Ministry of Energy and Mineral Development

Residential Customer Lighting Survey

Prepared with the
Support of the Energy Advisory Project/GTZ

JUNE 2006

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1.0   OVERVIEW OF THE SURVEY

The Government of Uganda, through the Ministry of Energy and Mineral Development (MEMD) is planning a massive countrywide distribution of Compact Fluorescent Lamps (CFLs), commonly known as "Energy Savers" in the near future to help electricity consumers to save money on their electricity bills. The program will be implemented by UMEME.

In preparation for this program, a study on Residential Customer Lighting was conducted to establish the following:

1. The types and nature of residential lighting presently used,

2. The normal lighting practice,

3. The extent of consumer awareness of energy savers that are now available in the market.

The results of this survey are intended to help MEMD and UMEME to understand how electricity is used and this would enable them to introduce energy conservation programs that would help consumers save money on their electricity bills and reduce power blackouts.

2.0   IMPLEMENTATION

2.1   Survey Sample

The survey sample was taken from Kampala city, which has 140,000 consumers out of about 220,000 in the UMEME power system, excluding large and medium industries.[1] Kampala city has five divisions namely: Makindye, Rubaga, Kawempe, Nakawa, and Central Divisions. Recently two more divisions, Makerere and Kyambogo came into being specifically to cater for the needs of the large number of educational institutions located in their areas of jurisdiction. However, because some legal requirements have not been finalised, the two divisions are not yet fully fledged[2].

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[1] Source: UMEME
[2] Source: http://www.ugandadish.org/kampala.doc - report "Kampala District Profile"

Residential Customer Lighting Survey in Kampala City

Figure 1 Map of Kampala city showing the five divisions

Below is some socio-economic data[3] on Kampala city that is relevant to the survey:

Housing:

- 54% of city residents live in tenements (muzigo).
- 12% live in stores and garages.
- 65% live in rented houses.
- 71% of all families occupy rooms as opposed to houses.
- 36% of city houses are built of mud and wattle.
- 34% of city house require up grading or replacing.
- About 80% of homes lack toilets/latrines.
- Average population per household is 5 people.

Incomes:

- 80% of the population is low-income.
- Gross National Product (GNP): US$2820(1990).
- Income Per capita (IPC): US$ 220-250 (1990).
- 100,000 job seekers per year from other Districts come to Kampala.

2.2   Questionnaire Design

A comprehensive questionnaire provided by the World Bank was tailored to suit the local conditions. The questionnaire is attached in the annex.

2.3   The Survey

The survey was conducted within a time frame of two weeks due to the urgency attached to the overall program. At least 500 households and small commercial businesses were sampled, 100 households and small commercial businesses from each of the five divisions of Kampala (the two new divisions were not considered as separate, rather

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[3] Source: http://www.ugandadish.org/kampala.doc - report "Kampala District Profile"

incorporated in the five mentioned ones). A structured interview approach with the questionnaire was used. The survey team comprised of five graduates from both engineering and social sciences. Each surveyor was assigned 100 households in one division.

2.4   Interpretation and Data Analysis

Responses from the survey were grouped and analyzed using EpiData and SPSS programs. The information was interpreted both quantitatively and qualitatively using tabular and graphic illustrations.

2.5   The Time Schedule

Given the urgency with which results were required for the CFL program, the whole survey was conducted within a period of one month (May/June 2006) as described below:

12th – 25th May 2006	The Survey
26th – 28th May 2006	Data Entry
29th – 30th May 2006	Preliminary Data Analysis
31st – 9th June 2006	Data Interpretation and Report Writing

3.0   RESULTS

- A total of the 527 households were surveyed, of which 19% were from Rubaga, 20.1% were from Makindye, 19.2% were from Kawempe, 19.0% were from Nakawa and 22.8% were from Central division. The results were grouped according to customer category and the number of replaceable lamps in each category was indicated, as well as the percentage number of incandescent bulbs that are used for 2 or more than 4 hours per day as shown below in Table 1.

