

RELATIONSHIPS BETWEEN ENERGY USE AND INCOME LEVELS, FOR HOUSEHOLDS IN GHANA

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Abstract

Energy is arguably one of the major challenges the world faces today, touching all aspects of our lives. Access to energy, especially modern sources, is key to the success of any development initiative and it is important to understand the factors driving their uptake in developing countries like Ghana. According to the 2005/2006 Ghana Living Standards Survey (GLSS5) conducted by the Ghana Statistical Service, 45.88% of households used electricity as the main source of lighting whilst 52.32% used kerosene, and 1.80% used gas lamps, solar, candles, generators, etc. Similarly, 55.06% used wood as their main fuel for cooking while 28.72% used charcoal, 8.94% used gas, and 7.28% of the population used other cooking fuels or did no cooking.

This paper confirms the hypothesis that access to modern forms of energy increases as income levels increase. In the case of Ghana, the paper shows that the number of households using electricity as the main source of lighting increased with increasing income levels whereas kerosene had a decreasing trend. In the same vein, charcoal and gas were observed to be the fuels of choice as their usage increased with increasing income unlike wood which was observed to go down as income levels increased. Similar trends were observed at the regional level where, apart from the three northern regions, all the other regions in Ghana had a clear trend with an increasing number of households using electricity as the main source of lighting, and charcoal and gas as the main fuel for cooking, as the income quintile levels increased.

Keywords: Energy access, income, quintile, developing countries

Introduction

Access to modern forms of energy sources or services has become part of the development agenda in any country, especially, developing countries. Modern cooking fuels are considered to be those that have a high energy density, high combustion efficiency and high heat-transfer efficiency with sufficient heat control characteristics [1]. They include Liquefied Petroleum Gas (LPG), Kerosene and other non-conventional technologies. According to the United Nations Development Programme (UNDP) and the World Health Organization (WHO) the term modern fuels refers to electricity, liquid fuels (such as kerosene), and gaseous fuels (such as liquefied petroleum gas (LPG), natural gas), and excludes traditional biomass and coal. Lack of access to these sources dramatically affects health, limits opportunities and widens the gap between the rich and the poor.

Developing regions differ widely with respect to access to modern fuels, but access is more limited in the Least Developed Countries (LDCs) and sub-Saharan Africa. In developing countries overall, more than 40 percent of people rely on modern fuels; however, in LDCs and sub-Saharan Africa, only 9 percent and 17 percent, respectively, have access to modern fuels. Almost one-third of the population in developing countries overall uses gas (mostly LPG), but less than 10 percent of people in LDCs and sub-Saharan Africa have access to gas [2].

Association is drawn between human development indices and energy consumption, economic growth and poverty. It turns out that poverty has a bearing on the types of energy consumed, which in turn, affects health, education and income earning opportunities. Access to reliable and affordable energy remains an essential prerequisite for combating poverty, and available evidence shows that a significant proportion of the population in SADC countries lack access even to the most basic energy supplies and services [3, 4, and 5].

Biomass is the main source of energy for many of the poor in Ghana. They either lack access to, or cannot afford, modern energy services. Their fuel choices are limited to the most basic cooking fuels, such as firewood, in its untransformed state, and charcoal, which are used with low efficiency. Electricity and kerosene are the main sources of energy for lighting in Ghana [3].

The relationship between energy and income levels has been a source of concern to many countries and organization. As part of the Millennium Development Goals, the UN Commission for Sustainable Development explicitly acknowledged that access to sustainable energy services is an essential element of sustainable development, stating that: “To implement the goal accepted by the international community to halve the proportion of people living on less than US\$1 per day by 2015, access to affordable energy

services is a prerequisite” [7]. Also, there has been a lot of hypothesis that energy consumption is related to income levels [8,9] , the use of both traditional (biomass energy burned in conventional stoves) and modern (electricity and kerosene) sources improves household consumption and income, the return on modern sources is 20 to 25 times higher than that on traditional sources[9]. This paper shows the relationship between income levels and access to modern forms of energy in Ghana.

