



# Development and Energy in Africa (DEA)

Case Study

Impact of electrification (by grid extension) on selected  
rural communities of Ghana

Prepared by



OCTOBER, 2006.

## TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	1
Overview.....	1
Background.....	2
<b>Case Study Framework</b> .....	4
<b>Approach</b> .....	6
<b>Research Plan</b> .....	6
<b>Field Methodology</b> .....	9
<b>Results and implications</b> .....	13
Description of Communities.....	13
Indicator Based Results.....	15
<b>Conclusions and Recommendations</b> .....	24
Achieving goals of the National Electrification Scheme (NES).....	24
Adequacy of the Assessment Framework.....	26
<b>Appendix 1 -- References</b> .....	27
<b>Appendix 2</b> .....	28
<b>Appendix 3 -- Questionnaires</b> .....	32

*The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.*

## INTRODUCTION

### *Overview*

This report showcases the findings and discussions of a Case Study carried out in the EKUMFI–OTABANADZE, EKUMFI–EKRAWFO and EKUMFI–ATAKWA communities of the central region of Ghana in August 2006. The aim of the study was to investigate the impacts of rural electrification by grid extension on the social, economic and other aspects of the lives of the people. Guided by the seven key sectors of focus in the country's Growth and Poverty Reduction Action Plan II (GPRS II) the study further examined the impacts of electrification on Agriculture, Small and Medium Enterprise (SMEs), Health, Education, Water, Communication, and Household sectors of the communities.

The National Electrification Scheme (NES) was instituted in 1989 as the Government of Ghana's principal instrument to achieve its policy of extending the reach of electricity to all parts of the country over a thirty-year period from 1990 – 2020. The importance of the NES was seen in the fact that at the beginning of the NES, only about 15% of the total population of Ghana had access to electricity supply. However, for the rural population who from more than 70% of the country's population, access to electricity was only 5%. The goals and objectives of the NES are targeted towards:

1. Poverty reduction, especially in the rural areas;
2. Increasing the overall socio-economic development of the nation;
3. Increasing people's standard of living, especially those in the rural areas;
4. Creating small-to-medium-scale industries in rural areas;
5. Enhancing activities in other sectors of the economy, such as agriculture, health, education, tourism, etc;
6. Creating jobs in the rural areas and thus reducing the rate of rural to urban migration.

Sixteen years down the line however there is growing evidence that not all the objectives have been achieved although through the NES access to electricity nationwide has risen to 54% as at 2005. The case study, findings of which are highlighted in this document, examined the impact of the electrification on seven selected sectors of the communities.

## ***Background***

The Development and Energy in Africa (DEA) is a 30-month long project funded by the European Commission under its Intelligent Energy - Europe (IEE) COOPENER Programme and co-financed by the Danish Government. The project is being implemented by Risoe National Laboratory of Denmark, the project coordinator, and in collaboration with Energy Center of Netherlands (ECN) in partnership with six African centers. The Kumasi Institute of Technology and Environment is the project partner in Ghana.

The principal aims of the DEA project are:

1. To identify and examine the developmental impacts of energy interventions linked to improving energy access and poverty alleviation.
2. To use the information and insights gained to improve on-going and future energy interventions by energy policymakers and institutions in six Sub-Saharan African countries: Botswana, Ghana, Mali, Senegal, Tanzania and Zambia.

The project is being implemented in three stages. In the first stage, information was obtained through three parallel Work Packages that facilitated and formed the basis for the development of an Assessment Framework, specifically for evaluating the impacts of energy innovations on sustainable development. The three parallel activities are:

- (i) A literature survey
- (ii) A cataloguing of experience with relevant energy projects and innovations in the target countries
- (iii) A process of consultation with stakeholders in the respective countries.

In the second stage, the Assessment Framework itself will be developed, then tested through national Case Studies and refined. Finally, in the third phase, the Assessment Framework will be presented to policy makers and stakeholders in the six countries and eventually introduced further in the region and other developing countries.

The key output of the DEA is an Assessment Framework which will be an operational tool for policy makers and other stakeholders to integrate the complex linkages between energy interventions and socio-economic development into poverty reduction programs. The tool will allow energy interventions to be

better designed to contribute to real development needs, especially poverty alleviation and income generation, and to achieving the millennium development goals.

## Case Study Framework

The Assessment Framework (AF) is a step-by-step approach to carrying out an impact assessment of a given energy intervention. It is an operational tool for policy makers and other stakeholders to integrate the complex linkages between energy interventions and socio-economic development into poverty reduction programs. The AF encompasses the choice of indicators, the causal chain, data collection methods, data analysis techniques, and the optimal presentation of information among stakeholders. This tool, developed under the DEA project was used throughout the planning and implementation of the case study from the causal chain analysis through the analysis of data and results.

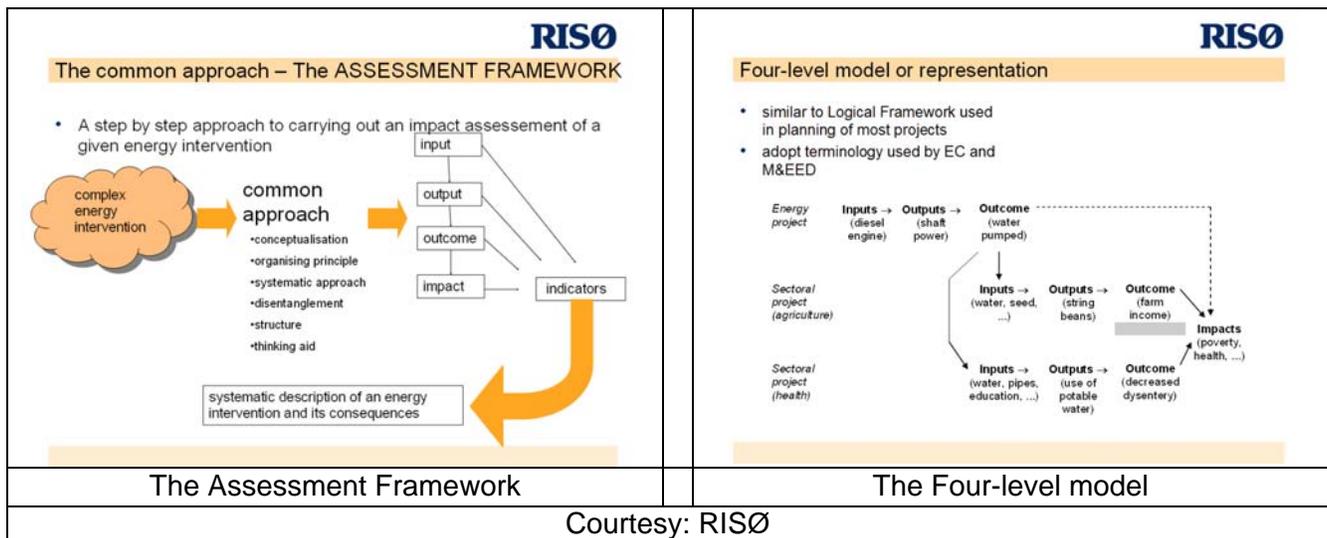


Figure 1 – The Assessment Framework and the Four-level model

In using the four-level model to construct the causal chain, the communities were split into seven sectors at the OUTPUT level. The seven sectors are Water, Health, Education, Communication, SMEs, Households and Agriculture. The OUTCOMES and IMPACTS were then assessed based on this segregation and presented in each case being specific to the sector under consideration. The outcomes and impacts were examined without any biases on consideration for only the positive outcomes/impacts but other issues which have negative implications were also considered. The resulting causal chain is as presented below.

