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Comparative Analysis of Residential Energy Consumption in Selected Areas of Cantilan Surigao del Sur

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ABSTRACT

Energy consumption is considered as one of the most crucial issues in our daily lives, yet, the fundamental understanding of how energy assessment and policies are designed remained as one of the biggest barriers because of the complexity. The study is focused on analyzing the residential energy consumption in selected barangays in the municipality of Cantilan, Surigao del Sur, Mindanao Philippines. The study provides well-documented data as basis for establishing policy for potential energy usage reductions and cost savings of the municipality. The study investigates the profile of the respondents, profile of household based on construction type; and residents' contributory factors and practices on energy consumption. The descriptive research design was employed through survey and informal interviews from the two most populated barangays in the municipality of Cantilan. A validated researcher-made questionnaire served as the main tool in the data gathering. Based on the findings, the contributory factors on energy consumption and the conservation practices of the respondent barangays mirrored their socio-economic status. Most respondents fall into low-income households, where only those essential appliances useful in their day-to-day activities are the priorities and things they afforded. Although most households only have a few appliances, the average monthly electric expense has increased due to high energy costs and frequent energy interruptions. The respondents' conservational habits are reflected in their energy consumption. It can be deduced that understanding the consumers' motivations of energy usage in a specific situation, will eventually lead to gaining insights of good energy consumption process in the area.

Keywords: Energy consumption; practices; rural areas; energy costs

INTRODUCTION

Energy is one of the many essential inputs for production, transformation, processing and commercialization across all sectors. Energy, generally contributes a vital role in a country's economic development as it enhances its productivity. In addition, the increased consumption of energy indicates an increase in economic activities. By inference, an improvement in the economic development of energy signifies that a country has a high economic ranking. On the other hand, energy consumption is considered as one of the most critical issues in most establishments. However, various barriers to the adoption of energy efficiency technologies have been identified, yet policies on the utilization and conservation have not yet been strengthened (Cattaneo 2019).

Large establishments are among the largest consumers of energy. Numerous studies focused on analyzing large commercial buildings' energy performance have proven that a need to investigate its performance consistently is necessary (Aiman Roslizar et al. 2014). The energy performance can be anchored on the International Energy Agency, whose major political aim in a global context is to increase energy efficiency and reduce greenhouse gas emissions. It is still being determined how each sort of energy is used by households, even though they use a variety of energies every day (IEA 2019).

One of the most noteworthy barriers to substantially improve buildings' energy efficiency is the need for more knowledge about the factors determining energy use (International Energy Agency 2016).

The total energy use of buildings as designed and as used frequently differs significantly. However, the causes of this discrepancy may be better understood and frequently have more to do with how people behave than how buildings are designed. This difference can lead to better understanding and better communication among the different sectors involved in the topic of energy savings in buildings. In general, building energy consumption is primarily influenced by different factors.

In some developing countries like Philippines, energy consumptions have nearly doubled over the past decades, thus prompted its concerned department to outlines transformative actions for attaining secure, sustainable, reliable, quality, and reasonably priced energy for the country in line with the government's long-term vision (Department of Energy 2023). Part of its submitted plans is the 2019 Energy Efficiency and Conservation Act (EE&C Act) that aims to pursue the promotion of the development and use of efficient and renewable energy technologies. However, the implementation has not completely reached to the rural levels due to complacency of assigned tasks.

A study finding about the energy consumption analysis in Surigao Del Sur State University-Cantilan campus, found out that majority of the faculty-occupants and their behaviors significantly contribute to the fluctuation of energy consumption in the school, where it can be indicated from the working hours extended by the faculty-occupants when important activities are scheduled. However, there needs to be evidence of indicative interest in providing solutions for the schools to gain profit, modelling for a cleaner environment and cost-saving schools (Enteria & Dela Pena 2020).

There is a high need to be clarified how household characteristics and energy usage are related. Given the significance of energy in our daily lives, one of the biggest barriers is the need for a fundamental understanding of how energy policies are designed.

There are identified countries that usually feel the situation. These countries are commonly located in tropical regions, like the Philippines. The impact of insufficient energy consumption on the development of various areas of the country and on people's standard of living varies due to differing environment of most developing countries. Moreover, poor energy consumption, lack of understanding of household dynamics and other factors influencing their energy consumption would surely lead to inadequacy and danger (IEA 2019).

