UGANDA BUREAU OF STATISTICS

PROGRESS REPORT FOR THE

HOUSEHOLD SURVEY ON THE IMPACT OF THE ENERGY CRISIS

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1 INTRODUCTION

The Ministry of Energy and Mineral Development (MEMD) contracted Uganda Bureau of Statistics (UBOS) to conduct the Energy Survey (ES). The survey was implemented as a follow-up study on households that indicated that they consumed electricity during the 2005/06 Uganda National Household Survey (UNHS).

1.1 Background

The prolonged drought experienced over the last years that has resulted in low lake water levels, has greatly affected hydropower production. The installed capacity of 380MW at Owen Falls is only used at around 140MW at the moment. Moreover, there has been a lack of investments in the sector. As a result, Uganda is currently facing an acute electricity supply shortage and has become more reliant on expensive thermal power. Hydropower generation makes up 67% of the current generation mix totalling 450 GWhs per quarter, thermal generation 26%, imports 5% and small hydropower stations 2%. Average production costs range from Shs 31/kWh for hydropower to Shs 330/kWh for thermal power.

Power demand increased in recent years given robust economic growth, and is currently estimated at 382 MW during peak hours (6 p.m. – midnight), 280 MW during shoulder time (6 a.m. – 6 p.m.), and 203 MW during off-peak hours (midnight – 6 a.m.). Available supply however is only 246 MW during peak hours and shoulder time, and 132 MW during off-peak time. This results in load shedding at peak periods of around 140 MW. On average it is around 75 MW.

Plans to increase power generation are available. E.g. thermal power generation will be increased by 50 MW in the last quarter of 2007 to arrive at a total thermal capacity of 150 MW. The co-generation plant from Kakira Sugar Works is also expected to start delivering power to the central grid in the last quarter of 2007. Other generation plans include mainly small hydropower stations, coming on board in 2009 and the large hydropower plant of 250 MW in Bujagali, expected in 2011. The Ministry of Energy and Mineral Development is currently looking into developing the Karuma hydropower station as a public-private partnership.

Although end-user tariffs have been increased by a cumulative amount of 96% over 2005-2006 (in three increases), Government of Uganda is still subsidizing the sector heavily to keep tariffs affordable for consumers. During financial year 2006/07, over Shs 200 billion has been spent by Government to subsidize thermal power generation. It is expected that Government subsidization will remain necessary up to 2011 when the Bujagali hydropower plant, providing relatively cheap power (estimated at Shs 225/kWh, or USc 13/kWh), becomes operational.

Only about 5% of Uganda's population has access to electricity, making it one of the lowest per capita energy consuming countries worldwide. Combined with chronic electricity shortages, continued problems in the energy sector will greatly affect the country's prospects for economic growth. Yet, the electricity shortage has affected all sectors in the economy. The manufacturers and providers of commercial services are not able to operate in a predictable manner. Also social service providers and individual consumers are hit. If most of the energy requirements are not met, the headway gained from a strong macroeconomic performance may decline. This would be unfortunate since the country has vastly improved since 1986 – poverty levels have gone down and the economy grew at close to 6.5% during the 1990s (due to a combination of low inflation, stable exchange rate, large foreign reserves, and increasing foreign direct investments).

2 Objectives of the Energy Survey

The overall objective of this survey was to obtain vital information on the performance of the main sectors of the Ugandan economy, their expenditure and use of electricity since 2005-2008 and use of other energy sources.

Specifically, the household survey was intended to reveal the impact of electricity shortages and electricity prices at the household level.

The survey findings will therefore be used as an input into two studies namely: "the Study to assess the Impact of the Electricity Supply Constraints on the Ugandan Economy" and "the Poverty and Social Impact Analysis (PSIA) of the Power Sector Reforms in Uganda".

