

Power Consumption of Household Appliances

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Abstract

Power consumption is one of the most considered factors in buying appliances since it is the barometer of every monthly electric bill. Constant monitoring, awareness, and proper usage of every appliance especially at home provide check and balance; however, it has objectively contributed to positive changes and development. The study assessed the power consumption of household appliances of the residents in Villaba, Leyte, Philippines. The respondents were representative member of each household. The study used a descriptive-survey design. The results revealed that the television set (TV) is the most frequently used with the maximum number of hours in use of forty-four (44) hours, followed by an electric fan with fifty-one (51) hours and then the third is a refrigerator with one hundred five (105) hours in use per week. Based on the findings, it can be concluded that power consumption depends on these factors namely: low voltage, appliance's wattage, power failure, standby power, and user's end. With proper orientation and awareness of the user, the electric bill of each household may be minimized. Thus, a consumer awareness program and further seminars/training be administered to each household or consumer about the power consumption of appliances.

Keywords: *consumer awareness program, electric bill, household appliances, power consumption, standby power*

Introduction

Power consumption of household appliances is of major relevance because households account for approximately one-third of the total energy consumption in developed countries [17]. The operation of most types of domestic appliances, lighting, and air conditioning relies upon [1]. Practically all new homes have at least 100- ampere service. In addition, most houses today have a 240-volt service. Power is the rate of energy transfer. It is equal to the product of current and voltage. It is the unit of energy used by companies to calculate our consumption called kilowatt-hour. This is the energy developed in one hour at the constant rate of 1KW while the power rating of most appliances at home remains constant. The amount of energy used depends on the number of hours an appliance is actually operated. Homeowners, of course, have themselves a high interest in reducing energy consumption because energy is an important cost factor. Their usage awareness alone has the potential to

reduce consumption by 15% in private households [19]. Individual consumer behavior and everyday practices help to explain a substantial part of household power consumption and usage is technically identical houses can vary by as much as 300% or 400% due to these factors [4]. However, promoting the sustainable use of electricity is often regarded as particularly difficult, because electricity differs significantly from other consumer goods: It is invisible, untouchable, and only consumed indirectly via related activities, such as working with a computer [3]; [5]; [6].

Standby power use occurs in many modern appliances. These appliances cannot be turned “off” without being unplugged or continue to draw power while not performing their primary purpose. Standby power has become a growing concern in the international community. Studies in Germany [15], Japan [14], the Netherlands [16], and the United States [12], [7] have found that standby power accounts for as much as 10% of national residential electricity use. These studies (and others) have resulted in standby measurements of thousands of appliances, but few measurements of total standby power consumption in individual homes. To our knowledge, the Jyukankyo Research Institute in Japan [12] and ADEME in France [16] have conducted the only studies of whole-house standby power consumption, but the results have not been widely circulated. Whole-house measurements of standby power provide important perspectives on the variation of standby electricity consumption in individual homes and the likely impact of policies is aimed at a reduction.

In the past days, numerous consumers could essentially unplug their appliances and go on vacations, expecting that their power meter would simply stop. Standby power is a force devoured by appliances when turned off or not playing out its essential capacities. Standby power utilization gives great freedom to diminishing both energy utilization and greenhouse gas discharges [18].

In this paper, standby power utilization of different homegrown appliances was resolved to utilize an energy cost meter. The test results show that the standby power of the different household electrical appliances is burning through greater power during standby mode [18].

The significance of protection of standby power for saving the energy burned-through is introduced. The standby power utilization during night mode was featured in. The energy squandered as such is usually alluded to as "standby loss" or "spillage power". The way of life and financial development is simply founded on how much energy is created, used, and energy saved. The vast majority don't know about the way that advanced electrical and electronic appliances, even those having on/off switches, devour power for standby capacities [11]. Another study about “Home Appliance Energy Monitoring and Controlling Based on Power Line Communication”, state that developing a remote monitoring and controlling power (RMCP) has been created with high reasonableness for automatic and power management of home electric appliances. It requires no new design and a benefit of minimal effort, low power utilization, a little volume, and advantageous establishment [9].

“Estimation of Standby Power Consumption provides a good opportunity for reducing both energies consumption and greenhouse gas emissions [18]. They found out that standby power consumption of various domestic appliances is consuming more electricity during standby mode.

Another study of “Power Monitoring and Control for Electric Home Appliances Based on Power Line Communication” stated that electric home appliances can be controlled and

monitored through domestic power lines. By using Power Line Communication (PLC), home power management can be attained to control large- sized electric home appliances [10].