# THE CAUSAL CHAIN

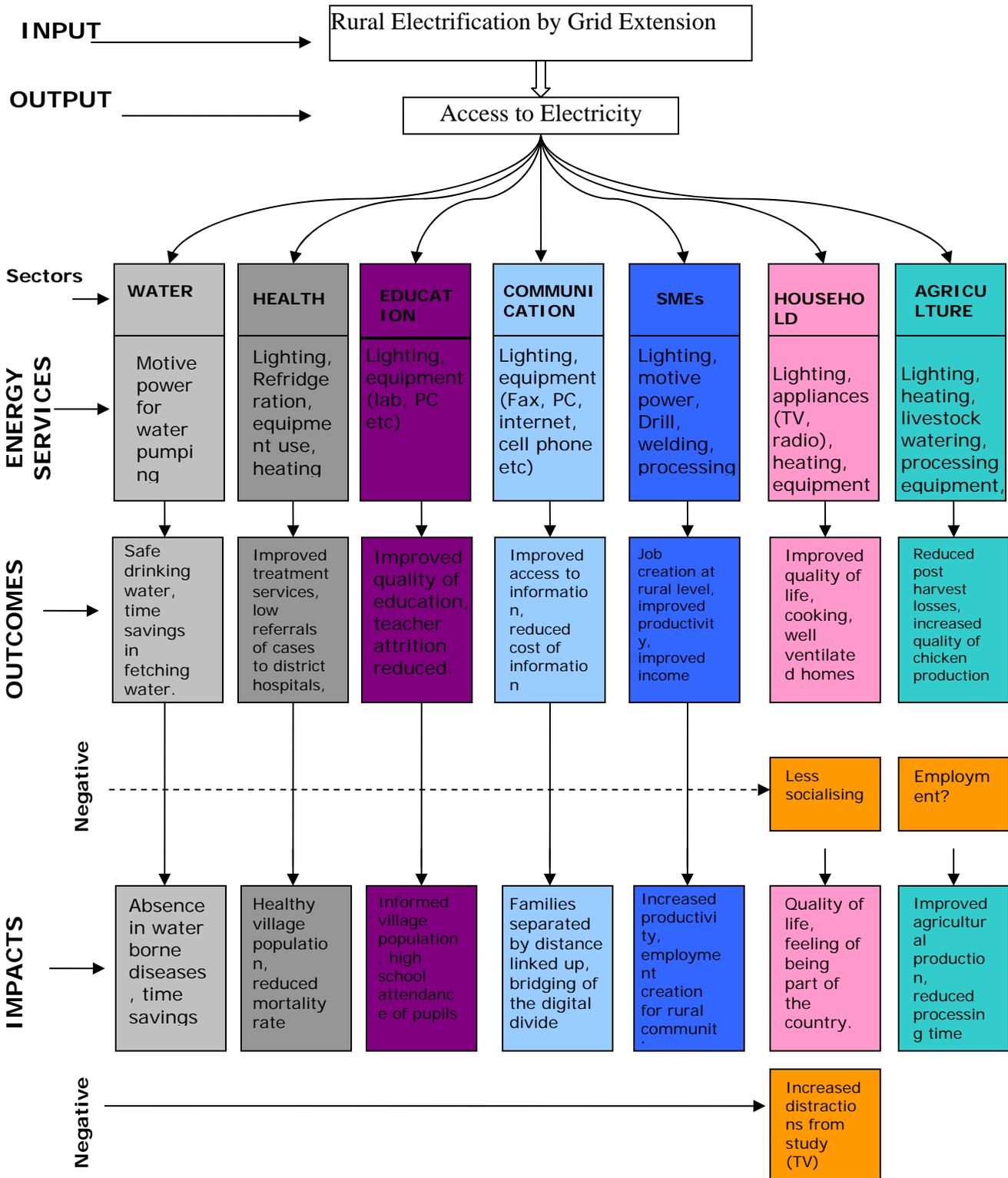


Figure 2 -- The causal chain developed using the Four-level model

## Approach

Data has been collected through questionnaires, which targeted the three communities. Using the “Fringilla Approach<sup>1</sup>”, the communities were divided into seven sub-sectors viz WATER, HEALTH, EDUCATION, COMMUNICATION, HOUSEHOLD, SMALL AND MEDIUM ENTERPRISES, and AGRICULTURE. Questionnaires were developed based on tailored needs/indicators of the various sectors. In all the following threefold methods were used:

1. Questionnaires – questionnaires were developed with the indicators and what to measure etc. Data from the field study was collated and analysed for direct and derived conclusions. The questionnaires can be found in *Appendix 3*.
2. Close and personal observations of respondents and facilities within the communities, and
3. Desk study from different reports such as the Achievements of the National Electrification Scheme (NES), and Internet.

Using the Casual chain, the Indicator Table which uses the “Elements in the causal chain” (Input, Output, Outcome, Impacts) to determine a) What to Measure b) Indicators c) Units d) Source and e) Data Collection Method was developed and used to design the research plan. *See the Indicator Table in Appendix 2.*

## Research Plan

Guided by the What-When-Who tool, the broad research plan was designed as follows:

*Table 1 –Research Plan*

	WHAT	WHEN	WHO	REMARKS
PREPARATION	Finish draft questionnaires	July, 11th	SQ	share questionnaires with EECG
	Receive comments and finalise quests.	July, 13th	SQ	
	Follow-up on arrangements for study	July, 14	SQ/	follow-up on arrangements for research
	Recruit AP and RA	July,	SQ	AP done (Albert Berkoh), RA to be done
	prepare for FG	July, 17/18	SQ/AB	
	Elaborate DC Plan	July, 19 - 21	SQ/AB	
□	Desk study	late July/Aug-	SQ	continued

<sup>1</sup> The Fringilla Approach sometimes called the Fringilla Process is the approach developed by the representatives from all the five countries participating in the DEA project

		ongoing		exercise
	Interviews	late Jul-Aug	RA	
	FG	Aug	AB	
	HH surveys	Aug	RA	
	observation	Aug	RA/AB/SQ	done same time as interviews
	Doc Prel Results	Sept	SQ	feedback to Risø and ECN
	Update Stakeholders on Prel results	sept/oct	SQ	
<b>ANALYSIS AND REPORTING</b>	Data analysis	Sept	AB/SQ	
	Report writing	Sept	SQ	waiting for format
	Discussing draft report	Sept	SQ/stakeholders/GM etc	
	Finalising report	Sept/oct	SQ	
	communicating results	Oct	SQ/stakeholders/GM etc	national workshop to be coordinated
	RP- Research Plan			
	Q- questionnaire			
	RA- Research Assistant			
	FG- focus group			
	DC- data collection			
	Doc- document			
	Prel- Preliminary			
	HH- Households			
	cont- continued			
	SQ- Solomon Quansah			
	GM etc- Gordon Mackenzie and Risoe/ECN teaTP			
	AB- Albert Berkoh			
	RA-Research Assistants			

Table 2 Research Plan Guide

SOURCE	METHOD	SAMPLE SIZE	RESPONDENT	RESOURCES	DURATION-DAYS
Villagers	interviews	40-50	affluent	1P+ 3 RA	10
			female headed households		
	focus groups	10	female	IP +AP+ 3RA	1
		10	males	IP +AP+ 3RA	1
		20	combined	IP +AP+ 3RA	1
School	interviews	1	headmaster	1P+AP	0.5
		5	selected teachers	1P+AP	0.5
		20	selected pupils	1P+AP	1
	records		results		collect same time as visits
			attendance		
Clinic	interviews	1	Matron/head	1P+AP	0.5
		2	nurses	1P+AP	0.5
		10	patients	AP+RA	1

SOURCE	METHOD	SAMPLE SIZE	RESPONDENT	RESOURCES	DURATION-DAYS
	records		patient records/volumes	1P+RA	
	observation		equipment	P+AP+RA	same time as interviews
Communication Centre	interviews		Operator	1P+AP	1
			other staff	1P+AP	
			Users	RA	
	records			1P+RA	collect same time as visits
	observation			1P+AP+RA	same time as interviews
Businesses	interviews	1	Owners	P	1
		2 to 5	workers	1P+AP+RA	
	observation			P+AP+RA	same time as interviews
Utilities	water		billing section	P	1
	electricity		billing section	P	1
farmers	interviews	1	owner	P+RA	1
		2 to 5	workers	RA	
	data processing			AP	5
	analysis			AP	12
	Report writing			P+AP	5
<b>total</b>					<b>44</b>
AP- assistant researcher					
RA- Research Assistant					

## Field Methodology

Using a tradition-sensitive approach, the research team on arrival at the communities firstly approached the Assemblyman and briefed him on the mission and the purpose of the visit/project and its importance. The Assemblyman, then, as tradition-demands gave a prior notice to the chiefs of the three communities through the Unit Committee members. He then led the research team to the chiefs to formally inform them about the project and the assistance that the team required from them. The chiefs then paved the way for the research activities and then dispatched the village 'gong-gong' beater<sup>2</sup> to announce and gather the inhabitants for the focus group discussions.



A sophisticated gong-gong beater (using a megaphone instead of a gong-gong) announcing our arrival and the start of the focus group discussion. This advancement was exhibited in one of the three communities.

<sup>2</sup> Gong-gong beater is a local traditional messenger responsible for calling the people and calling for people to gather.

**Tradition-Sensitivity:** In the traditional African setting, any 'stranger' visiting a village to meet any person or having a mission to accomplish in the village must firstly meet with the chief/opinion leaders to present himself/herself. This visit must usually be accompanied by the presentation of alcoholic drinks and 'cola'. This is based on a traditional saying which literally translates that "No one goes to the palace without gifts". This is very important in such villages where traditional practices are still key in the social governance structure. Doing this as any research team literally opens the door for access to the village and creates the environment for receiving all the needed cooperation and assistance from the people.

**Men and Women Only Focus Discussions** -- It is traditionally incorrect to meet with the wives/women before you meet with the men. This will completely be affront to the men and will not work in the favour of any research person going to any village for research or information gathering purposes. This in itself serves to intimidate the women for fear of being reprimanded by the husbands after your meeting and will eventually lead to poor information release. They will literally be scared to give you information. It must be borne in mind that these communities are generally male dominated and the research team used this approach just to ensure success of the research with gender-insensitivity.

*Focus Group Discussions (FGD)* – In all the three communities, the FGD preceded all the other individual one-on-one interactions and questionnaire administration. This was also to ensure that prior to visiting individuals in their households they would have had knowledge of the research activity as well as shorten the time spent explaining the process to every individual at the household level.



*Collective FGD (male and female)* – A general observation made during the collective FGD was that all the women either gathered and sat behind the men or grouped themselves in a different area away from the men. The women were initially not forth-coming with answers/contributions until after being pushed by the men to do so. Even then only a few were bold enough to come out with answers and contributions. This further enforced the research team’s initial plan to have separate FGDs for men and women after the collective one.

*Men only FGD first* – This discussion was more or less business as usual with the men boldly expressing their views on the impact of electrification on their communities.

