences linked to technology. Instead of using a straightforward rating scale, a best-worst design was utilized to elicit more precise assessments of relative preference. The procedure entails selecting the options that are "most important" and "least important." To determine the relative value or utility assigned to each option, the outcomes of repeated decisions made across various option sets were compiled.

The survey was divided into three sections: part one covered demographic information, household responses, and energy usage; section two covered attitudes about lowering energy use; and section three covered current procedures for doing so. The response rate to the survey was increased in a number of ways. The researchers sent each participant a personalized cover letter along with the survey, outlining its significance and requesting their participation. Responses from participants were guaranteed to be anonymous.

Approximately 50 households living at Bliss San Isidro Calape to serve as the target respondents. An established 30% of the population served as the baseline for the respondents. Either husband or wife acted as the respondents to the said survey. The samples included people from a wide range of socioeconomic statuses, household sizes and compositions, educational levels, and job situations. The sample demographics' specifics were summarized.

Results and Discussion

The results of the demographic details, responses, and energy usage of the households are shown in narrative form. Based on the data, the highest of the latest electricity bills paid by the respondents was 3,189 pesos, with nine members earning above ten thousand pesos monthly and using 15 units of appliances. This is followed by 3,085 pesos spent on the electricity bill by the household size of six members earning 2,500 to 5,000 pesos monthly and using five units of appliances, and 1,512 pesos by the household composed of six members earning above ten thousand pesos per month and using 12 units of appliances. The lowest paid electricity bill was Php 42.75 by the household with six members earning 5,000–7,500 pesos with no appliances in their house; Php 109 by the household comprising five members earning 2,500–5,000 pesos using low-energy bulbs and television; and Php 180.00 by the household of four members earning below 2,500 using low-energy light bulbs and television. The data reveals that the

amount of energy usage is a result of the number of users within the household, the monthly income, and the quantity and kind of appliances used by the energy consumers. The data reflects that the first three households with the highest electricity bill were using air conditioning units.

Table 1. Attitudes on Reducing Energy Consumption Based on the Perception of the Respondents

Opinion	Mean	Descriptive Rating
I am aware of at least three ways to lower my household's energy use.	4.17	Agree
By using less energy at home, I can contribute to environmental protection.	4.17	Agree
I can spend less money by using less energy in my home.	4.65	Strongly Agree
It makes me feel good to lower the amount of energy I consume at home.	4.47	Agree
I reduce my household's energy usage like what my family and friends do.	4.87	Strongly Agree
Reducing my household consumption is convenient for me.	3.61	Agree
I lessen the amount of energy I use at home like what experts think.	3.69	Agree
I lessen the energy I use at home as promoted by the government.	3.39	Agree
People I know have made efforts to lower their household energy usage.	3.61	Agree
I have made efforts over the past five years to lower the amount of energy I consume at home.	3.87	Agree
I have complete control over whether I reduce my household energy consumption.	3.65	Agree

Table 1 presents the attitudes toward reducing energy consumption based on the perceptions of the respondents. I reduced my household energy consumption like my family and friends do and got a total mean of 4.87. I can spend less money by using less energy in my home, which garnered a total mean of 4.65. Both opinions are rated strongly agreeable. The rest of the opinions are rated agree. It is clear that reducing energy consumption at home is influenced by the necessity of reducing household energy consumption, like what family and friends do, and by saving money.

Table 3. Present Practices in Reducing Energy Consumption

Adaptation Measures	Frequency	Rank
Unplug things when you are not using it	22	1
Turn off lights upon leaving the room	20	2.5
Turn off the television when nobody is watching	20	2.5
Open windows instead of turning on lights at daytime	19	4
Use firewood in cooking.	17	5
Turn off the circuit breaker upon leaving the house.	15	6
Turn off your computer, or at least the monitor, rather than leaving it on constantly.	13	7.5
Use a lid to seal in the heat when cooking.	13	7.5
Line-dry your clothing	12	9.5
Cleaning the coils in your refrigerator	12	9.5
Use LED lights when sleeping at night	10	11.5
Replacing electrical devices with the latest devices designed for minimizing energy use.	10	11.5
If using aircon, keep the door and window closed and with curtains	9	13
Put large jugs of water in your freezer	6	14
Buy solar power battery charger	3	15

Table 3 reflects the present practices of the respondents in reducing energy consumption. Unplugging things when you are not using them ranks first with a frequency of 22. Turn off lights upon leaving the room, and turn off the television when nobody is watching, which has an equal frequency of 20 (rank 2.5). Open windows instead of turning on lights is ranked fourth with a frequency of 19, and using firewood in cooking is ranked fifth with a frequency of 17. Only three of the respondents practiced buying power battery chargers. Most of the adaptation measures being practiced by the respondents are simply unplugging and turning off appliances. A very few of them resorted to buying gadgets to save electricity.

Conclusion

The amount of energy usage is a result of the number of users within the household, the monthly income, and the quantity and kind of appliances used by the energy consumers. Reducing energy consumption at home is influenced by necessity based on what friends and family think as well as the need to save money. Most of the adaptation measures being practiced by the respondents are simply unplugging and turning off appliances. A very few of them resorted to buying gadgets to save electricity.

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