The present situation reflects the idea on difficulties of establishing or evaluating policies and programs related to energy conservation, unless, driven by a law that requires implementation. The National Electrification Administration (NEA) under the Department of Energy (DoE) has the mandate for rural electrification programs in the country. At present, NEA is constantly trying its best to serve the country's remaining 2.7 million households without electricity (Laput 2019). As electricity becomes a basic need for the Filipino people, the demand for and use of electricity in residential buildings is rapidly increasing. However, despite the advantages, convenience, and comfort it provides, the danger that electricity poses should not be overlooked.

People living in the rural and urban areas have different energy conservation practices and policies due to differences in situation and socio-demographic profile. The type and composition of socio-demographic factors of households influence their energy consumption behavior and practices.

FIGURE 2. Overview of the (2) two selected barangays in Canitlan Surigao Del Sur
Source: Photo courtesy of Google Map.com

In the article of Energysage (2023), it is stated that the use of energy varies based on a few factors such as the size and age of home, number of people living in home, insulation of the house, and the types of products and appliances use throughout the house. The statement is closely related to the study of Belete Debebe et al. (2023), that empirical revealed that a mix of factors, including age, gender, household size, education, income, access to electricity, off-farm activities, distance to forest, access to market, and type of house considerably govern a household's choice of energy conservation.

Households living in urban areas spend more on electricity than those living in rural areas (Danlami 2017). The number of a household's members (i.e. household size) affects the household's energy consumption decision; the larger the household size, the lesser the adoption of clean energy (Danlami Applanaidu & Islam 2018). Lastly, it is established that there is a strong correlation between household's energy use and the educational qualification of the household head.

The scenarios are also observed in tropical countries, particularly in countries lying along the coast of the pacific, like Philippines. And one of the identified provinces and municipalities that are experiencing high energy disruptions is the municipality of Cantilan in Surigao Del Sur Province. The municipality is considered a coastal municipality in Surigao del Sur, Mindanao, Philippines. Cantilan has 17 barangays, where its two most populated areas are barangay Magosilom covering the 14.88% of the total population and Lininti-an, which gives its shares 11.70% of the total population (PhilAtlas, 2022). The climate in Cantilan is hot, oppressive, and overcast. Over the course of the year, the temperature typically varies from 77F to 89F and is rarely below 75F or above 92F. The municipality often experience devastation from natural disasters such as typhoon and flooding. The wetter season lasts 7.8 months from June to February (weatherspark.com). The municipality continuously encounters problems on energy consumption that necessitate a fundamental knowledge on energy usage and policies. There have been previous and recent cases of frequent power interruptions in the area, provoking the residents to question the policies and programs of Surigao del Sur Electric Cooperative Incorporation II (SURSECO II). It is within the situation to consider the comparative analysis of residential energy consumption in the selected most populated barangays in the municipality. The results are hoped to help significantly in formulating energy conservation measures for potential energy usage reductions and cost savings among Cantilan Surigao Del Sur residents. The study was specifically focused on a comparative analysis of the residential energy consumption in selected barangays in Cantilan, SDS. The study also looked into the determination of different contributory factors on energy consumption, conservation practices of household members and energy consumption records. Finally, the study's results contributed to the administration, stakeholders, employees and community identifying the potential energy usage reductions and cost savings of the municipality of Cantilan, Surigao Del Sur.

METHODOLOGY

This study employed the descriptive research design, where the researcher's gathered information from the two selected barangays in Cantilan Surigao Del Sur, namely Barangays Lininti-an and Magosilom, being the most populated and wider land area in the said municipality. The design was deemed appropriate because it underwent all the information available to describe the situation and practices of the respondents with respect to residential energy consumption. A consecutive sampling method was also employed during the survey and interview of the respondents. A total of one hundred twenty (120) respondents were surveyed while only six (6) from each barangay were submitted for informal interviews for triangulation of responses. The residents of those identified barangays served as the respondents of the study. The data gathering was done between the months of August and November were frequent power interruptions and fluctuation of energy consumption in the municipality was experienced.