*Women only FGD*– When the women gathered alone, there was a complete change in their attitude from a previously ‘timid’ position in the presence of their men to a vibrant and aggressive one. It was a little ‘chaotic’ trying to ‘control’ them with many of them eager to express their views and answer questions. Intuitively, one of them took the position of a leader and controlled/decided who raised up their hands to answer a question or contribute.

Both the men and women groups were in agreement on the positive impacts of electricity on their communities. They were quick to say that they had a better sense of security and safety (snake-bites have reduced dramatically), improved access to the world and staying abreast with worldwide developments through radio and television, reduced incidences of eye illnesses due to good lighting.

*Household visits* – After the FGDs, the research team went over to the households to administer questionnaires on individual bases. This further enabled people to freely give their impressions on the impact of electricity both on the communities and their households. A strong observation made here was that because the people had the impression that every household would be interviewed almost all the inhabitants had gone back to their households to wait for the research team. Thus unknown to the research team a number of households had abandoned their chores to wait at home for the team. The negative effect of this was that, by close of the day, people from households that were not interviewed were disappointed.



*Household one-on-one interview*



*A teacher being interviewed*

*SMEs* – the communities generally lacked many businesses. The few businesses sited in the communities included general ‘provision shops<sup>3</sup>’, drinking bars, Hair Salons, and food-vending points.



*A female owned SME -- Pottery*

<sup>3</sup>Provision Shops are local shops that sell household confectionaries and mostly household consumables.

*Education (Schools)* – Although all the communities had schools up to the Junior Secondary level, the schools were on vacations at the time of the research so there were no official visits to the schools. Interviews were conducted with teachers who are resident in the communities as well as school children that were available.

*Health (Clinics)* – all the three communities did not have health posts/clinics located within the communities. The third community, Ekrawfo had a clinic located about 100 meters away. This clinic is privately owned and was established about 4 years after the extension of grid electricity to the community.

## Results and implications

### *Description of Communities*

#### **COMMUNITY 1 -- EKUMFI OTABANADZE**

Key village information: Ekumfi Otabanadze is a community of about 1000 people with 1 Kindergarten, 1 Primary School, 1 Junior Secondary School and drinks borehole water. The community has no well defined market place, no rural bank, and no post office. *Real access in the community is about 75%.* Highlights of information gathered from the Focus Group Discussion are as follows:

- Electrification wiring type is the single phase type. This the people believe has not helped in developing businesses.
- Predominant Occupation is peasant farming, there is however a pottery which used to employ over a 100 people but is now employing just a handful
- Youth are migrating to other societies in search of greener pastures.
- Need structures for teachers that are posted to the community.
- Town was very dark and people didn't know things like iced water, fridge etc
- Frequency of snake bites reduced in the community since electrification.
- Difficulty in acquiring meters ( institutions should check on a periodic bases and help acquire the meters because people need them).
- Community members pay 1,500,000 for meters but even with that one needs to be near an electric pole.
- Residents have planted about 2 acres of trees used as electric poles.
- Community paid for the meters but no payment for the electrification project.
- Poultry industry – had 100 workers (ratio 75% females/25%males) but without electricity now left with just 1 person.
- Cost of wiring average 55,000 – 250,000

#### **The Electrification Process**

*Personnel* from the Electricity Company of Ghana contacted the chief and unit committee members and informed them about an upcoming electrification. The unit committee members then asked all members of the community to wire their households within a grace period of a month.

*The ECG* itself contracted a company to undertake the electrification but the community contributed by way of communal labour.

#### **Community Requests**

*The ECG* should collect the bill themselves instead of asking consumers to go to the nearest district office to pay because it costs too much to do that.

*Unfair* cost of getting extending electricity to houses (same as in the cities) is not good for rural communities. There should be special provisions made for rural dwellers.

*A group* planted about 2 acres of electric poles to be used for electrification based on promises received but do not know what to do with them now

*Those* who did not wire their households before electrification now have to go through a tough process to get connected. This trend must be changed

#### **Interesting perceptions**

*The meter* readers for the Electricity Company of Ghana do not read the meters correctly and therefore provide them with the wrong bills.

*Single phase* cannot power even the smallest of a corn mill. Community members do not know that there are single phase motors that can be used to power corn mills.

## COMMUNITY 2 – EKUMFI ATAKWA

Key village information: Ekumfi Atakwa is a community of about 1000 people with 1 Kindergarten, 1 Primary School, 1 Junior Secondary School and drinks borehole water. The community has no well defined market place, no rural bank, and no post office. *Real access in this community is about 40%.* Highlights of information gathered from the Focus Group Discussion are as follows:

- Has single phase transformer – not suitable for SME's
- Not happy with power outages
- Takes too long for ECG to repair problems
- Few poles available, makes it impossible for new houses to have electricity

## COMMUNITY 3 – EKUMFI EKRAWFO

Key village information: Ekumfi Ekrawfo is a community of about 1700 people with 1 Kindergarten, 1 Primary School, 1 Junior Secondary School and drinks borehole water but has pipe borne water which is not very reliable. The community has a well defined market place, no rural bank, and a post office. There is a private clinic which is about 100 meters away from the community. *Real access in this community is about 75%.* Highlights of information gathered from the Focus Group Discussion are as follows:

- Wiring here is 3 phase type.
- Now children go to the classroom to study
- There is increased security
- Increased economic activities – number of beer bars have increased
- Street light percentage is 45%
- Expectations were to have more SME's
- Number of SME's low because of lack of capital
- Disadvantages of light – frequent power outages, damage of equipment, ECG must notify them before power outages
- School meters are considered as commercial – leading to high bills
- Electricity encourages people to come to villages when they are transferred, because of light now teachers come over when they are transferred.

### Problem encountered in Electrification process

Someone took advantage of the people by posing as a government official who could arrange to get their communities electrified. He then asked them to contribute various sums of money after which he absconded. Of the three communities this particular community had low access at the household level because some of the people were more cautious when the real officials contacted them for the electrification process and were in some cases unwilling to make any payments again. This accounts for the 40% access in this particular community.

### The Electrification Process for Ekrawfo

The chief and his elders came together and formed a committee of 8 who were sent to the headquarters of the ECG to meet with the director to petition him for the electrification. Individuals were then asked to wire their households. The Community provided communal labour and food for the ECG workers.

### Interesting findings

The ECG has a local representative who on specific days sits on a table at the market place, an announcement is then made for all to go and make payments of their bills with that representative thus preventing people from having to travel a long distance to make such payments.

### Irony

Although this community has the 3 phase wiring (which in the view of the members of the other communities is needed for businesses to be established) it still lacked businesses.

## Indicator Based Results

Using the indicators identified in the Indicator Table (*Appendix 2*), data from the case study was analysed with reference to the various sectors of the community. Results are interpreted as follows:

### HOUSEHOLD SECTOR

*Access to Electricity:* -- Two of the three communities registered about 70% of the households as connected to the electricity. At the time of electrification all the two communities had just about 55% percent access but over the period after the electrification more and more households are getting connected to the grid which led to an increase in the access rates to 70%. The continued supply of electricity to the households depends largely on the ability of the households to pay for the service. The measures taken by the Electricity Company of Ghana in ensuring that few households default in the payment has resulted in the ratio of households with access to households that are paying for the service being close to 1:1.

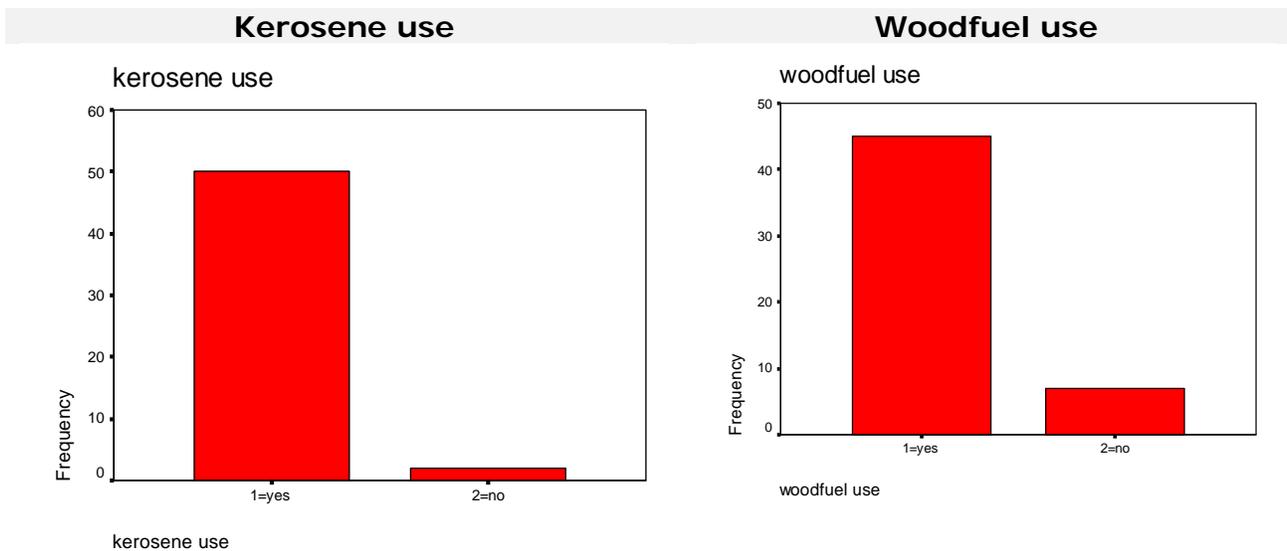
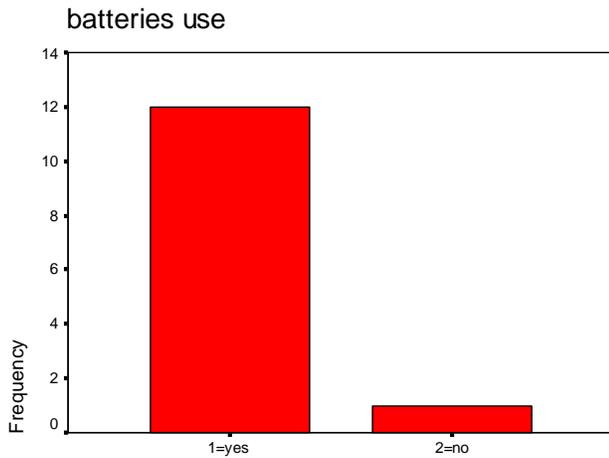