Table 1. Key Results of the Survey

Customer category	Electric use (kWh/month)	No. of HH in sample	Lamps per HH	Incandescent Lamps per HH	% Number of incandescent bulbs by average hours of use per day	
					>4 hr/day	2 hr/day
Low income residential		231	3.13	2.37	62.2	37.8
Middle income residential		176	6.80	3.97	60.4	39.6
High income residential		100	9.25	4.21	57.1	42.9
High income + small commercial		20	3.60	2.15	25.8	74.2

- The highest percentage of households (43.8%) falls under low income residential customers, closely followed by the middle income residential customers (33.8%). 19% of the households were in the high income residential customer category and 3.8% fell under the high income residential + small commercial customers. Table 2 further indicates the number of households in each category and the total number of lighting fixtures that were found.

Table 2. Grouping of Lamps in Households

Customer				Lamps in HH (Grouped)				
Category	Description	No. of HH	%No. of HH	1-2	3-5	6-8	>8	Not Specified
Tier 1	Low income residential	231	43.8	122	72	25	10	2
Tier 2	Middle income residential	176	33.4	19	57	47	53	-
Tier 3	High income residential	100	19.0	1	17	39	43	-
Tier 4	High income residential + small commercial	20	3.8	6	9	3	1	1
	Total	527	100.0	148	155	114	107	3

- In respect to general housing and income information, the survey indicated that the average population per household is five (5) and the average number of rooms per household is four (4). 64.3% of the households had 1-2 bedrooms.

- 52.2% of the respondents were living in rented houses while 40.4% owned the homes they lived in. of those renting, the survey however did not establish who was directly responsible for paying the electricity bill.

- 30.6% of the households claimed to have an electricity bill below 20,000UShs, whereas 27.1% claimed to lie between 20,000 and 60,000, and 14.1% had bills over 60,000UShs. 28.1% of the respondents did not know.

- The largest numbers of lighting fixtures (36.7%) were found in the bedrooms, 23.3% were found outside, and 12.6% were found in the family room. The percentage number of lights in the kitchen closely tied with those found in the bathroom/other (7.8% and 8.9% respectively). Fig 1 gives the percentage of the total number of lamps in the different locations. Fig 2 shows the types of lamps.
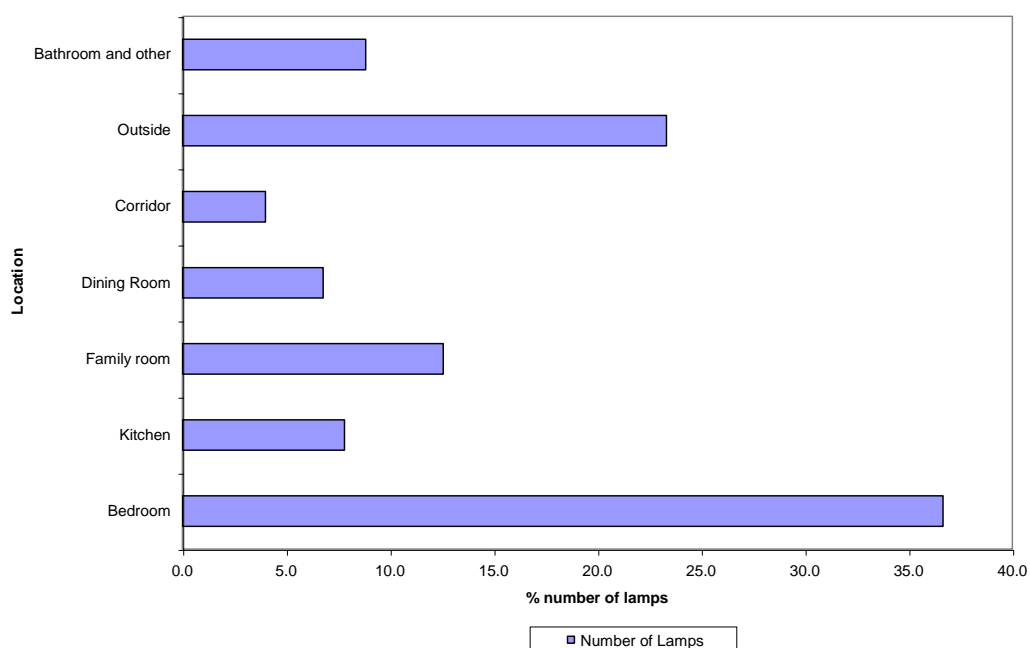

