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Keywords: *condominium; credit meters; pre-paid meters; electricity bills.*

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Assessing the Efficient Utilization of Electricity by Domestic Consumers in the Agona District

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Keywords: condominium; credit meters; pre-paid meters; electricity bills.

I. Introduction

Electricity supply in Ghana suffered a serious decline as a result of several factors but mainly due to poor inflows for water into the Volta basin, which until then accounted for 95% of Ghana's electricity supply. Industry including the Volta Aluminum Company (VALCO) accounts for the largest consumption of electricity in the country. VALCO alone takes about 59% of total electricity consumption. After the industrial sector has taking 79% of the country's total electricity consumption, the residential, commercial and government sector account for the remaining 21% (Energy Foundation, 1999).

Until recently, Ghana's total energy requirement was produced from hydro generation. This is now complemented by thermal generation and imports. For example, in 1999 Volta River Authority (VRA) produced the total energy requirement of the country with 60% from hydro generation 25% from thermal generation and 15% import from La Cote d'Ivoire (Donkor, 2001).

Though power from hydro plants is relatively cheap to produce, its availability depends on the rainfall pattern, hence the need to diversify supply base from hydro to other bases such as thermal power system. Such an approach could help minimize the effect of decline in electricity generation resulting from drought in the Volta River basin, forcing the power utilities to embark on a power curtailment exercise, which adversely affect the economic growth of the country.

According to VRA (2001), the authority operates a total installed power generation capacity of 1,432MW. This is made up of two hydro-electric plants on the Volta River with installed capacities of 912 MW at Akosombo and 160MW at Kpong, a 30MW diesel plant at Tema, and a 330MW combined cycle thermal power plant at Takoradi.

II. Background to The Study

The annual growth in the demand for electrical energy before 1986 was low as 2%. However, for the period 1986 –1997, Ghana moved into a higher energy consuming bracket with a 10-15% annual demand growth rate. The phenomenal growth in the demand for electricity was mostly due to the economic policies of the 1980's (economic recovery programme and structural adjustment programme) which brought about profound changes – production level of factories going up and new private enterprise opening by the day in every community which need to be connected to the national grid. Also, at the current annual growth rate of 10-15%, the demand for electricity energy is expected to increase to at least seven times (7x) the present level of demand by the year 2020. However, Ghana lacks the energy resources to satisfy the ever-increasing demand, building new power capacity plants is extremely expensive and the need to import fuel to run new thermal plants is also not an attractive option. Report by Donkor (2001) indicated that in 1998, Ghana imported electrical energy from Cote d'Ivoire at much higher cost than is available domestically due to inability to produce sufficient electrical energy.

Research conducted by Energy Foundation (1999) observed that it has been estimated that the level of waste in the use of electrical energy by consumers is over 20%, indicating that consumers waste the entire generation of Kpong hydro power plant. This is due to the use of obsolete equipment, inadequate maintenance on appliances and lack of knowledge about the very steps that can be taken to improve the efficient use of electrical energy.

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a) Statement of the Problem

Electrical energy is one of the pre-requisite for national development. As the government is doing all it can to ensure an uninterrupted power supply for industrial and commercial consumers, there is a need to save energy as much as possible. For example, in March 2003 an increase in electricity tariff in the country saw many domestic consumers paying huge electricity bills; however, consumers are ignorant about how to use electricity efficiently to reduce their energy consumption. As stated by a consumer "why do I consumed so much of electricity and pay so much".

b) Purpose of the Study

The purpose of the study was to assess the efficient utilization of electricity by domestic consumers in the Agona District. Again, to evaluate the benefits derived from judicious use of energy by consumers.

The key issues of the study were therefore to find out;

i. The consumption pattern of electrical appliances.
ii. The availability of energy efficient technology.
iii. The energy saving tips and measures.

c) Research Questions

The research questions that guided the study were as follow:

1. What methods of billing systems are being employ by service providers?
2. How do consumers know that an appliance is energy efficient?
3. What strategies can be put in place to reduce the waste of electricity consumption in the households?

d) Significance of the Study

The study aimed at finding out how energy is dissipated by domestic consumers. It will also help to identify the most suitable practices and measures to put in place to reduce energy in the households. Moreover, it would help erase the erroneous impression consumers have on the staff of ECG as thieves thinking that the huge bills they pay are due to illegal increment of bills. Finally, the study may serve as an operative level for further research into certain aspect of the efficient use of electricity.