A validated researcher-made questionnaire was the primary tool in the data gathering. The researcher-made questionnaire contained the profile of the household respondents in terms of age, sex, educational attainment, family size and income, and occupation. A separate house profile was also taken, including household construction type, size area, number of rooms, type of house, annual residential energy consumption bill and the standards that led the household respondents to identify their best practices in energy conservation and contributory factors on energy consumption.

The new normal situation due to the pandemic prompted the researchers to conduct the data-gathering procedure in a limited face-to-face setting. Mainly, entry protocol among the authorities' concern was done. Pre-planning was also conducted before the implementation of the study. Phase I includes the investigation of the fundamental information about the residential energy consumption in Cantilan Surigao Del Sur through the validated researcher-made questionnaire. Phase II includes surveying the selected residents of barangay Liniti-an and Magosilom on the contributory factors in energy consumption and their conservation practices. The survey and informal interviews among the household respondents

were done through a snowball technique. Data were analyzed and presented in tables using the SPSS software version 26 where the results on frequency, mean and standard deviation are reflected.

RESULTS AND DISCUSSION

The study is focused on the comparative analysis of residential energy consumption in the selected barangays of Cantilan Surigao del Sur, Philippines. The demographic profile of the respondents is presented in Table 1.

TABLE 1. Profile of the respondents

		Barangay A		Barangay B	
		Frequency	Percent	Frequency	Percent
Age	20-30 years old	11	18.3	14	23.3
	31-40 years old	12	20.0	12	20.0
	41-50 years old	17	28.3	8	13.3
	51-60 years old	13	21.7	12	20.0
	60 years old and above	7	11.7	14	23.3
	Total	60	100.0	60	100.0
Sex	Male	22	36.7	27	45.0
	Female	38	63.3	33	55.0
	Total	60	100.0	60	100.0
Educational Attainment	Elementary	7	11.7	8	13.3
	High School	19	31.7	34	56.7
	Vocational	6	10.0	17	28.3
	College level	28	46.7	1	1.7
	Total	60	100.0	60	100.0
Family Size	4 below	31	51.7	35	58.3
	5-9	19	31.7	19	31.7
	10 and above	9	15.0	5	8.3
	4.00	1	1.7	1	1.7
	Total	60	100.0	60	100.0
Family Income	5,000 below	29	48.3	32	53.3
	5001 - 10000	14	23.3	12	20.0
	10001-15000	9	15.0	8	13.3
	15001-20000	4	6.7	5	8.3
	20001 and above	4	6.7	3	5.0
	Total	60	100.0	60	100.0
Occupation	Working Professional	13	21.7	12	20.0
	General Laborer	4	6.7	9	15.0
	Skilled Worker	12	20.0	14	23.3
	Self-employed	31	51.7	25	41.7
	Total	60	100.0	60	100.0

Table 1 presents the demographic profile of the two selected barangays in the municipality of Cantilan. The profile includes the age, sex, educational attainment, family monthly income and occupation of the residents. Barangay A has respondents ranging from ages 41-50 years old, while Barangay B has variational ages ranging from 20 – 30 and 60 above ages who are females. Common respondents from Barangay A are college graduates, while Barangay B has concentrated on High School undergraduates. However, regarding family size and income, both barangays are composed of family members of 4 with an income of 5,000 or below. Their occupations mirrored their status, commonly declared as self-employed and low-income households. The situation of the two selected barangays is emphasized in figure 2, along with its house construction types. From the surveyed areas, it can be observed that Barangay A houses are made of wood and lumber in a bungalow design, while Barangay B houses are located near water areas, with only one floor level. The survey areas of the two selected barangays concentrate on the most populated areas and less-income households.