3 Survey Design and Coverage

The survey was implemented as a follow-up study on households that indicated that they consumed electricity during the 2005/06 Uganda National Household Survey (UNHS). Since the study targeted households consuming grid electricity, households in Northern Uganda were not included due to the low coverage of grid electricity in the area.

Using this criterion a total of 470 households that reported consuming electricity in 2005/06 were randomly selected to form a panel sample. On average there were four(4) panel households per EA. Alongside these, an equivalent 470 non-consumers of electricity so as to constitute a paired sample. These additional households will later be used in the analysis as controls whose data will be used to eliminate the effect of pre-existing differences and to control sample bias. In total 840 households were targeted in 111 Enumeration Areas (EAs) as summarized in table 1 below:

Table 1: Distribution of EAs and sampled households by Area

Area	**No. of EAs**	**No. of panel Households**	**No. of control households**
Urban	66	338	338
Rural	45	138	138
Total	**111**	**476**	**476**

The Enumeration Areas were selected on basis of location of grid electricity consumers (panel households). The fact that most of the consumers are in urban areas explains why there were more urban EAs selected as compared to rural EAs. Appendix table AI shows the distribution of selected EAs by Region and District. A map showing the spatial distribution of panel households is contained in Annex I

4 Survey Instruments

The Survey comprised two modules namely;

(a) Household Questionnaire:- the purpose of this module is to collect relevant information on electricity access, consumption, payment and uses at household level

(b) Enterprise Questionnaire:- to collect relevant information on electricity uses at household enterprise level

The household questionnaire covered:

a. Household Information on the Head and Spouse
b. Access to and utilization of Grid electricity
c. Alternatives to Grid electricity
d. Household Appliances
e. Household Consumption Expenditure

The enterprise questionnaire covered:

a. Household enterprises
b. Energy Use by household enterprises
c. Coping Mechanisms of Household Enterprises

The content of the questionnaires was based on the recommendations of an M& E consultant who was engaged to guide the designing team on the appropriate questions for a survey intended to feed into a PSIA. A detailed report with M & E guidelines is attached in Annex II

5 Recruitment and training of Fieldworkers

UBOS recruited and trained appropriate field staff to serve as field interviewers and supervisors. There were 21 field staff divided into 7 teams, each with 1 Team leader and 2 Interviewers. The team leader was responsible for the entire team, contacting local officials, selecting households to be interviewed and ensuring high quality of the work in the team. Recruitment was language-specific:

Luganda	-	3 Teams
Lusoga	-	1 Team
Lugisu/Lugwere/ Ateso		1 Team
Runyoro/Rutoro	-	1 Team
Runyankore/Rukiga	-	1 Team

Candidates were centrally recruited on the basis of maturity, language skills, education level, and willingness to work away from home. All field staff were trained for a period of 10 days with two days of field practice. Training involved both classroom and practical demonstrations. The trainees were trained on the roles of the fieldworkers, household sampling, how to fill the questionnaires, field supervision and handling of field returns.

6 Data Processing

Data processing began one month after the commencement of fieldwork. Data entry operators were recruited and trained to handle field returns and capture the data. Two office editors were recruited to support the data entry team with editing. The Directorate of Information Technology (DIT) at UBOS provided the programs for entering, editing and tabulating the survey data, as well as in training data processing staff.

7 Response and Attrition rates

The overall response rate for the panel sample was 65 percent. However the control households had a response rate of about 83 percent. There were no significant differences in response rates between urban and rural areas. Table 2 summarizes the results of interviews by area and study group.

Table 2: Response rates by Area of residence

Area	Complete	Not at home	Refused	Hh not found	Total	Response rate
----------Treatment group (Consumers)----------						
Urban	217	4	5	112	338	64.2%
Rural	91	1	1	45	138	65.9%
Total	**308**	**5**	**6**	**157**	**476**	**64.7%**
----------Control group(Non-consumers)----------						
Urban	296	42	0	0	338	87.6%
Rural	100	38	0	0	138	72.5%
Total	**396**	**80**	**0**	**0**	**476**	**83.2%**

8 Workplan and Deliverables

The sequence of activities leading to the implementation of the Energy survey was summarized in the work plan attached in Annex III. The work plan is divided into three phases namely the preparations; field operations and data processing.