Fig 1. Percentage of the total number of lamps in the different locations

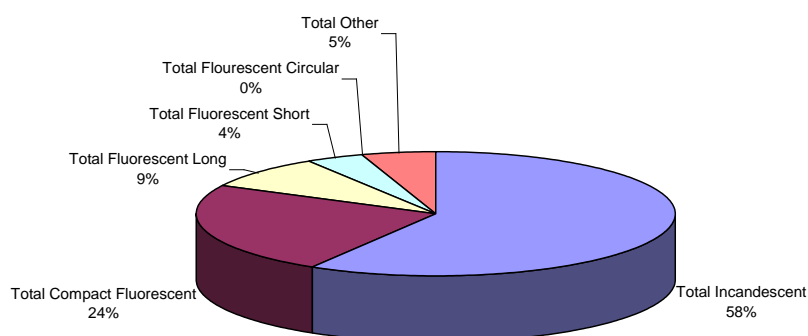- 58.6% of the lighting fixtures found in the different rooms in the household had incandescent lamps.

Fig 2. Types of lamps

- The survey was able to determine 70.6% fixtures that were in physically retrofitable i.e. having pin or screw fittings. The fittings of the rest of the lamps were not given because the surveyors were not given access inside the rooms of the house.

- 90.4% of the fittings for incandescent bulbs were pin and 9.6% were screw. See Table 4.

- The watt-sizes of lamps were also surveyed. Table 5 shows the different watt-sizes that were found. Some respondents when asked did not know the wattage.

- The number of hours that the retrofitable lights were on was also called for. Lights used for more than 2 or 4 hours per day were counted to give an indication of the number of retrofitable opportunities economically viable. See table 6

- The survey also included questions on consumer attitudes and familiarity with compact fluorescent lamps. Some of the indicative results are discussed below.

- 80.3% of the households were already acquainted with energy savers. When asked where they had learned about them, the majority cited radio and television advertisements (45.9% and 30.9% respectively), followed by newspaper advertisements.

- The majority of the households (77.1%) expressed an interest in using energy savers. It was further revealed that the most important reasons that they would consider buying CFLs were to save energy / help the environment (42.4%), the quality of light (19%), to save their electricity bill (13.7%), and the longevity of the lamp (12.5%). 12.4% did not give a reason.

- The minority that objected to purchasing CFLs (22.9%), cited their high cost (50%), doubts in the savings, light quality, flicker, colour and the unsuitability for the fittings present (18.4% in total). 31.6% did not give a reason.

- Finally, it was necessary to investigate where customers purchased their lamps and how much was spent on them. Incandescent lamps are mainly purchased from local shops (73.3%) at a price of 1,000UShs. CFLs are mainly purchased from lamp dealers (53.5%) at a price of about 10,000UShs. Customers purchase fluorescent lighting from lamp dealers (47.8%) at a price of 10,000UShs

Table 3. Total Number of Lamps in different Locations and Total type of Lamps

Customer type	Bedroom	Kitchen	Family room	Dining Room	Corridor	Outside	Bathroom and other	Total Lights	Total Incandescent	Total Compact Fluorescent	Total Fluorescent Long	Total Fluorescent Short	Total Fluorescent Circular	Total Other
Low income residential	314	49	116	35	16	151	44	725	548	105	36	18	0	18
Middle income residential	444	87	138	78	47	303	100	1197	698	256	131	58	0	54
High income residential	284	86	109	84	51	215	96	925	421	323	79	33	1	68
High income + small commercial	28	6	4	1	3	12	18	72	43	14	9	3	0	3
Total	1070	228	367	198	117	681	258	2919	1710	698	255	112	1	143
Percentage	36.7	7.8	12.6	6.8	4.0	23.3	8.8	100.0	58.6	23.9	8.7	3.8	0.0	4.9