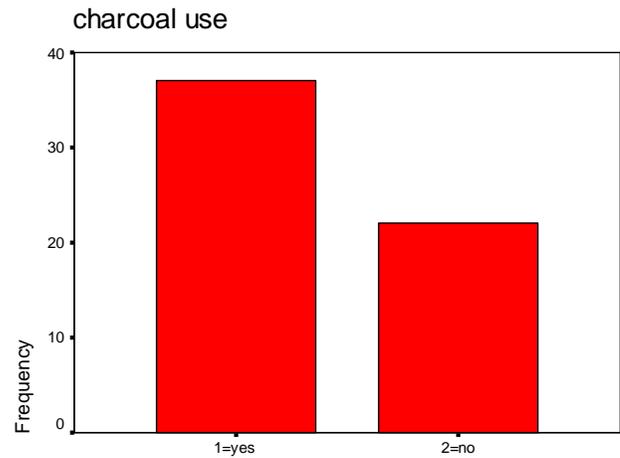
Figure 3 –Distribution for kerosene and woodfuel use

## Battery use



batteries use

## Charcoal use



charcoal use

Figure 4 – Distribution for battery and charcoal use

*Use of Modern Electrical Appliances:* -- Against the baseline of the lack of electricity, there were few households that had access to modern electrical appliances. The commonly used appliance was Portable Radio Sets. These were powered by dry-cell batteries. About 95% percent of households had at least one portable radio. Of the three communities only one household had a 'black and white' television set powered by car batteries prior to the electrification and was only used on Sunday evenings. Electrification has led to an avalanche of modern household electrical appliances in all three communities. The gamut of appliances include Television sets, Radio-cassette recorders, Refrigerators, Fans, Blenders, Lighting bulbs, Pressing Iron, Water Heaters, Video cassette players and CD players. All electrified households had a number of these appliances

*Employment Creation:* -- The electrification process itself did not create employment for local people. The reason for this is that the contractor for the project was based in the city and all workers were recruited from the city and put on the project. However, the communities provided free communal labour for the reasons that 1) it was a way of helping the contractors expedite the electrification process and 2) it is generally a cultural practice to be hospitable to 'strangers' and they demonstrated this by helping the 'strangers—in this case the contractors' with the clearing of places for siting of poles, digging of holes for poles and providing food for the workers.

There were divergent views on incidence of direct employment creation as a result of electrification. Respondents from the two communities with the Single Phase wiring were of the view that electrification had not led to the creation of direct employments in the communities. This they attributed to the inability of the Single Phase Wiring to provide adequate power for motive equipments that are needed for most SMEs. Contrary to the research team's expectations, the situation was no different from the community with the full Three Phase Wiring. Respondents here also complained bitterly about the lack of jobs in the

community and were quick to say that electricity had not led to the direct job creation. The reason they assigned for this shortfall however, was the lack of capital for business startups as well as the low market size for businesses hence businesses that were started had to fold up.

*Household Income:* -- A higher percentage of respondents indicated that they had experienced a general increase in their household incomes. This they attributed to households' ability to augment the traditional means of income generation with such activities as the sale of 'iced' water and other frozen items by use of their refrigerators.

*Energy Types and Use:* -- Energy types considered included electricity, kerosene, candles, firewood, charcoal, batteries (dry-cell). Electricity was mainly used for lighting and occasionally used for water heating purposes. 85% of respondents still used kerosene as fuel for cooking and occasionally lighting in the event of power outages. Candle use was virtually non-existent with only about 5 % alluding to its use and reason is safety (fire risk). Close to equivalent number of kerosene users used firewood as well charcoal for cooking with 76% and 63% respectively. 93% used batteries (dry-cell) and respondents indicated that these are used for torches (during power outages), portable radios (which serve as accompaniments to the farms). 45% were of the view that electricity had greatly reduced their expenditure on energy

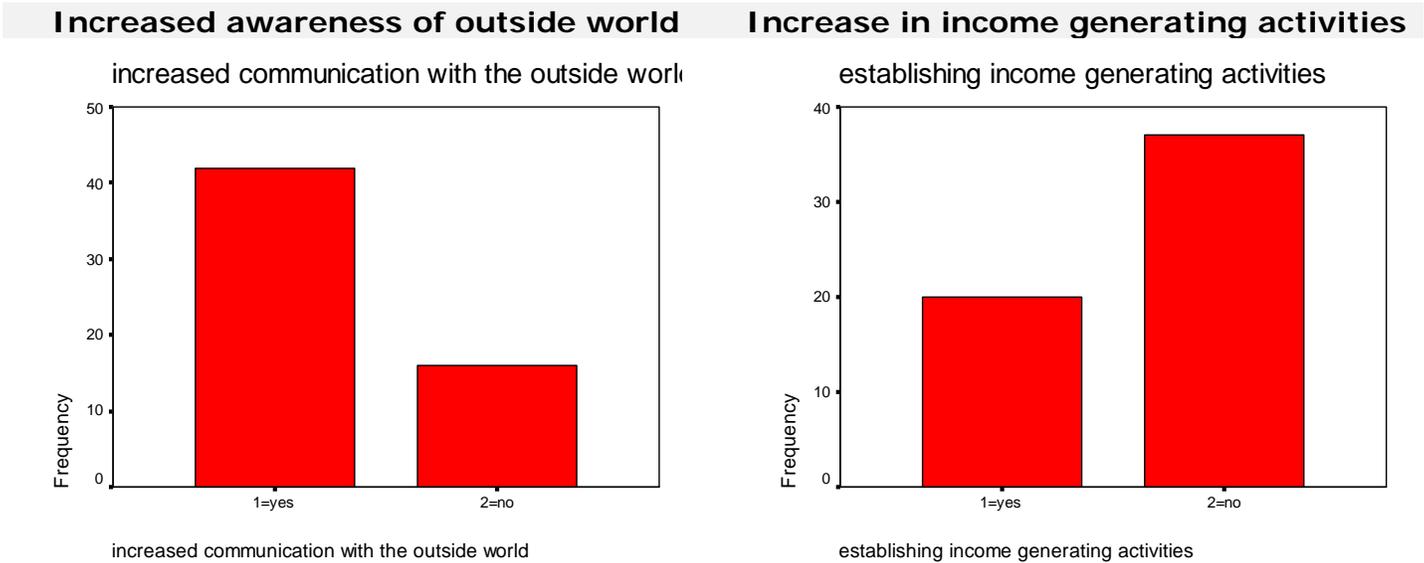
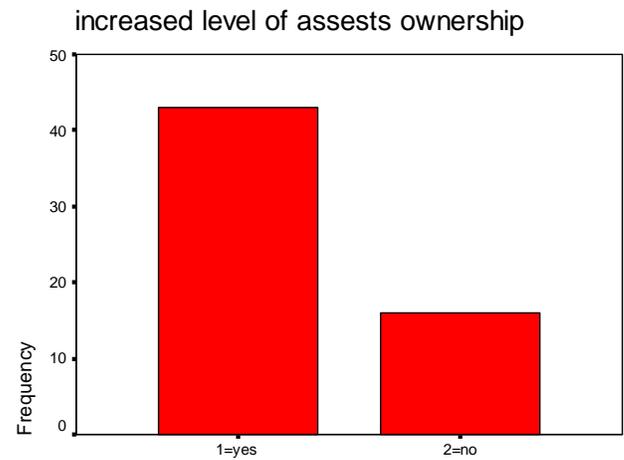
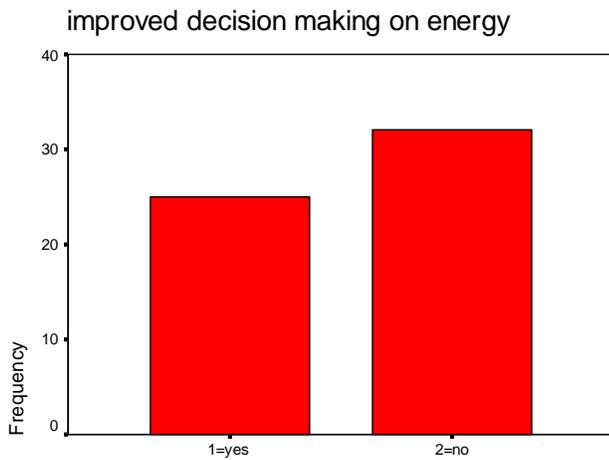


Figure 5 – Distribution of increase in communication with outside world and establishing income generating activities