8.1 Phase one: Preparations

This initial phase laid the foundation for conducting the Energy Survey. It involved retrieval of questionnaires of all households that indicated consumption of electricity during 2005/06 UNHS, finalisation of the energy survey questionnaires and the interviewers' manual of instructions. All necessary logistical requirements which included procurement of field supplies and finalisation of the field plan were finalized. In addition, the recruitment of field staff to conduct the main field work was undertaken.

8.2 Phase two: Field Operations

The second phase of the survey focused on fieldwork. Prior to conducting the interviews, households that were visited during the 2005/06 UNHS were identified. Data was then collected from the respondents using the questionnaires developed in the first phase. According to the work plan, fieldwork was completed with one month. Close supervision of the exercise was conducted to ensure minimum errors.

8.3 Phase three: Data processing

A data cleaning and verification workshop was held during which; Office editors scrutinized all the returns from the field to check for any errors that may creep in from the field. All data was transformed into a form and format that MEMD can utilize it.

Table 3 below presents a summary of key deliverables related to the activity work plan;

Table 3: Proposed schedule of activities and deliverables.

Period	Activity	Deliverable
Sept 2008 Week 1	Planning and survey design	Inception report
Sept 2008 Week 2-4	Training for pre-testing + Pre-testing questionnaires	Pre-test report
October 2008 Week 1	Discuss outcome of pre-testing with MoFPED, MEMD and other stakeholders	Final survey instruments
October 2008 Week 2 -3	Prepare for fieldwork: training for fieldwork + sample selection for fieldwork	Data collection schedule
October 2008 Week 4	Administering questionnaires for the household survey	Completed questionnaires
Nov-Dec 2008	Data entry, coding, cleaning and verification	Clean data set with data quality statement

9 Challenges

9.1 Flow of funds

Funds for the survey have not been timely or consistent with the work plan hence scheduled activities were almost always delayed.

9.2 Attrition

Considering that the study attempted to trace households that were last visited four years back during the UNHS 2005/06, it was not possible to find all targeted households. Only about 65% of households were traced. Hence the sample size was greatly affected.

9.3 The Small Sample Problem

While the UNHS 2005/06 covered a large sample of about 7000 households. Only about 10% of these were reported to consume grid electricity. Further, some EAs had very few households that consume electricity making it un-economical to attempt to trace them. Indeed only EAs with atleast 3 consumers were selected for the Energy study. This greatly reduced the effective sample size of panel households to about 470.

9.4 The Standard Evaluation Problems

The most likely bias may result from our selection of a sample based on location of consumers. Of course communities in urban areas have an advantage in availability of electricity and are therefore more likely to be included in the sample. It also seems likely that a host of characteristics that might influence a household's access to grid electricity also affect many outcomes positively. For example, households with better education levels may have had an advantage in complying with the application process, and also have higher incomes, again, contributing to an upward bias especially in urban areas. While these biases are surely cause for concern, the fact the study attempted a paired sample of consumers and non-consumers should reduce these considerably.