Income Quintile Levels

Household income is a measure commonly used by the Ghana Statistical Service to estimate to total income of households. Each household is measured by the income of every resident over the age of 18. The main components of total income according to the Fifth Ghana living standards survey were income from employment, agricultural and non-farm activities, rent, remittances, and other sources.

Table 9.1 indicates that the average annual household income in Ghana was about GH¢1,217 whilst the average per capita income was almost GH¢400. The highest quintile had an average annual income of GH¢1,544 and for the lowest quintile the corresponding income was about GH¢728. This meant that a household in the highest quintile had an income that is about twice as much as that of a household in the lowest quintile. The annual per capita income in Ghana was about GH¢397 implying that a Ghanaian lived on an average income of less than GH¢1.10 per day.

Table 1: Mean annual household and per capita income by quintile group

Quintile	Mean annual household income (GH cedis)	Mean annual per capita income (GH cedis)	Mean household size	Percentage Share of annual income
Lowest	728	116	6.4	8.9
Second	1,020	198	5.1	13.8
Third	1,098	296	4.4	16.1
Fourth	1,263	359	3.7	21.8
Highest	1,544	688	2.5	39.4
Ghana	1,217	397	4.0	100

Source: Ghana Living Standards Survey report of the fifth round (GLSS5), 2008.

At the regional level, Greater Accra had the highest average annual income of GH¢1,529 that is higher than the average national income of GH¢1,217 (Table 9.2). This is followed by Northern and then the Central. Upper West, Upper East and Volta regions had the lowest mean annual income of less than GH¢1,000. In terms of per capita income, four regions had an annual per capita income above the national annual average (GH¢397) with Greater Accra recording the highest GH¢544. Upper West and Upper East regions had average annual per capita incomes of less than GH¢130 while Northern and Volta have per capita incomes less than GH¢300.

Table 2: Households by quintile, Mean annual household and per capita income by region

Region	Quintile						Mean annual household income (GH Cedis)	Mean annual per capita income (GH Cedis)
	1	2	3	4	5	All		
Western	5.8	16.7	18.5	23.1	35.9	100.0	1,222	393
Central	7.0	13.7	21.0	23.8	34.5	100.0	1,310	464
Greater Accra	4.6	9.1	15.5	24.7	46.1	100.0	1,529	544
Volta	12.7	23.2	21.4	20.3	22.4	100.0	913	272
Eastern	4.9	14.3	23.1	25.7	31.9	100.0	1,145	379
Ashanti	7.9	14.6	16.3	22.3	38.9	100.0	1,149	410
Brong Ahafo	11.0	19.8	21.1	21.5	26.5	100.0	1,202	443
Northern	32.9	20.7	15.4	15.3	15.6	100.0	1,452	296
Upper East	54.8	19.1	13.0	7.2	5.9	100.0	616	124
Upper West	76.7	12.5	5.3	2.4	3.1	100.0	606	106
Ghana	12.6	15.5	18.2	21.6	32.0	100.0	1,217	397

Source: Ghana Living Standards Survey report of the fifth round (GLSS5), 2008.

The table further reveals that Greater Accra Region is better off than the other regions, with almost 50 per cent of its households falling within the highest quintile, and a much lower proportion of households (about 5%) within the lowest quintile. Ashanti follows with almost 40 percent and nearly 8 percent of its households within the highest and lowest quintile respectively. On the other hand, Northern, Upper East and Upper West had

much lower proportions of households ranging from 15.6 percent in Northern to 3.1 percent in Upper West in the highest quintile and high proportions of households ranging from 32.9 percent in Northern to 76.7 in Upper West in the lowest quintile. This indicates very high incidence of poverty in the northern parts of the country.

Main Fuel For Cooking

The usage pattern for energy in Ghana was similar to that of many developing countries. Traditional fuels such as firewood and charcoal provided the bulk of energy for cooking followed by gas. According to the GLSS 5 data, wood was the most popular fuel use for cooking, 55.06% of households followed by charcoal (28.72%). Only 8.94% of households used gas. All other sources, for example electricity, kerosene and other forms of fuel for cooking were used by the remaining 7.28% of households as shown in table 3. Again in the urban households (52.6 %) used charcoal as their main fuel for cooking, 17.83% used wood and about 20% used gas whereas firewood is the main source of cooking for rural households (80.2%) as shown in table 4, charcoal was used by only 11.62% of rural folks.

