Energy Consumption Among the Urban Poor in Kenya: A Case Study of Households in Kibera Slums

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Introduction

* In Kenya, urban households in informal settlements are almost entirely reliant on charcoal for their basic cooking energy needs. The population and economic growth have led to **increasing charcoal demand**, and unsustainable charcoal production is one of the major causes of **deforestation.** Although urban areas have long been **dependent on rural areas** for their fuels, little research has been done on the urban dimensions of the problem.
* **Substituting charcoal** with modern energy (electricity, LPG) is one of the solutions to reduce pressures on deforestation as well as health risks from indoor pollution, however few poor urban households can afford to do so. At the same time economic and environmental potentials of recycling charcoal dusts as **briquettes** are little understood and explored.

Objectives

(1) Identify household characteristics that influence the expenditure for each energy source for cooking (charcoal, briquettes, kerosene)

(2) Examine substitution among fuels used for cooking, with special focus on briquettes as an alternative to charcoal

Study area

Kibera slums

* The largest slums in Africa
* Estimated population: 170,070 (Kenyan census, 2009)
* The majority of the population are poor and live below the US$ 1 a day

* Sampling: randomly sampled 50 households along four foot paths by picking **every 5th household**.
* Sample size: **199** households living within **250M** radius from one of the **briquettes production sites**.
* Survey tool: Questionnaire

Sample characteristics

Table 1 Socio-economic conditions of the surveyed households

Characteristics	Mean	Std. dev.	Min.	Max.
Sample size	199			
Household size and composition				
Average household size (persons)	4.39	1.757	1	10
Female headed households (%)	16.6			
Household head graduated secondary school (	24.1			
Household head average age (years)	33.4	8.378	18	65
Childdren below 5 years of age (person)	0.88	0.773	0	3
Childdren aged between 5-14 years (person)	1.25	1.204	0	4
Males aged 15 years and above (person)	1.08	0.627	0	4
Females aged 15 years and above (person)	1.03	0.721	0	7
Income source (%)				
Regular salaried	11.6			
Casual laboring	35.7			
SME	40.9			
Annual Income (Ksh)	118,216	81,306	9,600	540,000

Source: Household survey conducted by the authors in 2010

Energy Options

Table 2 Share of household using specific type of fuel

		Dry season		Rainy season	
		percent of HHs	N	percent of HHs	N
Lighting	Briquettes	1%	1	1%	1
	Charcoal	1%	2	1%	2
	Kerosene	97%	194	97%	194
	Electricity	65%	129	65%	129
	Candle	3%	5	3%	5
Cooking	Briquettes	71%	141	71%	141
	Charcoal	90%	179	90%	179
	Kerosene	53%	105	54%	107

Source: Household survey conducted by the authors in 2010
Notes: The total number of respondents does not add up to 100% beacause respondents use more than one energy source.

	Charcoal	Briquette	Kerosene
Cost (Ksh kg^{-1})	25.9	2.2	88.9
Energy content (MJ kg^{-1})	25-33	15-19	44
Cost (Ksh MJ^{-1})	0.8-1.0	0.12-0.15	2.0
Device	Improved jiko/stove		Kerosene stove
Unit	Block 	Kasuku 	Bottle, polythene paper 
Advantages Disadvantages	cook fast, easy to use smoke, dusty, expensive	cheap, burns longer slow, dusty, difficult light	cook fast, easy to use expensive, smell, smoke

Source: Household survey conducted by the authors in 2010, Note: KSH=Kenyan Shiling, USD1=KSH78 during the survey period

Table 3 Combination of fuel use for cooking

	All of three fuels [G1]	charcoal and kerosene [G2]	charcoal and briquettes [G3]	kerosene and briquettes	kerosene only	charcoal only	briquettes only	**Total**
No. of HHs(%)	53 (26.6)	35 (17.6)	81 (40.7)	5 (2.5)	14 (7.0)	10 (5.0)	1 (0.5)	199 (100.0)