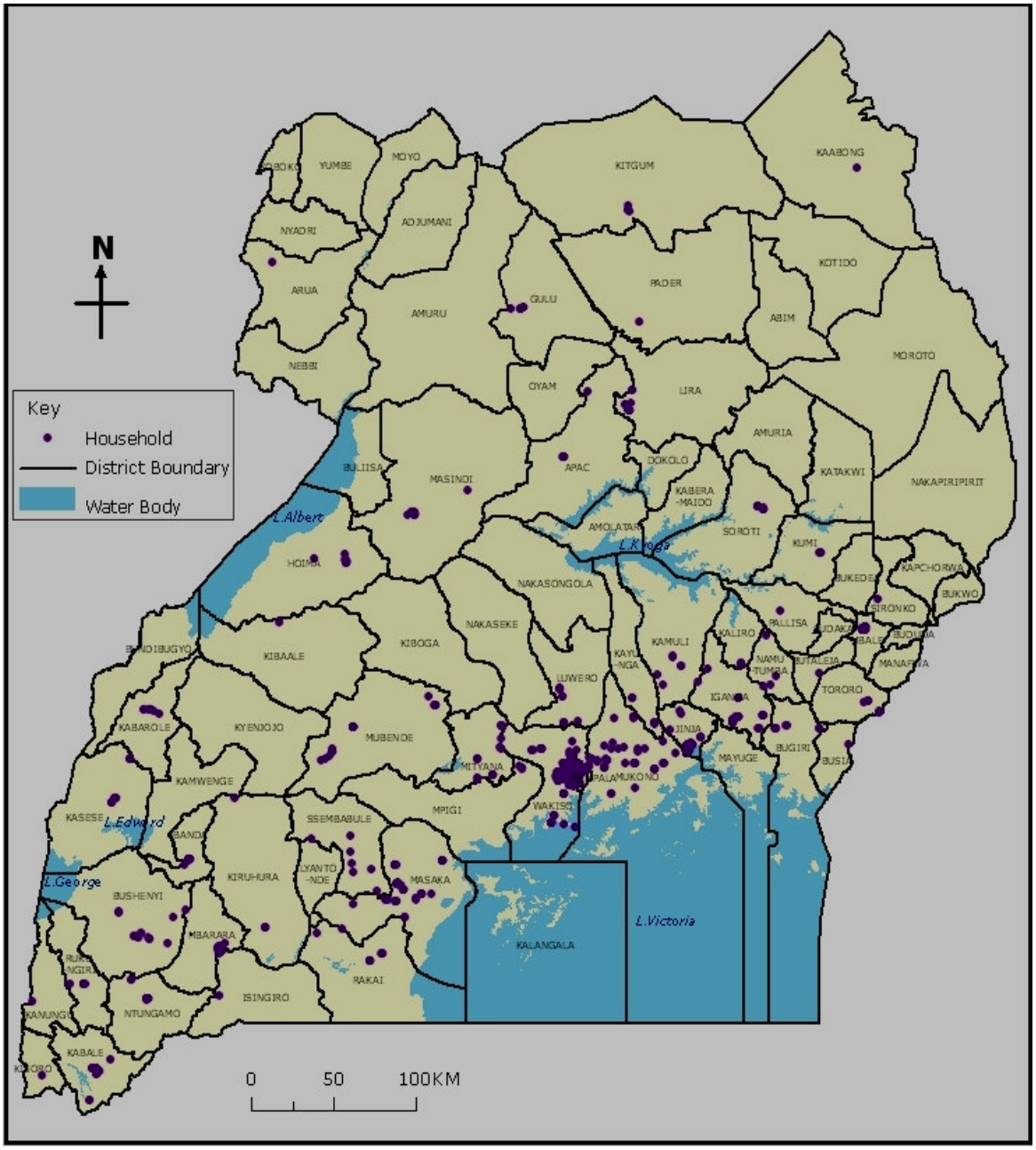
10 Next Steps in the Execution of the Assignment

Data capture was completed in March 2009 and a final dataset should have been submitted to MoFPED by end of March 09. However funds for data cleaning and remuneration of staff were with-held pending submission of accountabilities for funds advanced earlier. This was a new condition that was not earlier indicated in the MOU or contract.