Table 3: Share of numbers and percentages of household's cooking fuels for the income quintiles

Main Fuel Used for Cooking	Quintile					Total
	1	2	3	4	5	
Electricity	1 0.07	3 0.21	3 0.20	6 0.35	10 0.39	23 0.26
Gas	7 0.46	24 1.70	43 2.86	135 7.86	568 22.35	777 8.94
Kerosene	1 0.07	2 0.14	5 0.33	8 0.47	33 1.30	49 0.56
Charcoal	129 8.53	252 17.87	398 26.43	669 38.94	1,047 41.20	2,495 28.72
Wood	1,229 81.28	1,052 74.61	1,003 66.60	819 47.67	680 26.76	4,783 55.06
Crop Residue/Sawdust	122 8.07	42 2.98	15 1.00	4 0.23	2 0.08	185 2.13
Others	23 1.52	35 2.48	39 2.59	77 4.48	201 7.91	375 4.32
Total	1,512 100.00	1,410 100.00	1,506 100.00	1,718 100.00	2,541 100.00	8,687 100.00

Table 4: Share of numbers and percentages of household’s cooking fuels for rural-urban correlation

Main Fuel Used for Cooking	urban/rural - corr		Total
	urban	rural	
Electricity	19 0.53	4 0.08	23 0.26
Gas	721 19.93	56 1.10	777 8.94
Kerosene	41 1.13	8 0.16	49 0.56
Charcoal	1,906 52.68	589 11.62	2,495 28.72
Wood	645 17.83	4,138 81.63	4,783 55.06
Crop Residue/Sawdust	1 0.03	184 3.63	185 2.13
Others	285 7.88	90 1.78	375 4.32
Total	3,618 100.00	5,069 100.00	8,687 100.00

The results confirm much of the household energy research that was reviewed earlier in this paper. When income is low, wood dominates the energy used for cooking, with some gas and very little kerosene (Figure 1). As household’s income goes up, share of charcoal and gas goes up. This confirms the positive relationship between charcoal or gas and income. However, wood had a negative relationship for all income levels in Ghana

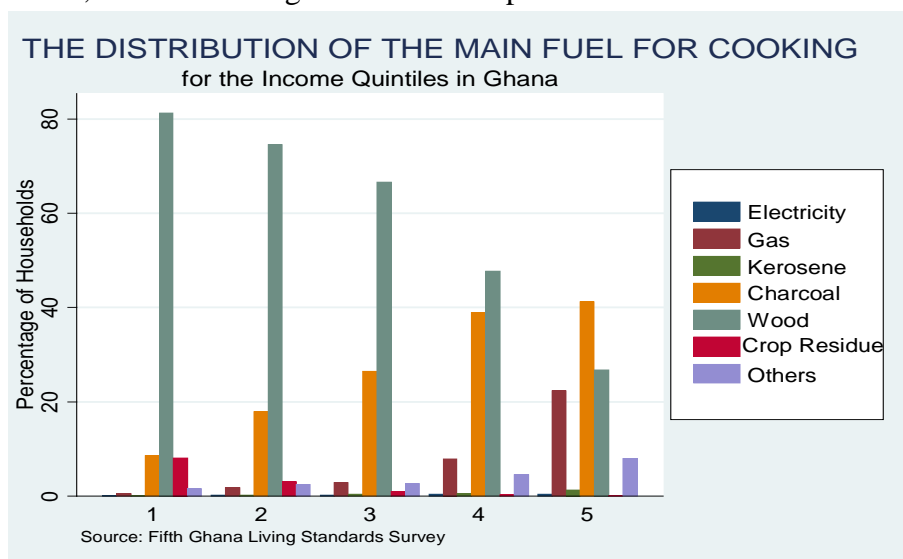


Figure 1: Percentage of household’s cooking fuels for the income quintiles

Table 5: Share of numbers and percentages of household's cooking fuels for the regions in Ghana.