FIGURE 2. Common house construction types of the selected barangays

TABLE 2. Profile of household based on construction types

		Barangay A		Barangay B	
Frequency		Percent	Frequency	Percent	
Household Construction Type	wood/lumber	23	38.3	21	35.0
	concrete	28	46.7	28	46.7
	combination	8	13.3	10	16.7
	10.00	1	1.7	1	1.7
	Total	60	100.0	60	100.0
House Size Area	110 and below	29	48.3	33	55.0
	111-119	9	15.0	11	18.3
	120-140	8	13.3	6	10.0
	150 and above	14	23.3	10	16.7
	Total	60	100.0	60	100.0

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No. of Rooms	2 below	23	38.3	30	50.0
	3-5 rooms	33	55.0	26	43.3
	6 and above	4	6.7	4	6.7
	Total	60	100.0	60	100.0
No. of Floor Level	bungalow type	39	65.0	45	75.0
	2-storey	21	35.0	15	25.5
	Total	60	100.0	60	100.0
Monthly Electric Bill	500 and below	4	6.7	16	26.7
	501-999	16	26.7	15	25.0
	1000 - 4999	30	50.0	24	40.0
	5000 and above	10	16.7	5	8.3
	Total	60	100.0	60	100.0

Table 2 presents the type of households of the selected barangays. Among the types of household constructions, the barangays are commonly composed of concrete (46.7%) bungalow-type of a house with an estimated house size area of 110 and below sq. meters. From the survey, Barangay A concrete households have 3 – 5 rooms while Barangay B has two and below a number of rooms. Based on the type of house and number of available spaces, both barangays keep a record of P 1000 – 4999 monthly electric bills, which reasonably corresponds to the type of construction and house sizes. The proportions for the type of households and the monthly electric bills of the two barangays are the same. Moreover, there have been a noticeable rise in the energy or power rate in the municipality, and despite the fact that most households only have a few appliances, the average monthly electric expense has still increased due to high energy cost and frequent energy interruptions.

TABLE 3. Contributory factors

Home Appliances and Gadgets Available in Every Households Frequency		Barangay A		Barangay B	
		Percent	Frequency	Percent	
Home Appliances and Gadgets	Rice cooker	2	3.3	4	6.7
	Electric stove	2	3.3	8	13.3
	Heater	4	6.7	7	11.7
	Refrigerator	14	23.3	2	3.3
	Electric iron	7	11.7	7	11.7
	Tv	9	15.0	11	18.3
	Electric fan	10	16.7	9	15.0
	Laptop	2	3.3	5	8.3
	Cellphone	6	10.0	5	8.3
	Air conditioning unit	4	6.7	2	3.3
	Total	60	100.0	60	100.0

It can be gleaned in Table 3 that in both barangays, TV (A= 15%; B = 18.3%) and Electric Fan (A = 16.7; B = 15.0) are predominantly the common appliances utilized by every household. However, Barangay A shows strong utilization of refrigerators (23.3%), while Barangay B concentrates on utilizing electric stoves (13.3%) to prepare their foods. Contrary to the record of Barangay A where it fondly uses refrigerators, Barangay B yields the least in utilizing refrigerators (3.3%) and air conditioning units (3.3%) since typical surveyed residents are situated close to coastal areas where humid and cool temperature is often experienced. Barangay A, though, less likely to use rice cooker and electric stove (3.3%) since residents prefer the charcoal cooking stove when it comes to preparing their

food. Priority of the Barangay A resident's energy utilization is on cooling appliances since the area is situated near the heart of the municipality where concrete building establishments are closely proximate with each other, thus ventilation is considered as another concern, requiring the resident to utilize cooling appliances for comfort. Since both of the barangays belong to low-income households, the purchasing power for modern automated appliances is highly a challenge that resorted them to simply acquire cheap and available appliances that functions the same with those automated appliances.

According to Weiyan Zong et al. (2020), in their modeling analysis results, household energy consumption behavior and its influential factors vary with energy types across areas. In connection, wealth status and type of fuel consumed by households exhibited the energy ladder hypothesis, as households which are poorest and poorer consume cheap sources of fuels like biomass and the richer and richest homes consume clean fuels like electricity and LPG for cooking (Alhassan Abdul-Wakeel Karakara & Isaac Dasmani, 2019).

From the study Bayudan-Dacuycuy (2018), electricity supply in rural areas is unreliable due to frequent outages or voltage reduction. Weather- and climate-related factors that can induce excess demand for electricity are likely to aggravate outages. A few of the varying factors such as weather, location, type of energy source mainly contributes to the energy consumption of the area.