III. Methodology

a) Study Area

The Agona District is situated in the eastern portion of the central region with a total land size of 540sq km and a population of about 15,8995(GSS, 2001). The district is bordered on the east by Awutu-Effutu-Senya District; on the west by Asikuma-Odoben-Brakwa District; on the north east by Akim West District; on the north west by Birim South District and to the south by the Gomoa District with Agona Swedru as the district capital. The district has 862 settlements with 11 urban towns; and out of the total settlements, only 15 have been connected to the national electricity grid (AgonaDistrict, 2003). The first public electricity supply in the district commenced in 1947 from a diesel generating plant and in 1967 when the hydro plant at Akosombo became operational, the power station was linked to the national electricity grid of VRA (http://www.-ecgonline.info/index.php/organisation/about-us. Retrieved February 1, 2002.).

b) Research Design

A descriptive research design of the survey type was adopted for this study.

i. *Population and Sampling Procedure*

The target population for this study was all the domestic consumers of electricity in the Agona District of the Central Region. The sample for the study was limited to five (5) towns in the district. Purposive random sampling method was used to select the towns; these included Swedru, Nyakrom, Kwanyako, Nsaba and Duakwa. Twenty (20) respondents from each of the towns were randomly selected.

c) Instrumentation

The data collection instrument included questionnaire, interview and observation schedules. The questionnaire was administered by the researcher to the respondents and the return rate was 95%.For the interview section, the researcher posed the questions and the responses given were written in a note book. Finding from observations were also recorded.

d) Data Analysis

Frequencies and simple percentages were used to analyze the data of the study. A narrative summary including direct quotes was made to further explain the data.

IV. Results

a) Research Question 1

This section ascertains the billing systems employed on the consumers by the service providers. The result in table 1 shows that more than half 66 (69%) of the respondents live in the compound houses while 29 (21%) live in bungalows.

Table 1 : Type of dwellings

Type	Frequency	Percentage %
Compound house (rooms)	66	69.0
Flat/Apartment	29	21.0
Total	**95**	**100.0**

Source: Field Data, 2003

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The data in table 2 records that all 95(100%) of the respondents consume energy from credit meters with no respondent calibrates with prepaid meter.

Table 2 : Method of billing systems

Method	Frequency	Percentage %
Credit meter	95	100.0
Prepaid meter	-	-
Total	95	100.0

Source: Field Data, 2003

The statistics in figure 1 illustrate that 16% of consumers monitor their meter readings daily, 32% check their consumptions weekly, 42% monitor consumptions monthly while10% never check their energy consumption pattern.

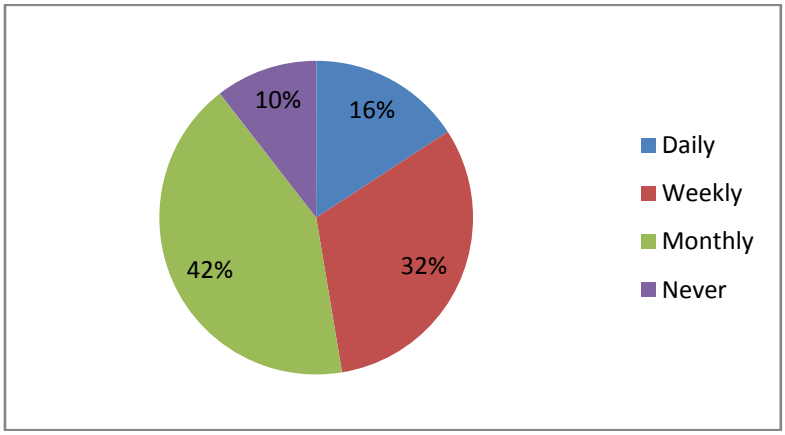

Figure 1 : Monitoring of Energy Consumption

Source: Field Data, 2003

The data in table 3 indicates that only 10 (11%) of the respondents fall within the 0-50 kWh consumption brackets while 40 (42%) and 45 (47%) consumers fall within the 51-300 kWh bracket and300+ kWh bracket, respectively.

Table 3 : Energy consumption bracket of consumers

Consumption bracket (kWh)	Frequency	Percentage %
0 – 50kWh	10	11.0
51 – 300kWh	40	42.0
300+ kWh	45	47.0
Total	95	100.0

Source: Field Data, 2003

The information in figure 2 shows that majority 80 (84%) of the respondents pay their own bills while 15 (16%) of the consumption borne by their employers.