Region	Main Fuel Used for Cooking							Total
	Electrici	Gas	Kerosene	Charcoal	Wood	Crop Resi	Others	
Greater Accra	13 56.52	399 51.35	22 44.90	630 25.25	77 1.61	0 0.00	116 30.93	1,257 14.47
Ashanti	1 4.35	164 21.11	7 14.29	517 20.72	758 15.85	1 0.54	126 33.60	1,574 18.12
Central	0 0.00	42 5.41	1 2.04	226 9.06	403 8.43	0 0.00	17 4.53	689 7.93
Western	3 13.04	56 7.21	5 10.20	265 10.62	491 10.27	0 0.00	14 3.73	834 9.60
Eastern	3 13.04	44 5.66	6 12.24	249 9.98	581 12.15	0 0.00	31 8.27	914 10.52
Brong Ahafo	0 0.00	27 3.47	1 2.04	185 7.41	558 11.67	0 0.00	24 6.40	795 9.15
Volta	1 4.35	29 3.73	5 10.20	176 7.05	499 10.43	0 0.00	10 2.67	720 8.29
Northern	2 8.70	6 0.77	0 0.00	123 4.93	643 13.44	0 0.00	21 5.60	795 9.15
Upper East	0 0.00	2 0.26	1 2.04	80 3.21	326 6.82	184 99.46	7 1.87	600 6.91
Upper West	0 0.00	8 1.03	1 2.04	44 1.76	447 9.35	0 0.00	9 2.40	509 5.86
Total	23 100.00	777 100.00	49 100.00	2,495 100.00	4,783 100.00	185 100.00	375 100.00	8,687 100.00

At the regional level, the use of wood is shown to follow the general national trend for the three poorest regions, thus, decreasing usage as income levels increases, the other seven regions do not show any trend (Figure 2). However the seven other regions of the country do not show any pattern. Also, charcoal, shown in figures 3, did not reveal any pattern in three northern regions, but their usage in the other seven regions increased as level of income of households increased.

Gas is revealed in figure 4 to be strongly related to the income levels of households for the income quintiles and all regions of Ghana. This means that as long as gas is available and affordable in all the ten regions of the county, it is the most preferred fuel for cooking. Wood on the other hand is the most used cooking fuel for the poorest in the three northern regions and charcoal is the adapted cooking fuel for the rich in all the other seven regions of the country.

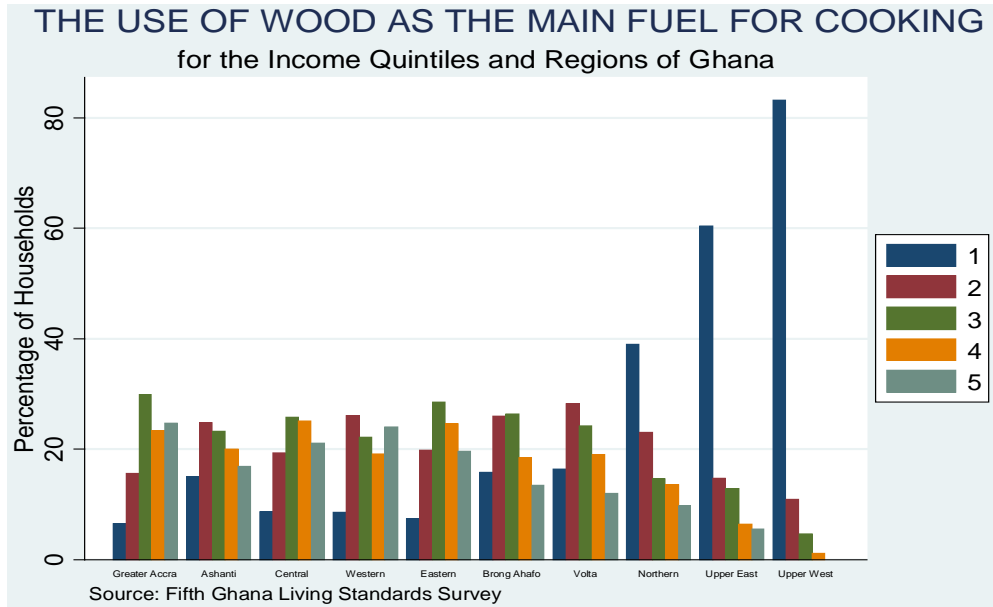


Figure 2: Percentage of households using wood as cooking fuel for the income quintiles and regions of Ghana.