TABLE 4. Conservation practices of household members

Practices in conserving energy at home	Barangay A		Barangay B	
	Mean	Std. Deviation	Mean	Std. Deviation
Turn off the lights when not in use	4.7500	.72778	4.8167	.67627
Use the appliances one at a time.	4.3333	.89569	4.7333	.66042
Unplug the electrical appliances in the outlet when not in use.	4.4333	.76727	4.4167	.92593
Turn off the lights when sleeping.	4.6833	.72467	4.7500	.67961
Iron clothes at the scheduled time	4.3500	1.05485	4.3000	1.13943
Don't use automated kitchen appliances.	3.9167	1.29263	3.9500	1.37070
Don't turn numbers of lights on at the same time.	3.9500	1.12634	4.2167	1.24997
Don't use drying machine when there is sunlight.	3.6500	1.33816	3.9167	1.51032
Don't use the washing machine if there are only a few dirty clothes.	3.5333	1.51228	4.0167	1.50132
When washing dishes, instead of consistently running hot water, plug the sink and fill it up.	4.1167	1.15115	4.2000	1.33785
Select the most energy-efficient models of appliances	4.3500	.97120	4.4500	1.03211
Replace fluorescent light fixtures with LED	4.5500	.69927	4.6833	.70089
Open windows to allow natural ventilation	4.6000	.66892	4.5500	.85222
Open the cover of non-sun-facing windows to receive natural daylight and turn off the nearby light fixtures.	4.4500	.92837	4.7333	.60693
Others	4.7500	.57120	4.3500	1.44767

Table 4 shows the practices in conserving energy at home by the two barangays in the municipality of Cantilan. Turning off the lights when not in use (A=4.7; B=4.8) and turning off the lights when sleeping are the top identified practices in conserving energy by households. It also follows that the proportion of replacing fluorescent light fixtures with LED (A = 4.5; B=4.6), opening windows to allow natural ventilation (A = 4.6; B=4.5), opening the cover of non-sun-facing windows to receive natural daylight and turning off the nearby light fixtures are manifested by the two barangays indicating the knowledge in conserving energy at home is evident. Nevertheless, Barangay A concentrates on conventional practices of conserving energy at home due to a limited number of home appliances and gadgets. Based on the profile, most of the respondents belong to low-income households of P5, 000 and below. The respondents' socio-economic status matched their practices in conserving energy at home, particularly Barangay B, which highly practices conserving energy at home by using the appliances one at a time

(B=4.7). The limited connection or outlet and energy source prompt the residents to alternate the use of the appliances. The inadequacy of resources, particularly the appliances and gadgets present at home, proportionate the respondents' socio-economic background. Thus, around half of the population surveyed hide some unusual and illegal energy conservation practices through connections from one source to another. Nevertheless, the use of washing and drying machines (A=3.6; B=3.9); and automated kitchen appliances (A=3.9; B = 3.9) are less practiced by the respondents since they do not have washing machines and modern automated appliances at home. Conventional practices that include hand washing, natural ventilation, charcoal and organic resources in cooking are commonly practiced.

The type and structure of socio-demographic factors of households influenced the energy consumption practices and behavior of the residents.

According to the study of Bindu et al. (2021), the social environment is a necessary place to disseminate energy-saving products and promote buying behavior among consumers. When considering demographic factors, gender positively affects energy-saving behaviors, specifically that women tend to practice energy-saving behavior more than men. Since most households are more active during the evening, the woman plays an important role in using energy-consuming equipment such as cooking, boil water, refrigerators usage, washing machines, water heaters.

Energy-saving attitudes and behaviors are shaped by a wide range of complex factors and are difficult to understand. However, promoting energy-saving behavior changes and sustainable energy consumption, needs more information and knowledge about what drives consumption and household lifestyle (Belaïd & Joumni 2022). The number of a household's members (i.e. household size) affects the household's energy consumption decision; the more significant the household size, the higher its consumption (Danlami et al. 2018).

Moreover, the characteristics of the building in which the households leave can also affect their energy choice behaviour. Based on the study conducted by Gianluca Trotta (2018), income and dwelling type variables with regard to energy-saving behaviors and energy efficient retrofit investments significantly diverge; in addition, interesting patterns emerge with respect to the respondents' age, sex, and marital status. By evaluating and understanding the household and dwelling characteristics that affect energy-saving behaviors and energy efficiency investments, it is possible to obtain a clearer idea of where and how energy and emissions savings can be made, and to propose effective and targeted policies that promote energy-responsible lifestyles.

