

ENERGY USAGE IN SELECTED CAPE PENINSULA COMMUNITIES

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ABSTRACT

Rapid urbanisation introduces trends, which can best be tracked through actual household surveys. Having reported earlier on energy-usage patterns in the communities of Macassar and Kyamandi in 2009, this survey was conducted in Khayelitsha in 2012, paving the way for smart-grid systems aimed at saving energy in the residential sector of metropolitan Cape Town.

Keywords: Appliances, Macassar, Kyamandi, Khayelitsha

1. INTRODUCTION

The objective of the research conducted for Eskom [1] in 2008/9 was to establish how government could assist communities. Comprehensive information was gathered by interviewing 500 households per community on the social issues and their electricity consumption in the study areas of Macassar and Kayamandi. The data obtained through interviews also indicated what other energy sources were being used by the chosen communities. The main questions asked included :

- How many people stayed in the house?
- How many people worked?
- Were there any other sources of income?
- Which appliances were there?
- How many times and for how long were the appliances used?
- What other energy sources were there?
- What developments do people want in their residential areas?

Full details of the results are reported elsewhere [1] and relevant issues will be included in this paper, using a third study area, Khayelitsha, also shown in Figure 1 [2]:

2. OBJECTIVE

The knowledge of appliances used in the residential sector and their rate of penetration does not only reflect the level of development of a community, but it will also show how energy is being used and abused. In an effort to save energy, this approach may assist the Cape Metropolitan authorities to speed up their initiative of introducing not only a smart grid, but also smart systems generally. According to the Local authority [3], such a system is aimed at improving reliability, self-healing networks, reduced losses in the system, optimisation of assets, technology-adapted data enabling co-generation and consumer participation.



Figure 1: Map of the Cape Peninsula showing Khayelitsha (near Cape Town International Airport), Kyamandi (near Stellenbosch) and Macassar (near Somerset West)

2. METHODOLOGY

Retaining the important aspects to enable comparisons to be made with earlier studies, a simplified questionnaire was developed. (see Annexure A). A statistically meaningful sample of 360 households was chosen across the various representative sites of Khayelitsha. Personal inspections of the homes were undertaken to determine the number of electrical fittings and appliances. Emphasis was placed on lighting, distinguishing between incandescent globes, fluorescent bars and compact fluorescent lamps (CFLs), since the latter had just been rolled out nationally by Eskom. More detailed information was also gathered on the energy source used for cooking and heating water. Interviews were conducted with the female head of household, since they are invariably better informed of expenditure and usage patterns.

The results obtained are shown in the following tables, comparing current findings with those obtained in previous studies in related communities.

3. RESULTS

Demographically there are two distinct groups: In Macassar 97 per cent of the population are Coloureds with 96 per cent speaking Afrikaans. Both Kyamandi and Khayelitsha, on the other hand, are predominantly Black.

In Kyamandi 98 per cent are Blacks with 97 per cent Xhosa speaking. Khayelitsha has a very similar demographic pattern, as checked during this survey in 2012.

The Questionnaire used gave the results shown for light fittings and electric plugs (Tables 1 to 3). The comparison of the penetration of major electric appliances in the various communities is shown in Table 4. Appliances, usually found in middle to upper-income groups and which showed noticeable growth in Khayelitsha, are shown in Table 5.

Table 1 : Frequency of light fittings per area (%)

No of Lights	Macassar (%)	Kyamandi (%)	Khayelitsha (%)
0	2	1	4
1 – 2	9	21	10
3 – 4	22	40	24
5 – 6	34	23	26
7 – 8	19	10	21
>8	14	5	14

Table 2: Breakdown of types of lights in Khayelitsha

Type	Fluorescent bars	Incandescent globes	CFL lamps
No (%)	67 (4%)	718 (48%)	712 (48%)

Table 3: Frequency of electrical plugs per area (%)