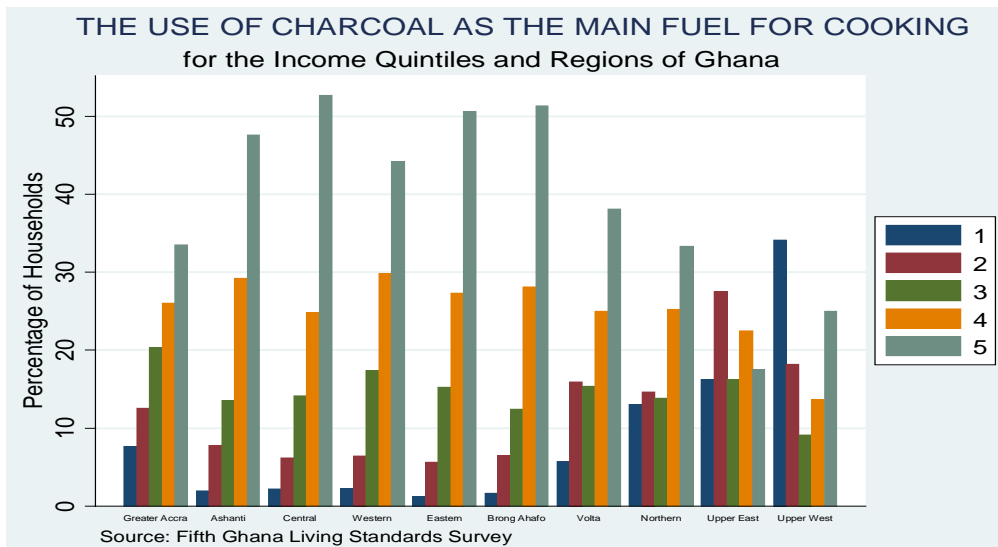


Figure 3: Percentage of households using charcoal as cooking fuel for the income quintiles and regions of Ghana.

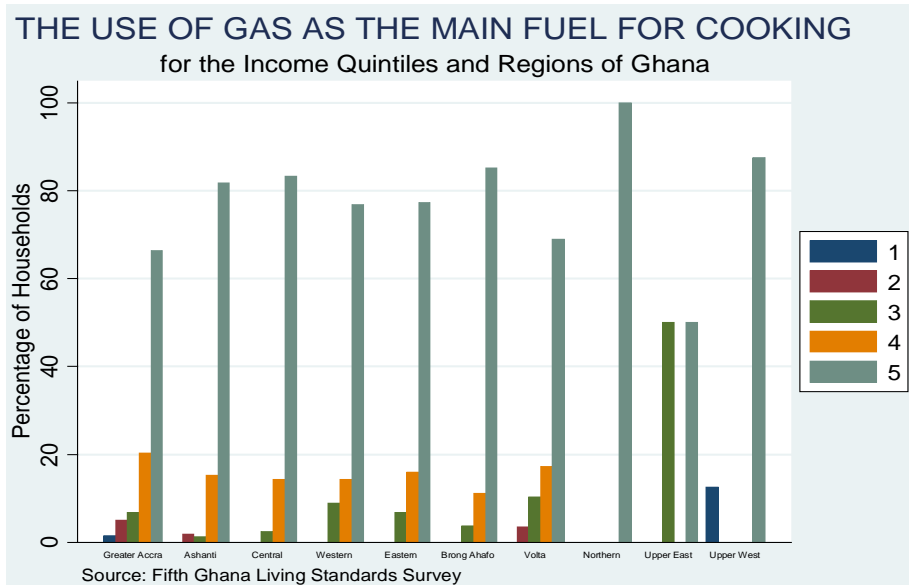


Figure 4: Percentage of households using gas as cooking fuel for the income quintiles and regions of Ghana.