Source: Household survey conducted by the authors in 2010

Results and discussions

Test of mean difference

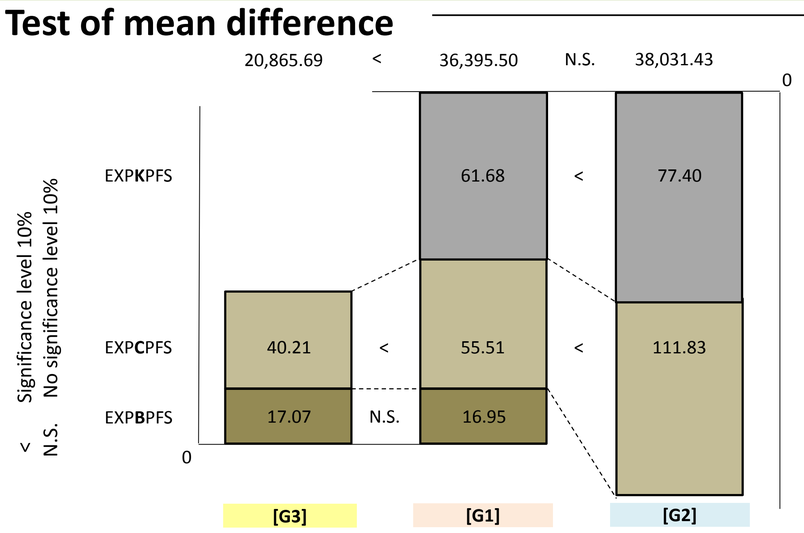

Table 4 (household basis)

Variable definition	Variable name	G3 : BC	t test	G1 : BCK	t test	G2 : CK	t test
		Mean	G3-G1	Mean	G1-G2	Mean	G2-G3
Family size	FS	5.12	***	4.34	*	3.77	***
Income	INC	99,350.62	**	133,177.40	N.S.	132,068.60	**

Table 5 (per person, over five years old)

Variable definition	Variable name	G3 : BC	t test	G1 : BCK	t test	G2 : CK	t test
		Mean	G3-G1	Mean	G1-G2	Mean	G2-G3
Income	INCPFS	20,865.69	***	36,395.50	N.S.	38,031.43	***
Expenditure on Kerosene (Ksh/week)	EXPKPFS	-	-	61.81	**	77.40	-
Expenditure on Charcoal (Ksh/week)	EXPCPFS	40.21	**	55.51	***	111.83	***
Expenditure on Briquette (Ksh/week)	EXPBPFS	17.07	N.S.	16.95	-	-	-

Correlation coefficients between expenditure and income per person

[G1] BCK

	EXPBPFS	EXPKPFS	EXPCPFS	INCPFS
EXPBPFS				
EXPKPFS	N.S.			
EXPCPFS	0.320	N.S.		
INCPFS	N.S.	N.S.	0.508	

[G2] CK

	EXPCPFS	EXPKPFS	INCPFS
EXPCPFS			
EXPKPFS	0.176		
INCPFS	N.S.	N.S.	

[G3] BC

	EXPBPFS	EXPCPFS	INCPFS
EXPBPFS			
EXPCPFS	0.425		
INCPFS	0.121	N.S.	

* Most Kibera households use fuels in various combinations and each fuel takes a different property depending on the combinations.
* Households using briquette fuel can reduce expenditure on energy sources for cooking.
* 1) Briquette fuel is used as complement for charcoal by households classified to G1 or G3. Households belong to G3 tend to consume more briquette fuel with an increase in income. 2) Charcoal can be described as a normal goods among households in G1. 3) Households in G2 use kerosene as a complement to charcoal.
* Further research should include the discussion about the rational use/choice of fuel from every aspects such as time constraint. The understanding permits more precise analysis on substitution and complementarities between fuels.

References

Karekezi. S., J. Kimani and O. Onguru (2008) Energy access among the urban poor in Kenya, Energy for Sustainable Development, 12(4): 38-48. Kenya Institute for Public Policy Research and Analysis (KIPRA) and The Energy Regulatory Commission (ERC) (2010) A comprehensive study and analysis on energy consumption patterns in Kenya, Synopsis of the Draft Final Report. Mugo, F. and C. Ong (2006) Lessons of eastern Africa's unsustainable charcoal trade. ICRAF Working Paper, 20. Gebreegziabher, Z., A. Oskam, and B. Demeke (2010) Urban Fuel Demand in Ethiopia: An Almost-Ideal Demand System Approach, Environment for Development Discussion Paper Series Aug 2010. Gebreegziabher, Z., A. Oskam, and B. Demeke (2010) Urban Fuel Demand in Ethiopia: An Almost-Ideal Demand System Approach, Environment for Development Discussion Paper Series Aug 2010.