Based on the study “Identifying trends in the use of domestic appliances from household electricity consumption measurements” found out that the mean annual electricity consumption for the households increased significantly by 4.5% ($t=1.9$; $p<0.05$, one-tailed) from the first to the second year of monitoring [2].

New techniques are developed which estimate the electricity consumption of different appliance groups, based on analysis of the five-minutely monitored data. The overall increase in electricity consumption is attributed to a 10.2% increase in the consumption of ‘standby’ appliances (such as televisions and consumer electronics) and a 4.7% increase in the consumption of ‘active’ appliance (such as lighting, kettles and electric showers).

This has led the researcher to embark on this study, in which after the result based on the findings, it will enlighten the end-users on how to properly use each appliance without having billed by our electric bill with so much cost.

Objectives of the Study

The purpose of this study is to assess the power consumption of basic household appliances of residents in Villaba, Leyte as basis for Consumer Awareness Program.

Specifically, it seeks answers to the following inquiries:

1. What is the profile of the respondents as to:
 - 1.1 lifestyle
 - 1.1.1 type of appliances most frequently used?
 - 1.1.2 number of hours of daily used,
 - 1.1.3 maintenance practices?
2. What are the factors that affect the power consumption as to:
 - 2.1 standby power, and
 - 2.2 actual power?

Methodology

The study used the descriptive survey method which was appropriate for data derived from using a questionnaire. A qualitative approach for collecting, analyzing, interpreting, and reporting data was employed. The study assessed the power consumption of basic household appliances as perceived by respondents through a device tool in the form of a prepared questionnaire. Furthermore, with reference to the findings from the assessment, a proposed awareness program was prepared for better and efficient use of appliances of every consumer therein.

The collection of data was done through the use of a researcher questionnaire and informal interviews with the expert. The researcher-made questionnaire is the main tool in gathering and collecting data. Every suggestion was incorporated in the final form by means of validating this with the expert and was consulted to the research panel for final approval.

The respondents of this study were selected from the different households of Villaba, Leyte, Philippines. There are ten (10) husbands, ten (10) wives, five (5) daughters, and three (3) helpers, who responded during the fielding of questionnaires and answered the informal interviews. Table 1 shows the distribution of respondents.

Table 1: Respondents Distribution of the Study

Respondents	Population (N)	Sample (n)	Percentage (%)
Husband	10	4	26.67
Wife	10	6	40
Daughter	5	2	13.33
Helpers	5	3	20
Total	30	15	100

Data Gathering and Analysis

This part contains the logical procedure taken during the gathering of data for the study. Several methods for the treatment of data were also presented along with the corresponding scoring procedures used for analysis and interpretations.

After the preliminary permission requirements had been complied with and corrections had been incorporated in the revision of the questionnaire. After its validation, the fielding of the questionnaires was conducted. It was distributed to the respondents. Questionnaires were documented and labelled properly.

Results and Discussion**Types of Appliances and the most frequently used**

There were eight appliances identified and the most frequently used were also recorded. Table 2 showed the appliances used and their rank.

Table 2: Types of Appliances and the most frequently used

Types of Appliances	Most Frequently Used
TV	9
Flat Iron	1
Electric Fan	6
Refrigerator	9
Air Conditioning Unit	2
Dispenser	1
Washing Machine	2
Rice Cooker	1

Table 2 shows the types of appliances that were commonly used by the respondents. Based on the data gathered, TV and the refrigerator were the most frequently used appliances in the household. It implies that most households utilized TV and refrigerator primarily over any appliances. Hence, choosing TV and refrigerator sets may be considered to minimize power consumption.

Types of appliances and the number of hours used

Each appliance was identified with their number of hours used. Table 3 shows the appliances from Day 1 to Day 9 with their corresponding hours of use.

Table 3: Types of appliances and its number of hours used

Types of Appliances	Number of hours used	Total
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	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	
TV	8	5	2	2	4	5	4	14	3	44
Flat Iron	2		1			1			4	10
Electric Fan	5	8	1		8	5		24		51
Refrigerator	24	24	4		24	5		24		105
Air Conditioning Unit	4					5				9
Water Dispenser						1				1
Washing Machine							1		2	3
Rice Cooker	1								1	2

Table 3 shows the number of hours each appliance is used. Based on the data, the refrigerator is the most utilized in terms of the number of hours for the duration of (9) nine days. It ranks first among other appliances because of its function - that is maintaining the freshness of any refrigerated products. One must consider the wattage of the refrigerator before deciding to acquire it.