Table 4. Total Number of Lamps with Pin/Screw Fittings

Customer type	Total Lights		Total Incandescent		Total Compact Fluorescent		Total Fluorescent Long		Total Fluorescent Short		Total Fluorescent Circular		Total Other	
	Pin	Screw	Pin	Screw	Pin	Screw	Pin	Screw	Pin	Screw	Pin	Screw	Pin	Screw
Low income residential	508	66	427	29	41	36	21	0	15	0	-	0	4	1
Middle income residential	600	113	389	54	117	54	42	1	31	0	-	-	21	4
High income residential	470	66	241	31	149	27	45	1	22	0	1	-	12	7
High income + small commercial	55	3	34	2	9	1	8	0	3	0	-	-	1	-
Total	1633	248	1091	116	316	118	116	2	71	-	1	-	38	12
Percentage	86.8	13.2	90.4	9.6	72.8	27.2	98.3	1.7	100.0	0.0	100.0	0.0	76.0	24.0
Pin + Screw	1881		1207		434		118		71		1		50	
Unspecified fitting	1038		503		264		137		41		0		93	
Grand Total	2919		1710		698		255		112		1		143	

Table 5. Total number of Lamps in Different Wattages

Customer	Description	Incandescent (W)				Compact Fluorescent (W)					
		40	60	75	100	5-9	11	14	15-18	20	23-25
Tier 1	Low income residential	22	55	131	120	2	1	8	10	5	1
Tier 2	Middle income residential	38	60	128	117	-	23	9	46	10	2
Tier 3	High income residential	23	78	72	72	3	16	25	86	19	2
Tier 4	High income residential + small commercial	3	5	15	10	-	-	-	4	-	-
	Total	86	198	346	319	5	40	42	146	34	4
	Percentage	9.1	20.9	36.5	33.6	1.8	14.8	15.5	53.9	12.5	1.5

Table 5 cont'd

Customer	Description	Fluorescent Long					Fluorescent Short (W)		Other lamp types (W)		
		18-20	28	36	40	60-100	14	18-20	15-18	36-40	60-100
Tier 1	Low income residential	-	-	4	17	-	-	12	2	1	1
Tier 2	Middle income residential	2	-	5	31	-	2	29	5	5	6
Tier 3	High income residential	2	1	4	37	4	1	21	1	6	5
Tier 4	High income residential + small commercial	-	-	4	4	-	-	3	-	1	-
	Total	4	1	17	88	4	3	65	8	13	12
	Percentage	3.5	0.9	14.9	77.2	3.5	4.4	95.6	24.2	39.4	36.4

Table 6a. Total number of Lamps by Different Average Hours of Use per Day

Customer	Description	Incandescent (hours/day)					Compact Fluorescent (hours/day)					Fluorescent long (hours/day)				
		<2	2	4	6	12	<2	2	4	6	12	<2	2	4	6	12
Tier 1	Low income residential	40	151	139	74	36	11	24	19	16	3	-	5	11	11	3
Tier 2	Middle income residential	36	151	124	82	24	17	68	50	28	3	1	12	17	29	8
Tier 3	High income residential	76	75	64	21	15	22	73	35	29	6	11	6	6	20	5
Tier 4	High income residential + small commercial	1	8	10	7	6	-	1	3	4	2	-	-	2	4	1
	Total	153	385	337	184	81	50	166	107	77	14	12	23	36	64	17
	Percentage	13.4	33.8	29.6	16.1	7.1	12.1	40.1	25.8	18.6	3.4	7.9	15.1	23.7	42.1	11.2

Table 6 cont'd

Customer	Description	Fluorescent short (hours/day)					Other lamp type (hours/day)				
		<2	2	4	6	12	<2	2	4	6	12
Tier 1	Low income residential	1	3	6	7	1	-	-	2	3	-
Tier 2	Middle income residential	1	10	4	18	6	3	-	10	6	-
Tier 3	High income residential	3	2	5	12	-	5	4	8	-	1
Tier 4	High income residential + small commercial	-	1	2	-	-	-	-	1	-	-
	Total	5	16	17	37	7	8	4	21	9	1
	Percentage	6.1	19.5	20.7	45.1	8.5	18.6	9.3	48.8	20.9	2.3

4.0   LESSONS LEARNT

- Previous knowledge by the household of the survey is very important – Households informed ahead of time ensure a good reception of the surveyors and more trust hence allowing greater access within the home. Announcements could be made on radio mentioning the specific area in which the survey can be carried out.