*Assets ownership (electrical appliances):* -- Against the baseline of no electricity, there was an appreciable increase in assets ownership with for example an increase in the number of television sets from 1 (pre-electrification) to about 25% ownership. 25% had owned refrigerators, 20% pressing irons, 44% sound systems (ghetto blasters)

### Improved decision making on energy

### Increase in assets ownership



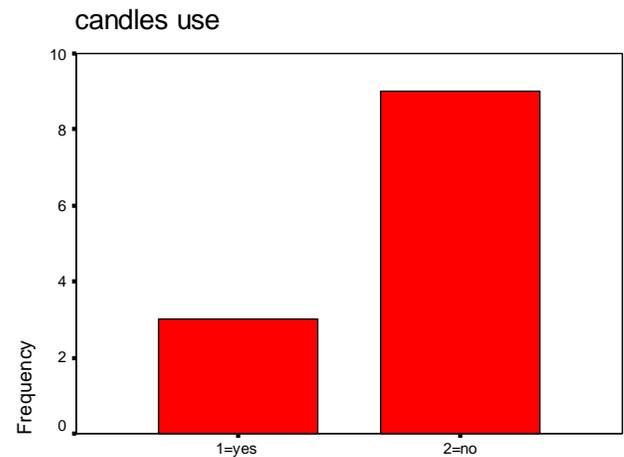
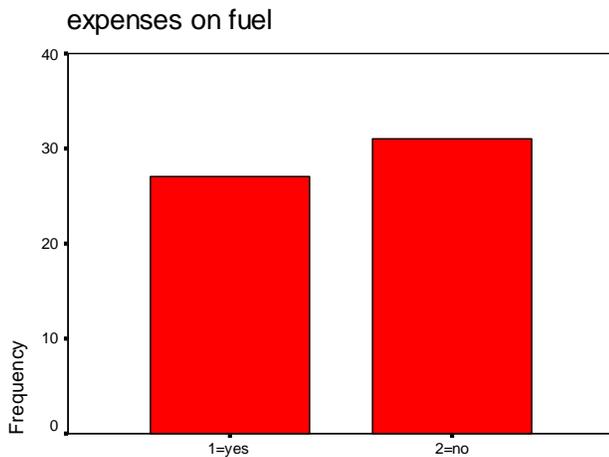
improved decision making on energy

increased level of assets ownership

*Figure 6 – Distribution of improved decision making on energy and increased level of assets ownership*

### Increase in expenses on fuel

### Use of Candles

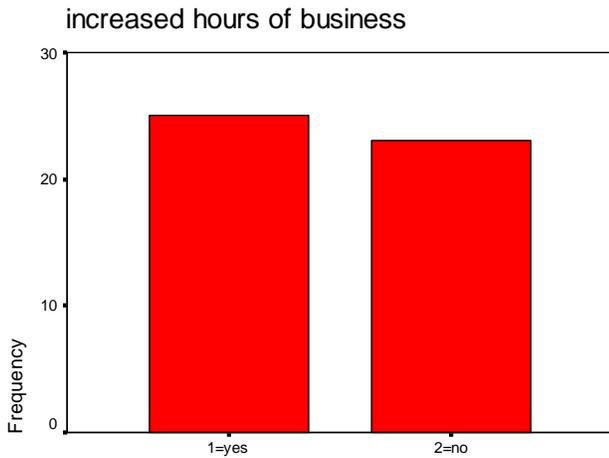


expenses on fuel

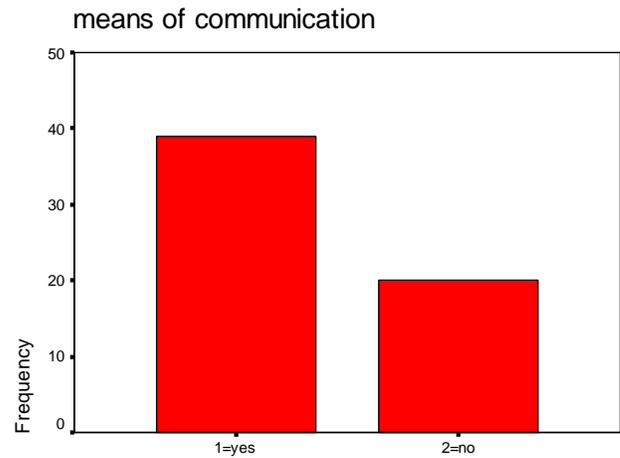
candle use

*Figure 7 – Distribution of increased expenses on fuel and use of candles*

### Increase in hours of business



### Increase in means of communication



increased hours of business

means of communication

Figure 8 -- Distribution of increased hours of business and means of communication

### HEALTH SECTOR

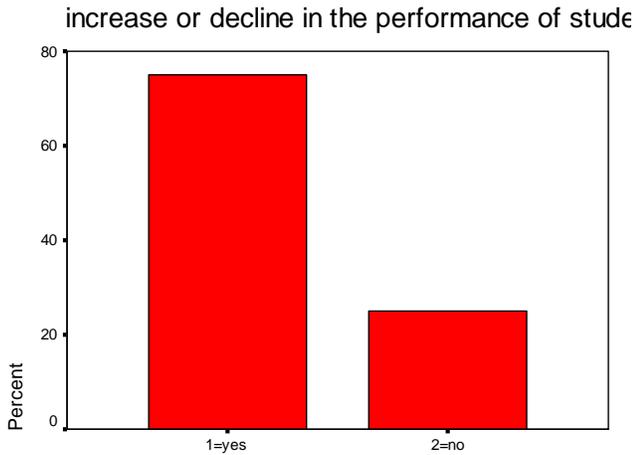
Respondents were quick to point out that the use of electricity for lighting had help in reducing health risks such as eye illnesses and respiratory diseases. Through listening in to health programmes on the radios and watching health discussions on the television they are better informed on health matters and there is a general increase in awareness of health issues. Only one of the communities had a private clinic sited close to it and this was even established after electrification and therefore could not provide data on pre-electrification health cases. The nearest hospital is 45 minutes from the clinic. Data provided for six months is as shown below:

General	3,902
ANC	606
Deliveries	133
Family Planning	97

### EDUCATION SECTOR

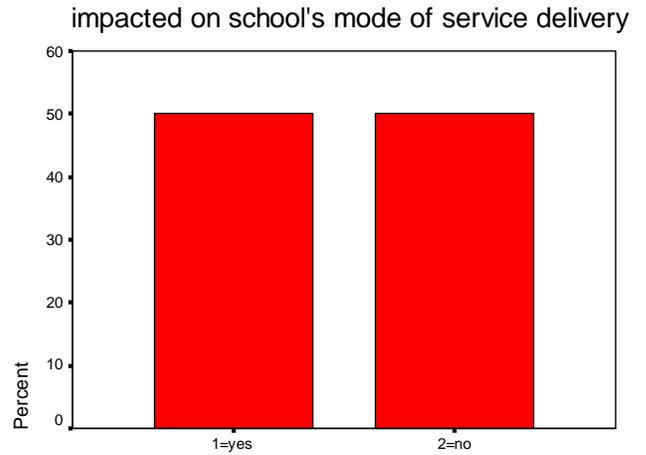
All the three towns had schools up to the Junior Secondary level. The closest Senior Secondary School is about 10 minutes from the communities. At the time of the research, the schools were not in session so actual visits to the school premises was not conducted. Interviews were conducted with about 5 teachers who were available. Concerning the impact of electricity on education, there was a split situation between those who thought electrification had increased or decreased school enrollment however, 75% of respondents indicated that the general performance of pupils had risen to higher heights. This is because the school buildings had been wired and were opened for evening classes for all pupils with close supervision by the teachers.

### Increase in performance of students



increase or decline in the performance of students

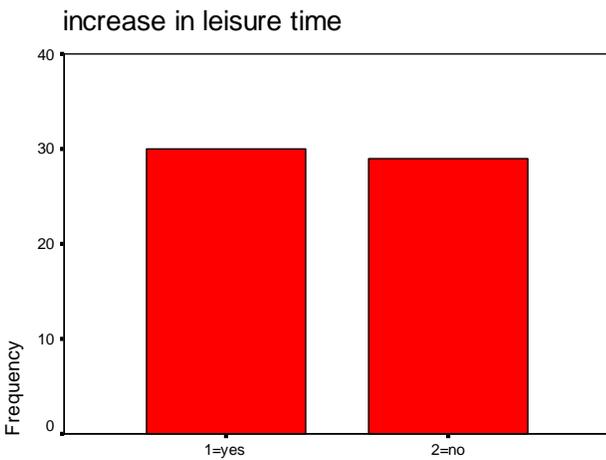
### Impact on schools' service delivery



impacted on school's mode of service delivery

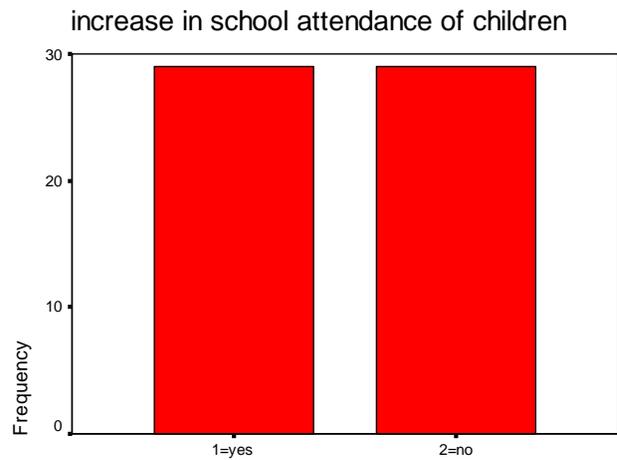
Figure 9 -- Distribution of increase in performance of student and impact on schools mode of service delivery

### Increase in leisure time



increase in leisure time

### Increase in school attendance



increase in school attendance of children

Figure 10—Distribution of increase in leisure time and increase in school attendance of children

Staff attrition, they indicated had reduced because the availability of electricity in the communities makes them attractive to teachers who are posted to such areas. This has also positively impacted on the quality of teachers in those communities. It was however noted that electricity had its negative impact of creating alternatives to studying thus some of the children engage in social vices.