APPENDIX: TABLE A1

Region	District	No. of EAs	No. of Consumers(sampled)
Central	Kampala	27	147
	Kayunga	1	4
	Masaka	8	27
	Mpigi	3	8
	Mubende	5	21
	Mukono	8	26
	Rakai	2	5
	Wakiso	14	50
	Sub-total	**68**	**288**
Eastern	Iganga	8	29
	Jinja	5	27
	Kamuli	2	5
	Kumi	1	5
	Mbale	5	30
	Soroti	1	4
	Tororo	1	3
	Sub-total	**23**	**103**
Western	Bushenyi	3	8
	Hoima	3	11
	Kabale	3	15
	Kabarole	1	8
	Kasese	2	6
	Masindi	2	8
	Mbarara	3	11
	Ntungamo	2	12
	Rukungiri	1	6
	Sub-total	**20**	**85**
Grand Total		**111**	**476**

ANNEX I: SPATIAL DISTRIBUTION OF HOUSEHOLDS THAT USED ELECTRICITY FOR LIGHTING, UNHS 2005/06



ANNEX II: MONITORING AND EVALUATION GUIDELINES RELEVANT TO PSIA

1 Introduction

Accurate baseline data on household energy use is essential to monitor and evaluate the effects of government energy policies on living conditions. The data from socioeconomic household surveys has been found to be insufficient and does not yield a complete picture of energy use, particularly as households transition between fuel types.

At present household energy data collected through household surveys is insufficient for extensive energy policy analysis. Uganda has not conducted a specialized household energy use survey before. Conducting the Energy Use Survey will provide greater insight into the role energy services play in household welfare and thus will contribute to energy infrastructure planning and energy policy analysis so that they achieve the highest possible social and development impact.

The following guidelines are recommended for consideration to help ensure that the survey provides more extensive and reliable data on household energy use than is available at present. The required Information can be presented in the following broad subject areas:

- **Core information:** This should include the fuel and electricity sources available to households, supply (including pricing, quality and reliability) and demand (e.g. the quantity consumed), characteristics of these sources, the energy services households derive from the fuels and electricity sources they consume, and household expenditures of these fuels and electricity.
- **Initial cost of access:** Since the cost of obtaining service (e.g. electricity connection fee or initial purchase of LPG cylinder) is recognized as a significant barrier to access, the Energy Use Survey can collect this information; along with data on sources of financing that the households use to defray these costs.
- **Alternatives to grid electricity**: Many areas often face unreliable grid electricity supplies (i.e. they are available infrequently or subject to interruptions); in some areas especially rural areas, electricity infrastructure may be lacking entirely. For these reasons, the Energy Use Survey should collect information on alternatives to grid

electricity. Access to these alternative sources and expenditures for acquiring and operating them should also be collected.

- **Energy end use**: The Energy Use Survey can investigate in detail the end uses of the energy sources consumed in order to quantify the benefits that households obtain from them. For example, to measure electric lighting's effect on rural households one must know the number of lighting appliances customers used before and after electrification. For households without electricity, these appliances include non–electric equipment (e.g. candles, simple kerosene wick lamps, regulated wick lamps and pressurized kerosene lamps). For households with electricity they include incandescent, fluorescent and compact fluorescent lamps. Information should be collected on length of time each lamp is used on a typical day. With this information, researchers can compare electrified and non-electrified households with regard to price and quantity of lumen hours used. Analysts will use such information to quantify the benefits of electric lighting using methods involving willingness to pay.
- **Attitudes:** The Energy Use Survey should contain a section that explores households' attitudes towards energy services. For example households may have the option to connect grid electricity service, but for various reasons choose not to. Respondents can be asked about the reason for their choices. Their answers may reveal high up-front connection charges, side payments to utility providers or inability to wire their houses internally for lack of qualified electricians or because of safety issues involving the materials used to construct their houses.
- **Socio-economic information on households** (household and housing characteristics). The Energy Use Survey should contain a limited set of questions on sources of income and expenditures for non-energy goods and services.

Missing Energy Questions in Household Surveys

Most of the household surveys contained some energy questions.