- Local authorities should at least be informed.

- Identification for surveyors – It is proposed that surveyors are given picture identification cards together with an official letter or a special uniform of official vehicle. This will further aid in gaining entry in households. In many cases, surveyors were only allowed into one room of the house, making it impossible to verify customer responses.

- Training of surveyors is crucial – Surveyors need to have a basic understanding of technology being deployed and some idea of what to expect in the answers (referral phone numbers or addresses in case they can't answer some questions). In some households, surveyors were further queried on issues of power cuts and high bills received.

- Survey data should be reviewed for inconsistencies as soon as possible – This means that the data collection and analysis process must be in place before the survey begins.

- While surveys should try to gather as much relevant information as possible, they should not last too long to inconvenience the customer and ensure good quality answers. The questionnaire used took on average half an hour.

- Samples of the bulbs should be carried along during the survey.

- Electricity Regulatory Authority (ERA) should explain the tariff and have it published regularly.

5.0   CONCLUSIONS

- The survey mainly targeted households in Kampala City. These were 527 in total.

- Incandescent bulbs take the largest percentage of use in the households. 2919 lamps were found, of which 58.6% were incandescent bulbs, 23.9% were compact fluorescent lamps, and 17.4% were fluorescent tubes and other lamps.

- On average, three (3) incandescent bulbs were required per household.

- The majority of fittings found in the households were pin. 90.4% of incandescent bulbs had pin fittings while 9.6% had screw fittings.

- 40W, 60W, 75W and 100W were the predominant sizes of incandescent bulbs found. 33.6% of the bulbs were 100W, 36.5% were 75W bulbs, 20.9% were 60W bulbs, and 9.1% were 40W bulbs.

- The awareness level of energy saving by use of the compact fluorescent lamps was very low in the low-income residential households. Some middle and high-income residential households had at least an energy saver or lamps of low watt-sizes.

- The low-income residential households mainly purchase lamps from local shops, while the middle and high-income households make their purchases from lamp dealers and supermarkets.

- Many of the households use incandescent bulbs mainly because they cannot afford the compact fluorescent lamps. Incandescent lamps are mainly purchased from local shops at a price of 1,000UShs. CFLs are mainly purchased from lamp dealers at a price of about 10,000UShs. Customers purchase fluorescent lighting from lamp dealers at a price of 10,000UShs.

- Energy, environmental and monetary savings' benefits of compact fluorescent lamps should also be stressed in the advertising campaigns.

6.0   RECOMMENDATIONS

In view of the results and conclusions drawn from the survey, the following are some general recommendations to be considered when developing the implementation strategy for the CFL program:

1. According to the survey, 949 lamps met the criteria for replaceable lamps i.e. they were incandescent bulbs of 40W and above. Further more it was also established that the average distribution of incandescent lamps was estimated to be 3 bulbs per household. Considering that 140,000 of UMEME's customers come from Kampala, this would mean that a distribution of an average of 3 lamps per household, 280,000 compact fluorescent lamps would cover Kampala.

2. The survey covered mainly residential households so the balance from the proposed 600,000 lamps to be procured could be able to cover some industrial buildings within/around the city and other cities like Jinja and Entebbe.

3. The survey established that the replaceable incandescent bulbs were of watt-sizes 40W, 60W, 75W and 100W. These should be replaced by compact fluorescent lamps of watt-sizes 7W, 11W, 15W, and 18W respectively. The required number of lamps should also be in the ratio 1:2:4:4 respectively.

4. It was also concluded that the households sampled had 90.4% incandescent bulbs with pin fittings and 9.4% bulbs with screw fitting. It is therefore recommended that of the compact fluorescent lamps introduced to replace incandescent lamps, an approximate ratio of 10:1 should be considered when selecting pin and screw fittings respectively.