## **COMMUNICATION SECTOR**

Respondents indicated that there were individuals who were operating table-top communication centers. These were fixed mobile equipment operated on table tops were inhabitants place and receive calls. Electrification has also led to many people in the communities owning mobile/cellular phones. Communities are now very open to the outside world since residents are in touch with family and friends nationally and internationally. Communication has also helped them in saving on the cost of transportation to and from other places just to deliver messages etc. 40% of respondents owned mobile phones. There is however the general perception that everyone in the community has a phone number on which he/she can be reach. This premise is built on the fact that the communication centers' phone numbers serve as phone numbers for the non-phone owning residents, thus any person can be reach on that phone. All the caller needs to do is to mention the name of the person she/he is calling. The increase in the number of mobile phone is a direct impact of the grid electrification.

## **WATER SECTOR**

All three communities depended on boreholes as the source of drinking water and water for other purpose. These boreholes are not fitted with motorized pumps therefore do not need electricity and a number of them are sited at vantage points in the communities thus making them easily accessible. There is therefore no direct linkage with electricity.

## **SMALL AND MEDIUM ENTERPRISES**

As indicated earlier, two of the communities that had the single phase wiring had the perception that because many heavy duty electrical equipment were the three phase type they could not purchase them for businesses that was the reason for the lack of many businesses in the communities. The irony however was that in the community that had the full three phase wiring there were equally few electricity using businesses and they attributed the general lack of capital for business start-ups as well as the not so developed market in the community. It was therefore obvious that the communities that were clamouring for three phase wiring so as to have businesses established were either living a dream world when the very next door community had what they were clamouring for and still lacked businesses. The lesson here is that to have as gains some of the direct impacts of electricity, development planners would have to look beyond just the provision of electricity and assess the other factors that are necessary to drive development.

The three communities collectively had six businesses namely Photo-studio, Mini market (provision shop), Terrazzo works shop, Hair salon, food-vending spots, and pottery. The provision shop, hair salon and pottery existed before electrification and had still not moved away from the traditional ways of operation. They were therefore not directly using electricity in their operations however, they all indicated that access to electricity had enabled them to extent working ours so as to work even at night thus boosting their production or service delivery. This has had the trickling effect of making more financial gains from the businesses and in some cases increase in the number of employees. The photo studio had benefited immensely from the electrification since all his

activities depended on electricity and will probably not have set up the business if there was no access to electricity. He uses electricity for developing his films. The terrazzo shop also depended on electricity and was only established after electrification extension to the communities. The businesses indicated that they are providing a wider range of service as against their counterparts in other communities that do not have access to electricity. They are more conscious of providing quality service because people are more enlighten lately and would demand higher quality service delivery and products. The quality of services has also engendered the increase in patronage of products and services.

### AGRICULTURE

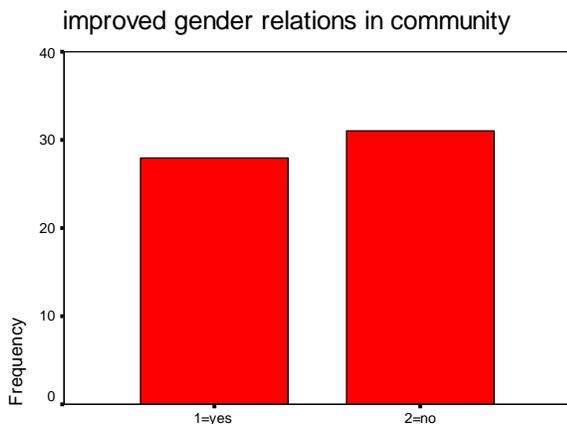
There were no large scale farmers in the communities. No farm-gates had electricity for processing hence electrification had not had any direct impact on agriculture in the communities.

### OTHER SOCIAL IMPACTS

*Social knowledge equity:* -- respondents in all the communities indicated that they were more knowledgeable now than they were before electrification because electrification indirectly gave them access to radios and television sets and other means of staying in touch with the outside world. Through listening in to educative radio programs and watching television programs there is a general increase in knowledge of people in the communities. They are more abreast with current trends in the world, they are well informed on national issues as well as global events through access to many community oriented radios which broadcast programs in local languages.

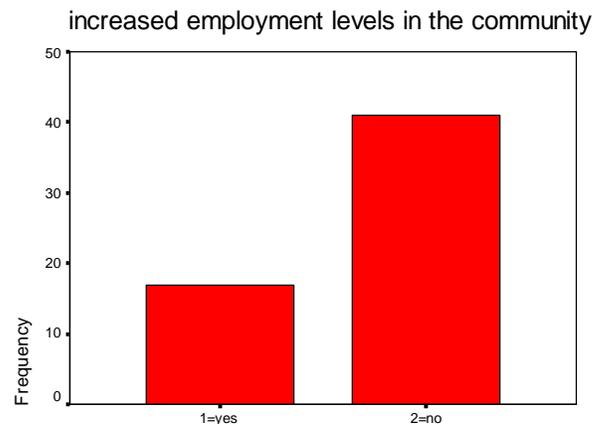
*Increased collective socializing* – respondents contended that there is an increase in many collective social activities such as funerals, parties etc. Availability of electricity has indirectly led to the general extension of such activities beyond the times that they used to be. Such programs go deep into the night because of good lighting.

Improvement in Gender Relations



improved gender relations in community

Improvement in employment profile



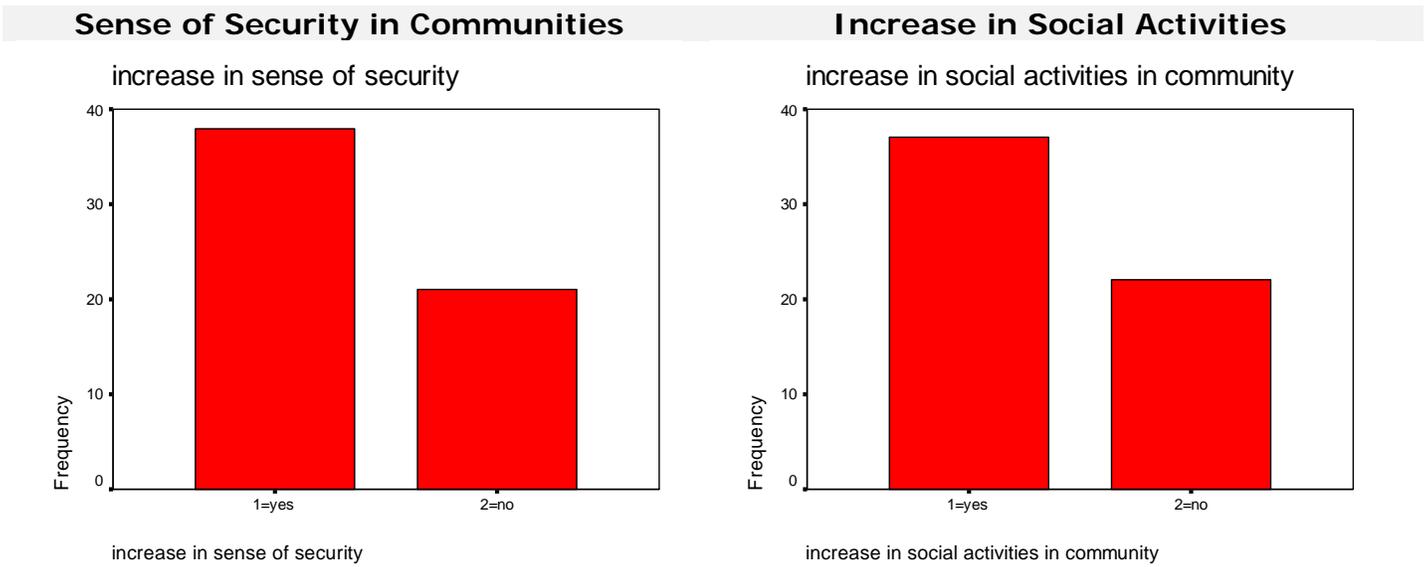
increased employment levels in the community

Figure 11 -- Distribution of improved gender relations and increased employment levels

*Alternatives to bedtime entertainment* – prior to electrification communities' bedtime were very earlier in the evening and people had no choice than to use sex as the only means of entertainment. This had the rippling effect of many unplanned childbirths. The advent of electricity has provided alternatives for entertainment as well as enlightenment and has had appreciable effect on the number of unplanned childbirths.

*Expansion of communities* – respondents perception is that access to electricity has had the effect of reducing rural to urban migration since their communities were gradually expanding instead of diminishing. This is because some inhabitants who would have built their house elsewhere are now building in their own communities. With an increase in the number of housing facilities and the number of people willing to stay in the communities there is general rippling effect reducing rural to urban migration and therefore the expansion or at least the maintenance of community sizes.