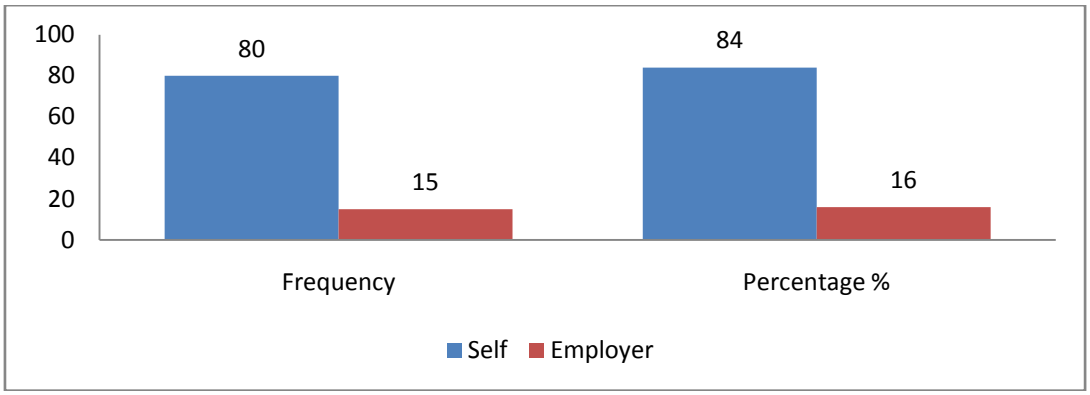

Figure 2 : Mode of Payment of Electricity Bills

Source: Field Data, 2003

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The result in table 4 postulates that majority 80 (84%) of the respondents share bills according to the number of points with 10 (11%) and five (5%) share tariff according to number of rooms and size of the households, respectively.

Table 4 : Method of sharing electricity bills

Method	Frequency	Percentage %
No. of point(s)	80	84.0
No. of room(s)	10	11.0
Size of household(s)	5	5.0
Total	**95**	**100.0**

Source: Field Data, 2003

The information in table 5 records that almost all 85 (89%) of the respondents submit that they do not know their appliance energy consumptions with only 10 (11%) indicate that they do know their appliance ratings.

Table 5 : Knowledge of consumption rate of household appliances

Response	Frequency	Percentage %
Yes	85	89.0
No	10	11.0
Total	**95**	**100.0**

Source: Field Data, 2003

b) Research Question 2

This section finds out some of the energy efficient technologies and practices being use by domestic consumers. The data in table 6 shows that majority 80 (84%) of consumers strongly agree that energy efficient technologies be made accessible to consumers as well as the purchase of energy efficient appliances while few15 (16%) opposed to the assertions. All 95 (100%) of the respondents strongly agree that electrical appliance importers and manufacturers conformed to energy efficient standards and codes. About three-fifth 65 (68%) of the population strongly affirmed that second hand electrical appliances consume more electrical energy than the modern type as compare to 30 (32%) who disagree to the response. More than three-forth 80 (84%) of respondents strongly agreed that television sets must be put off when nobody is watching with only 15 (16%) opposing the assertion. All 95 (100%) of consumers strongly agree that lights should be put off when not in use. More than half 60 (63%) of the respondents strongly disagree that the doors to refrigerators be opened frequently while 35 (37%) agree to the statement. The data also shows that all 95 (100%) of consumers strongly agree that consumption rates in the households must be monitored.

Table 6 : Energy efficient technology and practices

S/N	Statements	Responses			
		SA/A		SD/D	
		Freq.	%	Freq.	%
1	Energy efficient technologies should be made accessible to consumers	80	84	15	16
2	It is good to purchase energy efficient appliances	80	84	15	16
3	Electrical appliance importers and manufacturers should conform to energy efficient standards and codes	95	100	-	-
4	Second hand electrical appliance consumes more energy	65	68	30	32
5	Television should be put off when nobody is watching	80	84	15	16
6	Light should be put off when not in use	95	100	-	-
7	Refrigerator doors should be opened frequently	35	37	60	63
8	It is important to monitor how electricity is use in the households	95	100	-	-

SA= Strongly Agree, A= Agree, SD= Strongly Disagree, D= Disagree
Source: Field Data, 2003

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c) *Research Question 3*

This section finds out the strategies which can be put in place to minimize waste of electricity in the households.