2 Current data gaps

Household Surveys ask only about the main source of energy for a particular purpose. In the Household Questionnaire of the UNHS 2005/06, energy questions centered mainly on fuel types used for cooking or lighting, along with types of household appliances. Because the

survey permits only one answer, it is not possible to deduce which minor energy sources households use for lighting, cooking, and other end uses. To model the determinants of households' fuel choice thoroughly, it is important to accurately characterize all of the available energy options that a household does not choose.

In addition, Household Surveys typically lack sufficiently detailed questions on:

- Pricing in order to accurately determine unit prices households pay for fuels and electricity;
- Connection fees;
- Service quality and supply reliability from service providers and retail distributors;
- Seasonal variation, as it relates to pricing and service reliability;
- Households coping costs (e.g. how households behave during power outages or fuel shortages);
- Quantities of fuel and electricity consumed; and
- Attitudes toward various energy sources (e.g. whether households perceive particular types of energy as relatively clean or polluting, convenient, expensive, or reliable).

3 Indicators to be constructed from the data

3.1 Access indicators

The reason why a particular household lacks access to a modern fuel or electricity involves either a supply-side failure – the community where the household lives lacks a local distribution network – or a demand-side failure – the household chooses not to use the available service because it is too expensive, culturally unfamiliar or otherwise inappropriate. Because the policy implications of these supply- and demand-side failures vary so greatly, access indicators should differentiate between the two situations.

- **Access ratio:** This indicator refers to the percentage of all households that currently use a specific fuel or electricity. It does not discriminate between demand- and supply-side explanations for any shortfall in access. [Qn. During last 30 days has your household used […]? Agric residue, Dung, Firewood etc. Qn Does your household have electricity from […]? Car batteries, Generator, Electricity – mini grid, Electricity – national grid etc

- **Availability ratio:** This indicator refers to the percentage of all households for whom a particular fuel or electricity service is available, regardless of whether they use it. The indicator captures the extent to which electricity service or a particular fuel supply has reached all areas of a country and hence the extent to which households have the option of using the particular fuel or electricity source. [Qn. In your opinion, is […] readily available in the community? Grid electricity, Firewood, LPG, Kerosene etc
- **Usage ratio:** This indicator refers to the percentage of households in communities where the fuel or electricity is available trhat choose to use it. [Qn. During last 30 days has your household used […]? Agric residue, Dung, Firewood etc. Qn. During the last 30 days, has your household used […]? LPG, kerosene, Diesel petrol etc. Qn Does your household have electricity from […]? Car batteries, Generator, Electricity – mini grid, Electricity – national grid etc. Qn. In your opinion, is […] readily available in the community? Grid electricity, Firewood, LPG, Kerosene etc
- **Appliance use:** Several appliance use indicators may be calculated. The stock of electrical appliances may be used as a proxy measure of household economic wellbeing. In addition, a proxy indicator for indoor air pollution is the percentage of households using biomass fuels for cooking that own an efficient wood stove fitted with a chimney that extracts smoke from the exterior of the dwelling. Another proxy indicator is the percentage of all households that use electric stoves or LPG burners and stoves. [Qn. How many of the following items does your household own? Radio, T.V., Fridge, Cooker etc. Qn. During last 30 days has your household used […]? Agric residue, Dung, Firewood etc. Qn. During the last 30 days, has your household used […]? LPG, kerosene, Diesel petrol etc.]

3.2 Consumption Indicators

Consumption indicators provide policy makers a picture of the relative importance of various fuels and their household end uses.

- **Gross energy consumption:** This indicator is the total energy content of fuels and electricity that a household purchases. Low values of gross energy consumption may indicate that households cannot afford to consume sufficient energy to meet basic needs of cooking, lighting and heating. Conversely, high values may indicate that some energy forms are under-priced, causing wasteful use. [Qn. What is the typical unit of measure for […]? Agric residue, Dung, Firewood etc.; Qn. What is the

approximate weight of a typical unit of […]? Agric residue, Dung, Firewood etc. Qn. How many units of […] has your household used in the last 30 days? Agric residue, Dung, Firewood etc. Qn. What is the typical unit of measure for […]? LPG, Liquid fuels. Qn. What is the approximate weight of a typical unit of […]? Qn. How many units of […] has your household used in the last 30 days? Qn. How much electricity did the household consume from […] during 30 days of the last billing period?