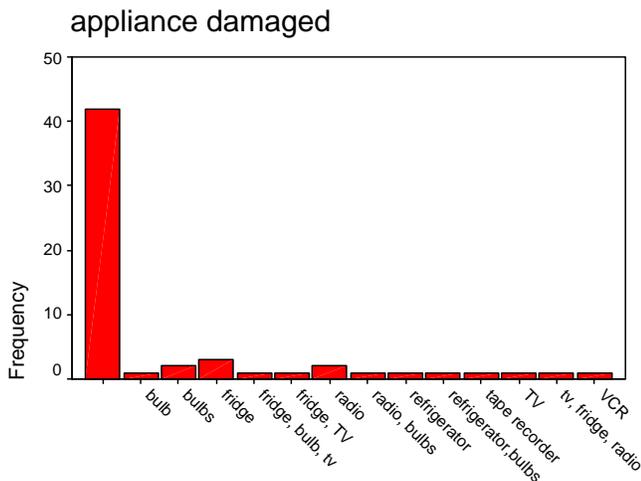
*Increased gender sensitivity* – respondents said that there is more awareness of gender issues through radio and television programmes and there is a gradual shift from being a less gender sensitive community to a more gender sensitive one.



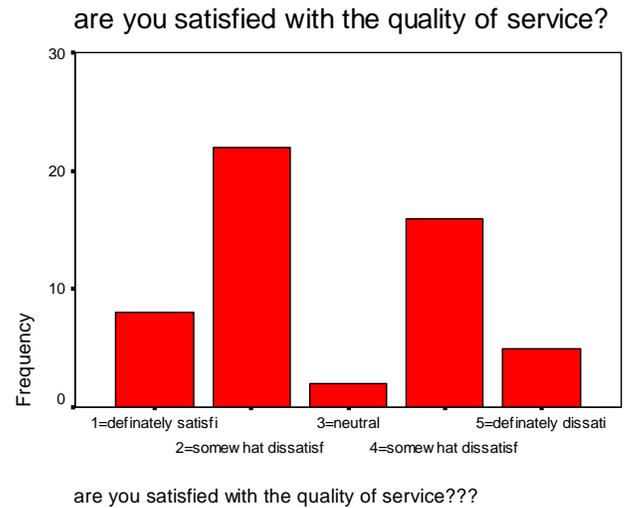
*Figure 12 -- Distribution of increase in sense of security and increase in social activities in community*

*Satisfaction with electricity service delivery* – there was a general strong sense of dissatisfaction with the service delivery by the Electricity Company of Ghana. This stemmed from the frequent unannounced power outages, frequent damaging of electrical appliances by power hikes, poor and customer unfriendly bill collection and disconnection by the Electricity Company of Ghana.

## Power hikes leading to equipment damage



## Satisfaction with Service Delivery



appliance damaged

Figure 13 – Distribution of equipment damage and satisfaction with service delivery

## Conclusions and Recommendations

### *Achieving goals of the National Electrification Scheme (NES)*

Generally, the communities examined under the case study have had some socio-economic gains as result of the NES. There is however an attribution gap in a number of the indicators examined since the communities cannot directly link the changes they have experienced to the electrification. In some case however, some were of the view that there have been negative impacts and outcomes as a result of electrification.

Cross-examining the NES's goals in the light of the study's findings we have the following conclusions:

#### *Goal 1 -- Poverty reduction, especially in the rural areas*

Direct poverty reduction could not firmly be established because all the communities were quick to indicate that they were experiencing great hardships and did not consider themselves richer than they used to be. The increasing costs of living (increase in fuel prices with the corresponding increase in prices of goods and transportation without an appreciable increase in employment opportunities in these communities) have in a number of cases further impoverished the people. To curb this trend, more needs to be done in the areas of employment creation in the rural areas and providing subsidized/special services such as special transport fares etc.

#### *Goal 2 -- Increasing the overall socio-economic development of the nation*

There is an increase in knowledge in the rural communities as a result of increased means of being in touch with the outside world. Communities are gradually becoming gender-sensitive through education on the radios and television. Rural dwellers are becoming more and more aware of their rights and responsibilities as a result. Electrification has led to an increase in assets ownership such as Television sets, refrigerators etc.

*Goal 3 -- Increasing people's standard of living, especially those in the rural areas*

Electrification has impacted positively on the living standards in some respect. There is an increased sense of security and safety in the communities. Respondents said that snake bites for instance had dropped drastically. There are increased social activities at night due to lighting. Electrification alongside the provision of other amenities such as potable water (borehole) has improved living standards in the communities.

*Goal 4 -- Creating small-to-medium-scale industries (SMEs) in rural areas*

Creation of small-to-medium-scale industries had not happened in the communities examined. This in the view of the communities was due to the inadequacy of the electric energy provided by the type of electrification. In the community that had adequate electric energy the number of small-to-medium-scale enterprises had not increased. Other factors for creating SMEs such as availability of capital, well developed marketing systems, were generally unavailable and in cases where available they are not accessible to the rural populace due to the strict and unfriendly conditions attached. It is recommended that in order to achieve this goal, innovative financing schemes and loans should be made available to rural communities and help should be provided to enable business startups. Adequate education should be carried out in the communities on the suitability of Single phase wiring for small-scale businesses if the right single-phase motive machinery is used. In situations where the capital for single phase machinery is not available assistance should be provided by way of innovative loans.

*Goal 5 -- Enhancing activities in other sectors of the economy, such as agriculture, health, education, tourism, etc;*

Some of the sectors had experienced positive impacts as a result of electrification however others had had no direct positive impacts. The water sector for instance had no direct positive impacts, no large-scale farming activities were recorded hence no direct impact on the agricultural sector. Education on the other hand had seen some improvements, through the provision of lights in the classrooms for instance children study at night under the supervision of teachers. Teacher attrition had reduced as a result. Electrification without the provision of corresponding health facilities does not engender improvements in the health of rural dwellers hence their absence in the communities. This was clearly evident in the communities as the only community which had a private clinic and maternity had been serviced by the clinic. The clinic has been the first port of call to provide first aid in some cases complete treatments. Since the establishment of the clinic there has not been a record of maternal death in the communities. Thus there is the need to establish health centers alongside providing electricity to help realize goal 5.

*Goal 6 -- Creating jobs in the rural areas and thus reducing the rate of rural to urban migration have been partly achieved*

Job creation is on a descent. The general lack of SMEs had led to the lack of jobs and the inherent migration of the youth from these communities.

### ***Adequacy of the Assessment Framework***

The tools provided by the Assessment Framework (AF) were used in the case study right through the conception to the reporting stage. The causal chain provided an easy-to-read and easy-to-think-through process of identifying all the relevant areas of the communities that need studied. The AF, guided by the four-level-approach (input, output, outcome, impact) was instrumental in guiding the filling of the Indicator Table. The Indicator Table on the other hand provided invaluable leads on 'what to measure', indicators, units, source and data collection methods. This was very useful in developing a good research plan to carry out a budget case study research. The AF is therefore an invaluable tool for carrying out research especially in developing countries.

The AF is adequate for pre-research planning, however researchers would have to know the peculiar needs and requirements of the type of research that is to be carried out and adapt the framework to suit their purposes. Another key issue is the need to have local knowledge on the approach to research methodologies in the targets communities. The lack of prior knowledge on appropriate methods (such as traditional governance structure, gender relations etc in the communities) will have disastrous consequences not only to the particular research team in question but will also create a negative impression about researchers in the minds of the target communities.

## Appendix 1 -- Reference

1. Ministry of Energy (MoE), 2005: The Achievements of the National Electrification Scheme (NES)

## Appendix 2

Elements in causal chain	What to measure	Indicators	Unit	Source	Data collection methods
Output	Increased access to electricity	Total no rural households connected	Connections & %	Utility records	Interview/desk study
Output	Increased access to electricity	No of rural households using electricity in 2006	Rural households	Utility bills	Survey
Output	Increased access to electricity	No of households paying for service	Rural households	Utility bills	Interview/desk study
Outcome	Increased use of modern electricity appliances	No of appliances using electricity per household	Appliances	Households	Survey
Outcome	Increased use of modern electricity appliances	Types of appliances per end use	N/A	Households	Survey
Outcome	Increased use of modern electricity appliances	Hours or frequency of use of appliances	Hours or none	Households	Interview
Outcome	Increased use of modern electricity appliances	Capacity/wattage of appliances	KW/kwh	Households/utility bills	Survey/interview/desk study
Outcome	Increased use of modern electricity appliances	Bills paid	\$	Utility bills	
Outcome	Reduced Consumption of paraffin/candles	Volume of fuel purchased before and after electrification	Liter/week	Households/shops	Interview