Table 5 presents the contributory factors on the residential energy consumptions. The contributory factors affecting the residents' energy consumption are relevant to the socio-economic profile of the respondent barangays. Based on Table 5, the major contributory factors on electricity consumption largely concentrate on the utilization of lighting where various types of lamps, which include the fluorescent lamp (A= 2.9%; B =3.0), incandescent lamp (A=3.3; B=2.9), and LED bulb (A=2.9; B=2.3) that are interchangeably utilized by every household. Aside from the lighting, residents of Barangay A most of the time utilize refrigerator (2.4) and TV (2.2) as part of their comfort and recreation, While Barangay B generally finds comfort using an electric fan (2.3) when the severe hot climatic condition is experienced. The results are qualitatively described as residents from both barangays have only a middle level of utilization with those electric appliances that lasted only from 2 to 4 hours in a day. On the other side, television, electric fan and refrigerators are lowly utilized for less than an hour.

TABLE 5. Contributory factors on the residential energy consumptions

		Barangay A		Barangay B	
Mean		Std. Deviation	Mean	Std. Deviation	
LIGHTING	Fluorescent Lamp	2.9167	.38142	3.0000	.00000
	Lighting Incandescent Lamp	3.3167	.56723	2.9000	.95136
	LED bulb	2.9500	.74618	2.3500	1.05485
COMFORT	Air conditioner	1.5167	.99986	1.8500	.95358
	Electric fan	2.3667	.95610	2.3333	1.01958
	Refrigerator	2.4333	1.04746	2.2833	1.07501

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COOKING	Electric pot	1.4333	.88999	1.5167	.87317
	Electric rice cooker	1.9833	1.01667	1.5667	.90884
	Cooking Electric stove	1.3500	.75521	1.3167	.70089
	Microwave	1.2167	.66617	1.1333	.46820
	Toaster	1.3000	.72017	1.2333	.69786
	Water heater	1.4833	.91117	1.3667	.78041
CLEANING-USE	Washing machine	1.7500	1.14426	1.5333	.92913
	Dish dryer	1.3167	.79173	1.5000	.91132
	Vacuum	1.2500	.67961	1.5333	.83294
RECREATION	TVs	2.2167	.99305	2.0667	.97192
	Speaker, radio and audio equipment	2.0667	.97192	2.0500	1.01556
	Computers	1.2667	.60693	1.5833	.94406

Regarding cooking, both the respondent barangays show no evidence of using modern heating appliances as they consistently prefer charcoal or organic resources in cooking. In terms of cleaning-use, washing machine is considered a necessity to both Barangay A (1.75) and Barangay B (1.5) respondents due to its efficient way of cleaning-use. The television, speaker, radio and audio are common appliances utilized for the recreational activities of the two barangays. This is strongly explained by the socio-economic status of the respondents-barangay where most of them fall into low-income households, that only those essential appliances useful in their day-to-day activities are the priorities and the only thing they can afford. Due to their purchasing capability, poorer households have been shown to own less energy-efficient services and old technology appliances (Grantham 2019). In addition, there is an observational increase on the energy or power rate experienced in the municipality that even with limited appliances present in every household, their monthly electric bill ranges from P1,000 – 4999. Energy consumption is considered overwhelming due to the situation.