The study in table 7 shows that one-third 20 (21%) of the respondents do iron their clothes daily while 40 (42%) iron their clothes twice in a week with 35 (37%) iron their clothes once in a week.

Table 7 : Rate of ironing clothes

Rate	Frequency	Percentage %
Daily	20	21.0
Twice weekly	40	42.0
Weekly	35	37.0
Total	**95**	**100.0**

Source: Field Data, 2003

The result in table 8 records that less than one-third 25 (26%) of the respondents defrost their refrigerators weekly; more than half 30 (32%) and 35 (37%) defrost their refrigerators monthly and quarterly, respectively, however, only five (5%) do not defrost the apartment at all.

Table 8 : Rate of defrosting refrigerators

Rate	Frequency	Percentage %
Weekly	25	26.0
Monthly	30	32.0
Quarterly	35	37.0
Never	5	5.0
Total	**95**	**100.0**

Source: Field Data, 2003

The statistics in figure 3 suggest that less than quarter 15 (16%) and 35 (37%) of the consumers use 25W and 40W incandescent bulbs lavatories respectively, while 40 (42%) and five (5%) use the 40W and 100W incandescent bulbs respectively.

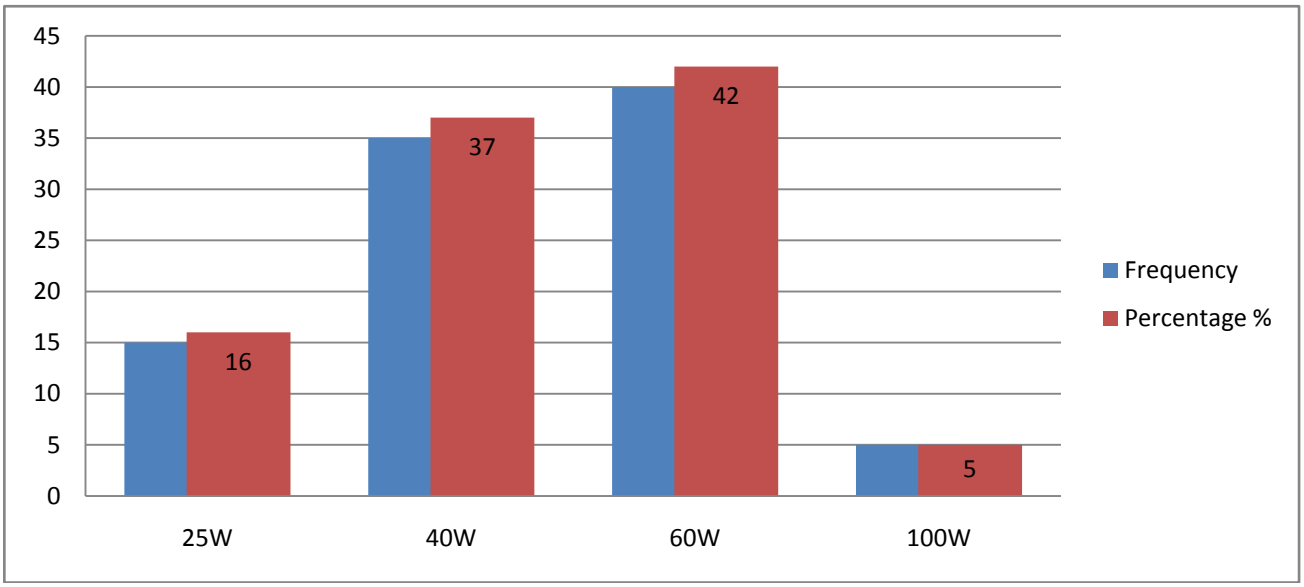

Figure 3 : Type of Incandescent Bulbs Use in Lavatories

Source: Field Data, 2003

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The data in table 9 shows that out of the 700 lamps indicated by consumers, more than two-thirds 550 (79%) use incandescent lamps, 100 (14%) use fluorescent lamps with only 50 (7%) using compact fluorescent lamps (CFLs) for lighting.