Elements in causal chain	What to measure	Indicators	Unit	Source	Data collection methods
Outcome	Reduced Consumption of paraffin/candles	Fuel expenses	# candles	Households	Survey
Outcome	Reduced Consumption of paraffin/candles	Fuel expenses	\$	Households	Survey
Outcome	Reduced Consumption of paraffin/candles	Fuel expenses	\$	Households	Interview/desk study
Outcome	Direct Job Creation on electrification	No of locally recruited employees during electrification	Employees	Rural electrification contractors/households	Interview/survey/desk study
Impact	Reduced Air Pollution	Reduced respiratory/eye illnesses in village electrified vs nonelectrified households	Numbers	Clinic records	Observation
Impact	Reduced Air Pollution	Indoor quality	Smoke free	Houses/huts	Interviews/surveys/desk study
Impact	Better Quality Education	School results before & after electrification	Grades	Schools/households	Interviews, survey, desk study,
Impact	Better Quality Education	Staff turnover or retention	New staff	Schools/households	Interviews, survey, desk study,
Impact	Better Quality Education	Quality of teachers	Qualifications	Schools/households	Interviews, survey, desk study,
Impact	Better Quality Education	Quality of teachers	Electricity ICT appliances	Schools/households	Interviews, survey, desk study,
Impact	Awareness on health issues	Community ICT equipment	Village programmes	Schools/households	Interviews, survey, desk study,

Elements in causal chain	What to measure	Indicators	Unit	Source	Data collection methods
Impact	Awareness on health issues	Health education programmes	Terminology	Schools/households	Interviews, survey, desk study,
Impact	Awareness on health issues	Knowledge of villagers	?	?	Interviews/surveys, observation, desk study
Impact	Reduced income poverty	Increased employed people in village	Employment status	Households/business entities	Survey
Impact	Reduced income poverty	New businesses using electricity in village	Business status	Households/ business entities/ utility records	Village authorities
Impact	Reduced income poverty	Household income	\$/household	Households	Survey
Impact	Reduced income poverty	Household income	Hours	Business owners/h/hs	Desk study
Impact	Reduced income poverty	Household income	Nos/increases/sales	Business owners/	Survey
Impact	Better Buisness Opportunity-through extended light	Household income	Sales \$	?	Survey/interviews
Impact	Better Buisness Opportunity-through extended light	Length of operation before & after electrification	?	H/hs	Interviews
Impact	Better Buisness Opportunity-through extended light	Patronage	Count	Schools	Interviews
Impact	Better Buisness Opportunity-through extended light	Quality of products served	Numbers	Households	Interviews

Elements in causal chain	What to measure	Indicators	Unit	Source	Data collection methods
Impact	Better Buisness Opportunity-through extended light	Range of products served	Numbers	Households	Interviews
Impact	Gender Needs met	Boys/girls attending school	Numbers	Households	Surveys/observations
Impact	Gender Needs met	Boys/girls fetching fuel	Numbers	Households	Survey/desk study
Impact	Gender Needs met	Male/female owning electrified businesses			
Impact	Gender Needs met	Malefemale headed households electrified			
Impact	Gender Needs met	Male/female h/hs lighting with electricity			

## Appendix 3 -- Questionnaires

Questionnaires were developed for the various sectors that were examined under the case study but only that for the Household sector has been attached here just for information purposes.

### DEVELOPMENT AND ENERGY IN AFRICA RURAL ELECTRIFICATION BY GRID ELECTRIFICATION QUESTIONNAIRE FOR HOUSEHOLD SECTOR

#### INTERVIEW DETAILS

Name of Enumerator.....Questionnaire Number.....

Name of respondent ..... Age of respondent..... Sex.....

Town/Village..... District/Region.....Code number.....

Starting Time..... Ending Time.....

Date.....

---

#### INSTRUCTIONS FOR THE INTERVIEWER

**A. Interviewers will have read the guidelines for interviewers and attend the briefing session prior to the interview.**

Introduce yourself and explain that this is part of a study being undertaken by Kumasi Institute of Technology and Environment (KITE). The aim of the study is to examine the impact of electrification in all sectors of the rural community where electrification by grid extension has been done for at least a year and how other initiatives apart from the electrification have helped in bringing about the impact. The project is designed to catalogue best-practices of successful energy interventions in Africa and their associated impact and can be used as an input to the GoG's general strategy on poverty reduction and can be used in designing policies to improve access and quality of service better for people like you. We will also be asking you a few questions on household income and expenses.

**B. Please communicate the following to the interviewees:**

Please remember that all the information you give us is **confidential**. It will not be communicated to anyone outside the research team.

**SECTION 1: GENERAL HOUSEHOLD INFORMATION**

- 1.1 What is your role in this household?  Husband  Wife  Other, specify
- 1.2 Who is the head of Household  Husband  Wife  Other (specify)
- 1.3 Age of Respondent \_\_\_\_\_
- 1.4 Occupational Status of main Income earner in your household
  - Working on own in family agricultural activity (fishing, poultry, farming)
  - Employee in waged job (check appropriate box below)
    - Government Sector of which...
      - \_\_\_Junior
      - \_\_\_Professional
    - NGOs
    - Cooperative
    - Private Sector
  - Self-employed other than agriculture (of which)
    - Self employed in a business with employees
    - Without employees
  - Unpaid work in family business
  - Other \_\_\_\_\_

**SECTION 2: HOUSING INFORMATION**

- 2.1 Did it have electricity before the village was electrified? If yes, what was the source?  Yes  No
- 2.2 Is the electricity metered?  Yes  No

No	Question	Current Status	Pre-electrification
2.3	How many rooms/offices does your household have?		
2.4	How many people live in your household?		

- 2.5 Was the house already wired before the village had electricity?  Yes  No
- 2.6 If 2.1 is No, who authorised the wiring of the house? Was any affluent person in village involved? (eg: Queen Mother, DCE, Assemblyman etc)
  - Matron/Head Doctor

Other, Please explain

2.7 How much did you pay in connection costs? \_\_\_\_\_

2.8 How long did it take from application to the actual connection? \_\_\_\_\_

**SECTION 3: ENERGY PROFILE**

Type of fuel	Cooking/Heating	Lighting	Appliances & other	Amount Spent Per Week (cedis)
Kerosene				
Wood-fuel				
Charcoal				
LPG				
Electricity				
Battery				
Generator				
Candles				
Other				

Do you have the following electrical appliances? If yes please provide the following information

Type of Appliance	Number		Hours of Use	
	Current	Pre-electrification	Current	Pre-electrification
Light bulbs				
Energy efficient bulb (CFL)				
Fluorescent bulb				
Air conditioner				
Hot water heater				
Refrigerator				
Electric oven				

Electric stove				
Television				
Pressing-iron				
Radio/CD/Sound systems				
Other, (specify)				
Light bulbs				

**SECTION 4: HEALTH IMPACT ASSESSMENT**

4.1 Has electrification had any impact on the health of your household?  No  
 Yes. If Yes please specify:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4.2 Has there been a change in the incidence of some specific diseases?  
Please list

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**SECTION 5: QUALITY OF LIFE IMPACT**

No	Question	Current Status	Pre-electrification
1.5	Has electricity change your expenses on fuel?		
1.6	Has electricity affected your means of communication?		
1.7	Has electricity changed the number of hours your do business?		
1.8	Has it affected the level of your assets ownership?		
	Has it affected your decision making on energy?		
	Has it helped in establishing any income generating activities?		
	Has it made it possible for you to be in touch with the outside world?		
	Has it affected employment levels in your community?		
	Has it created any changes in the gender relations in your community		
	Has electricity changed the sense of security around you?		
	Has social activities in your community changed		
	Has it affected your leisure time, please state hours		
	Has school attendance of your children changed? (boys vs girls), hours		

**SECTION 5: QUALITY OF SERVICE**

5.1 Are you satisfied with quality of service?

- Definitely satisfied
- Somewhat satisfied
- Neutral
- Somewhat dissatisfied
- Definitely dissatisfied

5.2 How many hours of service do you have everyday on an average? \_\_\_\_\_

5.3 How often do you experience power cuts (black outs)?

- Every day. If so, how long does it last (in hours) \_\_\_\_\_
- Few times a week. If so, how long does it last \_\_\_\_\_
- Few times a month
- Not at all

5.4 How has the quality been like over the last past 6 months?

- Has got better
- Has stayed the same
- Has got worse
- Do not know

5.5 Do you know of fluctuations in voltage?

- Yes
- No

5.6 If so, have you experienced such fluctuations in voltage/ brownouts?

- Yes
- No

5.7 Have you had your appliances damaged soon after brown-outs/power cuts?

- Yes (Go to 5.8)
- No (Go to 5.9)

5.8 Which appliances? .....

5.9 Of the following list, please choose three things that the utility could improve (ranking from 1 – most important, 2 second in importance and 3 third in importance) Please note that only one can be ranked first, one can be ranked second and one can be ranked third.

- \_\_\_uninterrupted supply
- \_\_\_fewer voltage fluctuations (brown-outs)
- \_\_\_longer hours
- \_\_\_lower electricity tariffs
- \_\_\_metering system
- \_\_\_billing system
- \_\_\_payment period
- \_\_\_officials attitude/responsiveness of utility
- \_\_\_other

5.10 Would you be willing to pay more for electricity if the quality was better?

- Yes
- No (Go to 6.1)

5.10 If yes, what improvement in quality would you pay for?

- \_\_\_reduction in number of outages
- \_\_\_reduction in number of brownouts
- \_\_\_longer hours

- \_\_\_improved metering system/own meter
- \_\_\_better/ clearer billing system
- \_\_\_officials attitude/responsiveness of utility
- \_\_\_other

***SECTION 6:DISCONNECTION/RECONNECTION***

6.1 Have you ever been disconnected?  
 Yes (Go to 6.2)  No (Go to 6.6)

6.2 If yes, why and when?

.....  
.....