Maintenance of Appliances

The mode of maintenance of appliances was identified. They are presented in Table 4.

Table 4: Maintenance of Appliances

Maintenance of Appliances	Frequency	Rank
1. Annually	8	1
2. Quarterly	1	3
3. Monthly	2	2
4. If problem arise	1	3
5. no response	(18)	-

Table 4 shows the maintenance of appliances. The respondents were instructed to choose how often they would have the maintenance of their respective appliances. Data shows that Annual maintenance got the highest score while *monthly* and *if a problem arises* got a score of 1. It shows that the respondents spend less time maintaining the usefulness of their gadgets. Hence, it can be deduced that the respondents are very careful about the usage of their appliances.

Table 5: Factors that affect Power Consumption (actual power)

Factors	Frequency	Rank
1. Low Voltage	1	
2. Power failure	7	1
3. Appliances' Wattage	2	3
4. Usage demand of the appliances	4	2
5. no response	(16)	-

Table 5 shows the factors that affect power consumption. The highest is the power failure. It is noted that appliances plugged in during power failure will likely increase their consumption when power is restored. It is most evident during summer where power shortage occurs, especially in the Philippines.

Table 6: Factors that affect Power Consumption (standby power)

Factors	Frequency	Rank
1. Appliances' standby power consumption	6	1
2. User's end	5	2
3. Appliances' use	3	3
4. No response	(10)	-

Table 6 shows the factors that affect power consumption in terms of standby power. Appliances' standby power consumption ranks first among the factors that affect power consumption (standby power). It signifies that the *Appliances' standby power consumption* is the most significant factor that affects power consumption when the appliance is not in use or in a standby mode.

Conclusion

Expanding the energy utilization mindfulness in each family is a significant step to make the client ready to deal with their energy utilization. The researcher has brought this idea permitting clients to notice the general family utilization as well as every gadget's utilization. In this way, clients can gain proficiency with the energy profile of every gadget and recognize the gadgets that consume the most power at home. Respondents as clients of power consumption ought to think about these things: wattage of appliances, long stretches of utilization, and maintenance of appliances to keep away from high power utilization, and consequently, high cost of the electric bill. With this information, clients are likely to develop better methodologies for saving energy costs.

Recommendations

1. Switch off the gadget when it isn't being used.
 2. Demand to utilize energy effectiveness items.
 3. Promote a program that requires estimation of standby power utilization.
 4. Consistent methodologies, for example, test systems, guidelines and intentional endeavors could likewise decrease expenses in power consumption.
- By observing the above recommendations energy can be saved for the benefit of individual and of the household.

Matrix for Power Conservation

Factors	Solutions
Low Voltage	Employ a voltage regulator on each appliance to regulate voltage inputs.
Power failure	<ol style="list-style-type: none"> 1. Be informative. Always be updated on scheduled power interruptions in your respective areas. 2. Turn off power breakers and switches when there is a power failure. 3. Unplug all appliances if possible when a power failure occurs.
Appliances' Wattage	<ol style="list-style-type: none"> 1. Familiarize the wattage ratings of each appliance. The higher the wattage of the appliance, the more it consumes power. 2. High wattage ratings produce much heat. It may lead you to use a cooling

Factors	Solutions
	device. This will consume power and adds up electricity usage.
Usage demand of the appliances	1. Scheduling the use of an appliance. Never turn on or use more than one appliance at the same time. 2. Be considerate of the appliance's life span. The more it is being used, the more its life span will be shortened.
Appliances' standby power consumption	1. Unplug all appliances when not in use. Once it is unplugged, it will not draw power, thus, no electricity consumption occurs. 2. Familiarize the standby power consumption of each appliance you have at home.
User's end	1. The consumer should be disciplined enough in terms of using each appliance. 2. Knows how and when to use each appliance. 3. Be cautious and responsible enough in handling each appliance at hand. 4. Monitoring monthly his power consumption for remedies of lowering it in succeeding months.
Appliances' use	Scheduling on each appliance usage is highly recommended,
Maintenance practices	1. Always have a regular checkup of all appliances at hand. 2. A well-maintained and regularly checked appliance means a well-performing appliance and thus, it will not easily reach its wear and tear and may contribute to the low power consumption of electricity.

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