3.3 Price Indicators

High values or rapid changes in price indicators may signal an affordability problem among certain groups. Analysis of variations in fuel prices may reveal the presence of spatial monopolies. Price indicators include unit price, mean weighted unit price, energy expenditure and start-up costs.

- **Unit price:** This indicator is the market price of each fuel and of electricity per unit purchased. The unit prices may vary geographically and may be an indicator of local monopolies or fuel scarcity. [Qn. How many of these units of […] did your household purchase during the last 30 days? Agric residue, Dung, Firewood etc.; Qn. What is the typical price your household pays per unit of […]? Agric residue, Dung, Firewood etc.; Qn. How many of these units of […] did the household purchase during the last 30 days? LPG, Liquid fuels. Qn. What is the typical price your household pays per unit of […]? LPG, Liquid fuels. Qn. How much electricity did the household consume from […] during 30 days of the last billing period? Qn. How much did the household pay for 30 days of electricity use?]
- **Mean weighted unit price:** The household average gross unit price of energy is the average of the unit prices for each fuel purchased by the household weighted by the share of that fuel in the households overall gross energy consumption. [Qn. How many of these units of […] did your household purchase during the last 30 days? Agric residue, Dung, Firewood etc.; Qn. What is the typical price your household pays per unit of […]? Agric residue, Dung, Firewood etc.; Qn. How many of these units of […] did the household purchase during the last 30 days? LPG, Liquid fuels. Qn. What is the typical price your household pays per unit of […]? LPG, Liquid fuels. Qn. How much electricity did the household consume from […] during 30 days of the last billing period? Qn. How much did the household pay for 30 days of electricity use?]

- **Energy expenditure:** This indicator is the price of each fuel multiplied by the quantity consumed. When summed for all energy sources, one can estimate the aggregate household energy expenditures as a percentage of household expenditure or income. [Qn. How many units of […] has your household used in the last 30 days? biomass and candles. Qn. What is the typical price your household pays per unit of […]? Agric residue, Dung, Firewood etc.; Qn. How many units of […] has your household used in the last 30 days? gas and liquid fuels. What is the typical price your household pays per unit of […]? LPG, Liquid fuels. Qn. How much did the household pay for 30 days of electricity use?]
- **Start-up costs:** This indicator represents the investment costs involved in securing access to an energy source (e.g. electricity connection charges or cost of initial cylinder of LPG). Connection costs can be expressed as a percentage of a poor household's monthly income [Qn. How much is the one time connection cost fee for […]?]

3.4 Reliability indicators

- **Reliability ratio**: This indicator is the average percentage of time for a given period (usually a month) that any given fuel or electricity is available for use. [Qn. On average, how many hours a day is electricity available from […]? Qn. How many times in the last 30 days did electricity from […] fail for more than 15 minutes?]
- **Reliability perception:** This indicator refers to gauging perceptions on the relative availability and scarcity of various fuel and electricity sources [Qn. In your opinion is […] readily available in this community? Electricity, Fuels.]

3.5 Other indicators to consider:

- **Unit cost of electricity**:
  Reason: Can be used to analyse a response in demand to price
- **Number of buildings with accessible metering data**
  Reason: Indicates accessibility of energy use information
- **Number of times meter is read:**
  Reason: Indicates how often the information is being sought.

ANNEX III: SURVEY WORKPLAN

Activity	2008			
	Sept	Oct	Nov	Dec
Retrieval of UNHS 2005/06 questionnaires for panel households				
Development of Questionnaires and Sample design				
Training of field workers				
Main field work				
Data Entry				
Data cleaning, editing, conversion and finalizing of data set				