No of Plugs	Macassar(%)	Kyamandi(%)	Khayelitsha(%)
0	0	0	1
1 – 2	23	34	9
3 – 4	26	43	38
5 – 6	23	16	31
7 – 8	15	5	14
>8	13	2	7

Table 4: Number of electric appliances (%)

Appliance	Macassar (%)	Kyamandi (%)	Khayelitsha (%)
Stoves	94	99	100*
Fridges	92	30	99*
Kettles	92	97	97*
TV sets	92	87	97*
Irons	86	32	96*
DVDs	17	24	86
Hairdryer	54	19	76
Geysers	60	1	74
Microwave	22	21	65
Toaster	48	25	60
Wash/mach	72	16	55*
Fan	23	7	40

*Notes: Out of 360 homes in Khayelitsha:

Stoves: 26 homes had 2 stoves, but 9 had no stove

Fridges: 1 home had 3, 26 homes had 2 and 23 had no fridge

Kettles: 45 homes had 2 kettles, but 14 had no kettle

TVs: 1 home had 10, 1 had 5, 5 had 4, 15 had 3 and

76 homes had 2 TVs, but 9 homes had no TV

Irons: 1 home had 10, 2 had 4, 4 had 3, 44 had 2 and 12 had no iron

Washing machines: 3 homes had 2, but 155 homes had no washing machine

Table 5: Electric appliances (%) which became popular recently in Khayelitsha

Popular Appliance	Macassar (%)	Kyamandi (%)	Khayelitsha (%)
Battery charg.	2	3	199
Heaters	11	3	58
Elec Pan	<1	-	48
Vac cleaner	<1	-	27
Tumbledryer	7	-	26
Dishwashers	<1	-	23
Computers	7	-	20

Results shown so far only reflect the penetration of selected appliances into the various communities. It now remains to show with what frequency chosen appliances are used per day, since this will have a bearing on the energy demand. The results obtained with the Questionnaire (Annexure A) are shown in Table 6:

Table 6: Appliance frequency of use (%) per day

Appliance	Once	Twice	Thrice	4 times
Stove	8	26	32	34
Kettle	3	25	26	45
TV	6	30	19	45
Iron	23	53	20	4
W/machine	23	53	20	4
Hairdryer	32	41	22	5

Electricity is, however, not the only energy source used in the townships, especially not for cooking, heating water and lighting. Results obtained in Khayelitsha are shown in Table 7:

Table 7: Energy sources used for cooking, heating water and lighting, respectively

Stove	Electricity	Coal, wood, gas	
	97%	3%	
Geyser	Electricity	Solar	Elec-Solar
	93%	5%	2%
Lighting	Electric lamps (n)	Candles per week	Paraffin Litres/week
	372	154 or Ave 0,4 candle/house/week	650L or Ave of 1,8L/house/week

4. DISCUSSION OF RESULTS

In the above tables, the maximum value in each column is highlighted to facilitate its interpretation.

According to Table 1, the number of lights in Macassar are peaking at 5 to 6 lights per home; whereas in Kyamandi most homes have between 3 and 4 lights; increasing to a more even distribution in Khayelitsha over the three categories ranging from 3 to 8 lights per home.

The reason for this could, according to Table 2, be the free distribution of CFLs, constituting 48 per cent of all lights in Khayelitsha on par with the previous incandescent globes. This trend will show a significant saving in energy usage in these homes.

According to Table 3, the number of plugs in all areas studied peak at between 3 and 4 plugs per home.