Table 9 : Type and number of lamps in the households

Lamp	Quantity	Percentage %
Incandescent	550	79.0
Fluorescent	100	14.0
CFL	50	7.0
Total	**95**	**100.0**

Source: Field Data, 2003

V. Discussion

The study revealed that most compound houses have been bridged to a central bulk meters which tend to force condominium electricity users into high consumption bracket, hence end up paying huge amount of electricity bills. Under such circumstances, consumers who feel that they pay more than they consume deliberately waste energy. Also, some consumers may waste energy since they know that others will pay for the waste. However, when consumers only pay for what they use they tend to be more conservative and every resident become an active participant in energy management of the condominium or institution (ECG, 2002: February; Schwaller and Gilberti, 1996).The finding confirms the assertion made by ECG (2002: August), Donkor (2001) and Energy Foundation (n.d) that lack of individual electricity meters to monitor the exact amount of electricity used by consumers encourages waste. The research added that though the progressive tariff structure could discourage waste by the rich, however it could also be a burden for consumers sharing common meters. This is because a condominium with a number of families may have a higher meter reading causing them to pay more per unit of electricity consumed. This presupposes that if each household in condominium is provided with separate credit meters, preferably pre-paid meters instead of central credit meters, consumption can be monitored and reduced, thereby conserving energy waste (VRA, 2003; 2002; ECG, 2002: June; Energy Commission, 1999).

The study further revealed that old equipment and appliances waste energy. This confirms report by Donkor (2001) and ECG (2002: July) that modern equipment such as lighting systems, air conditioners, refrigerators, cookers, washing machines and heating systems reduce energy consumption by 20% compared with standard ones. The study added that compact fluorescent lamps consume less energy and last longer as compared to the incandescent lamps of the same wattage. The research proved that currently no energy efficient standards and label codes laws to ensure that only energy efficient technologies are imported and sold in the country (Energy Foundation, n.d). This situation has led to the dumping of inefficient and obsolete technologies on the Ghanaian market and almost all the used appliances such as air conditioners, refrigerators and motors imported into the country are inefficient in every use and have been condemned in their country of origin therefore their high use has contributed to excess consumption of energy in the country.

The study also shows that consumers have little or no knowledge about some common energy conservation tips. This buttresses research conducted by Donkor (2001) and ECG (2003: January) that practicing simple conservation tips could have a significant effect in the residential and commercial facilities to reduce energy consumption in the area of audio-visual appliances, lighting, refrigeration and heating systems.

VI. Conclusions

Evidence from the study indicates that majority of households in the condominium are using central credit meters instead of separate credit meters or the pre-paid meters. Feedbacks from respondents suggested that lack of access to energy efficient technologies have contributed to the waste of electricity, hence, the need to use modern efficient appliances and the enforcement of energy efficient codes and standards on end-use products. It was emerged from the study that consumers have little or no knowledge about some basic energy conservation tips.

References Références Referencias

1. Agona District (2003). *Profile of Agona District* (June-August ed). Newsletter.1 (1), 2.
2. Donkor, F. (2001). *Energy Technology*: TEC 235 (Lecture notes), Kumasi, Ghana: UEW, Department of Technology Education.
3. Electricity Company of Ghana (2003).*Conserving electricity* (January ed). Newsletter. 44 (142), 5.
4. Electricity Company of Ghana (2002). *Billing meters* (August ed). Newsletter. 39 (137), 3.

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5. Electricity Company of Ghana (2002). *Energy efficient campaign* (June ed). Newsletter.37 (135), 1.
6. Electricity Company of Ghana (2002). *Strategies for effective revenue and debt management* (February ed). Newsletter. 33 (131), 1.
7. Energy Commission (1999). *Development of energy efficiency standards and label codes.* A paper presented at the National Forum on Energy Efficiency. January 27 – 28.
8. Energy Foundation (1999). *National forum on energy efficiency.* Accra: Ministry of Energy.
9. Energy Foundation (n.d). *Energy wise: Easy tips to reduce electricity consumption and save money*. Accra: Ministry of Energy, Ghana.
10. GSS (2001). 2000 population and housing census report. Accra: Ghana Statistical Service. Available: http:// www.ecgonline.info/index.php/organisation/-about-us(February 1, 2002)
11. Schwaller, A.E. and Gilberti, A.F. (1996). *Energy technology* (2nd ed).London: International Thomson Publishing.
12. Volta River Authority (2001). *40 years of powering Ghana's development*. 40 years Anniversary programme. November 2-December 8.Accra: VRA Printing Unit
13. Volta River Authority (2002). *Voltabuy* (February ed). Accra: VRA Printing Unit.
14. Volta River Authority (2003). *Voltabuy* (March ed). Accra: VRA Printing Unit.

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