Energy pricing, household and housing features, accessibility to provided energy, climate, home appliance kinds and efficiency, energy sources, and energy-related policies are only a few of the variables that affect how energy is utilized in houses (Fasika Chekol et al. 2023). As previously indicated, tenant behavior and attitudes toward home energy conservation have been extensively investigated in a wide range of multidisciplinary studies and have drawn rising interest in various national energy policy approaches (Ziegler 2019). Generally, energy conservation behavior is regressed on a set of variables, including personal traits (demographic and socioeconomic), gender, lifestyle, efficiency and safety of public transport, residential location, number of personal vehicles, and knowledge about sustainability. As opined by Shahzada et al. (2022), irrespective of their gender, individuals show more responsible behavior with the rising age. Therefore, it is critical for societies to provide relevant education where the young population is dominant. It is observed from the study that older women practice conventional methods of house chores to reduce energy consumption, while younger women prefer technological methods. When it comes to its educational background, the highly educated families tend to consume less electricity because of the established education on how to conserve energy. In terms of the electric billing experienced by the respondent-barangays, the average collections can be accorded to the report of Gomez (2022) who reiterated that in the Philippines, particularly in Northern Mindanao, the distributors charged consumers an average of P7.4 per kWh in 2016. Four years later, their average rate was P8.9 per kWh. From the same study, it is also noted that investor-owned power distributors in Northern Mindanao, like Cepalco, had the highest rate increase at 34.3% or from P6.4 to P8.6 per kWh, from 2016 to 2020. Currently, fluctuation and surge on energy sources remains a challenging issue, yet to be resolved.

SUMMARY OF FINDINGS

The study's findings on the comparative analysis of the residential energy consumption in selected barangays in Cantilan, Surigao del Sur, reveal that most of the respondents are females from low-income families with family members of 4 and below. The respondent-barangays are grouped into two: barangay A has respondents aged 41-50 years old, while Barangay B has variational ages ranging from 20 – 30 and 60 above ages. Common respondents from Barangay A are college graduates, while Barangay B has concentrated on High School undergraduates. Both the barangays are commonly composed of concrete (46.7%) bungalow type of houses with an estimated house size area of 110 and below sq.

meters. Based on the type of house and number of available rooms, both barangays keep a record of P 1000 – 4999 monthly electric bills, which reasonably correspond to the type of construction and house sizes. The proportions concerning the type of households and the monthly electric bills of the two barangays are the same.

The identified contributory factors on residential energy consumption are predominantly observed in the appliances utilized by the households. Barangay A shows substantial utilization of cooling technology, while Barangay B concentrates on using heat-generator appliances to prepare their foods. The two groups vary due to their location. The majority of the Barangay B respondents are situated near coastal areas where the humid and cool temperature is often experienced, thus cooling technology is considered as less contributory factor in their energy consumption, while Barangay A, less likely to use heat-generating appliances since residents preferred the charcoal cooking stove when it comes to preparing their foods. Since both of the barangays belong to low-income households, there is limited availability of modern automated appliances.

The practices in conserving energy at home by the two barangays in the municipality of Cantilan are turning off the lights when not in use and turning off the lights when sleeping as the top identified practices in conserving energy by the households. It also follows that the proportion of replacing fluorescent light fixtures with LED, opening windows to allow natural ventilation, opening the cover of non-sun-facing windows to receive natural daylight and turning off the nearby light fixtures are manifested by the two barangays indicating the knowledge in conserving energy at home is evident. Nevertheless, Barangay A concentrates on conventional practices of conserving energy at home due to the limited number of home appliances and gadgets.

CONCLUSIONS

The comparative analysis of the residential energy consumption in selected barangays in Cantilan, Surigao del Sur, was done to provide well-documented data as basis for establishing policy for potential energy usage reductions and cost savings of the municipality. Based on the profile, the majority of the respondents belong to low-income households, which provide a strong association between the common contributory factors and practices on energy consumption. The contributory factors on energy consumption and the conservation practices of the respondent barangays mirrored their socio-economic status, where most of them fall to low-income households, where only those basic appliances useful in their day-to-day activities are the priorities and the only thing that they can afford. Additionally, there has been a noticeable rise in the energy or power rate in the municipality, and despite the fact that most households only have a few appliances, the average monthly electric expense has still increased due to high energy cost and frequent energy interruptions. The energy consumption is patterned on the conservational practices of the respondents. Turning off lights and reduced utilization of cool and heat generating appliances are the respondents' common conservational practices. Analyzing the nature of the energy consumption process in the selected barangays, provides ideas on the consumers' motivation within the specific context of its energy usage and situation. Finally, the findings offer vital insights for decision-makers who are primarily in charge of ensuring the welfare of the community. Furthermore, it is also recommended that agricultural and rural development agents and non-governmental development agents work together at the keele level to improve access to energy infrastructure and eliminate energy poverty from the rural communities.

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