From Table 4, stoves remain a high priority in all areas – so do kettles. Fridges have become very popular in Khayelitsha, almost reaching 100%. The same applies to TV sets and irons. DVDs, belonging to the entertainment category, have shown remarkable growth, reaching 86%. Over three-quarter of the homes have a hair-dryer, suggesting a relative level of wealth per household in Khayelitsha. Due to national roll outs of hot-water systems, their number has also grown, reaching the three-quarter penetration level. Since the project is still being supported by Eskom and the Department of Energy, a finer breakdown of geyser statistics is beyond the scope of this snapshot survey, which still indicates a relatively low penetration of solar geysers (Table 7), relative to their electric counterparts. Micro-wave ovens have shown an encouraging three-fold growth in Khayelitsha, above the other communities four years ago. In the interest of saving energy, one would expect an even faster growth and use of micro-wave ovens for cooking. They seem to be suffering from lack of cultural acceptance – the same as solar cookers experienced in Africa a few years ago.

Toasters are also popular in Khayelitsha. Washing machines, reaching a penetration of 58 per cent in Khayelitsha, is remarkable from the low base of 16 per cent in Kyamandi. The trend is following the Macassar value of 72 per cent.

In Table 5 one sees growth of more sophisticated, appliances, following modern, fashionable trends. There are virtually two battery chargers for cell-phones per house to ensure continued communications, whereas only 3 per cent of the Kyamandi homes had a charger less than 5 years ago. The high score of heaters in Khayelitsha is probably due to the fact that houses are generally not orientated to face North, which would ensure a warmer room temperature inside the building. These are followed to a lesser extent by the even more expensive vacuum cleaners, dish washers and computers.

According to Table 6, stoves, kettles and TV sets are used mostly 4 times per day. Electric irons, washing machines and hairdryers appear to be used mostly twice per day.

In Table 7 it is shown that the vast majority of stoves in Khayelitsha are electric, since the urban community has no wood left to be gathered. In a rural community like Highflats in KZN, the opposite is true, where wood is used in stoves in 97 per cent of cases surveyed [4]. In the case of geysers, the solar and solar-electric hot-water cylinders only made up 7 per cent of the cases at the time of this survey.

For lighting in Khayelitsha, according to Table 2, the CFLs in 2012 shared about the same penetration as incandescent lamps, which they replaced in the interest of saving energy. It would be interesting to determine how many of the cheaper incandescent lamps were again installed after the energy-saving CFLs had reached the end of their lifespan.

According to Table 7, each home still uses on average 0,4 candles per week and 1,8 litres of paraffin per week.

6. CONCLUSION

The Khayelitsha survey demonstrates a remarkable growth (in under 5 years), in the penetration of residential appliances in a rapidly urbanising community. One is therefore dealing with a shifting urban community, which may be very different to one's expectations or experience with other, more rural communities. This fact needs to be borne in mind when replacing paraffin stoves with safer technologies like fuel gel stoves.

Smart systems need to be introduced urgently to combat energy wastage and to promote the effective use of renewable and sustainable energy.

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8. REFERENCES

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9. AUTHORS

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Presenter: The paper is presented by Ernst Uken.

ANNEXURE A : KHAYELITSHA RESIDENTIAL ENERGY USAGE SURVEY

Note: Your information will be kept confidential and is only intended for planning purposes.

Name of Householder: Tel No:

Home Address:

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Electrical fittings:						
	<u>Fluorescent bars</u>	<u>Incandescent globes</u>	<u>CFLs</u>	<u>No of Plugs:</u>		
No of Lights:						
Electrical Appliances:						
Stoves	Kettles	TVs	Fridges	Irons	Washing machine	
Hair dryers	Toaster	Fans	DVD	Heaters	Microwave	
Computers	Tumble dryer	Dishwasher	Elec.pan	Bat.Charger	Vacuum cleaner	
Appliance Usage:						
	1 x per day	2 x per day	3 x per day	4 x per day		
Stove						
Kettle						
TVs						
Iron						
Washing machine						
Hair drier						
Toaster						
Geyser:						
Power source:	Electric	Solar	Solar+Elec.	Coal	Wood	
Stove/Cooking:						
Power source:	Electric	Solar	LP Gas	Coal	Wood	
Lighting:						
Power source:	Electric	LP Gas lamp		Coal	Wood	
		Candles per week		Litres Paraffin per week		