Main Source Of Lighting

The main sources of lighting used by most households in Ghana were kerosene lamp and electricity, 45.88% of households use electricity while 52.32% use kerosene lamp as their main source of lighting as shown in table 1. The use of solar, generator, gas lamp and candles together make up the remaining 1.8%. The same table is obtained for the 10 regions except the three poorest regions of Ghana, northern, upper east and upper west, table 2. Almost four-fifth 79% of households in urban areas has electricity for lighting as against 23 % of households in rural areas.

Table 6: Percentage of household’s main source of lighting for the income quintiles in Ghana

Main Source of Lighting for Dwelling	Quintile					Total
	1	2	3	4	5	
Electricity (mains)	11.84	30.85	39.71	54.37	72.41	45.88
Solar	0.26	0.07	0.00	0.06	0.04	0.08
Generator	0.00	0.00	0.07	0.00	0.00	0.01
Gas Lamp	0.53	0.57	0.46	0.47	0.31	0.45
Kerosene	84.59	68.09	58.76	44.00	26.17	52.32
Candles	0.53	0.21	0.73	0.52	0.67	0.55
Others	2.25	0.21	0.27	0.58	0.39	0.70
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 7: Percentage of household’s main source of lighting for rural- urban correlation

Main Source of Lighting for Dwelling	urban/rural - corr		Total
	urban	rural	
Electricity (mains)	78.52	22.59	45.88
Solar	0.03	0.12	0.08
Generator	0.00	0.02	0.01
Gas Lamp	0.33	0.53	0.45
Kerosene	19.60	75.68	52.32
Candles	0.91	0.30	0.55
Others	0.61	0.77	0.70
Total	100.00	100.00	100.00

Although the share of kerosene as the main source of lighting in Ghana goes down with increasing income, that of electricity has a positive relationship with income levels, Graph 4. At the regional levels, electricity was generally accepted as the main source of lighting as income grows, except for the upper west and upper east regions, whereas as income of household goes down the share of households using kerosene lamp increase in the three northern regions but does not follow any trend in the other regions of the country. It can be noted from graphs 6 and 7 that, generally, electricity is the most used form of energy for lighting as long as it is available and affordable in almost all the regions while kerosene is a preserve for the lowest income earners in the three poorest regions of Ghana.

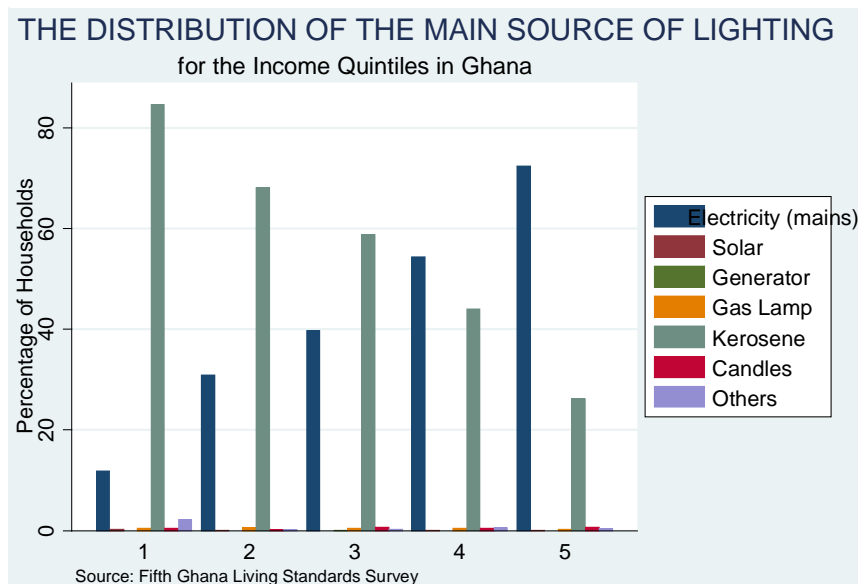


Figure 5: Percentage of household’s source of lighting for the income quintiles

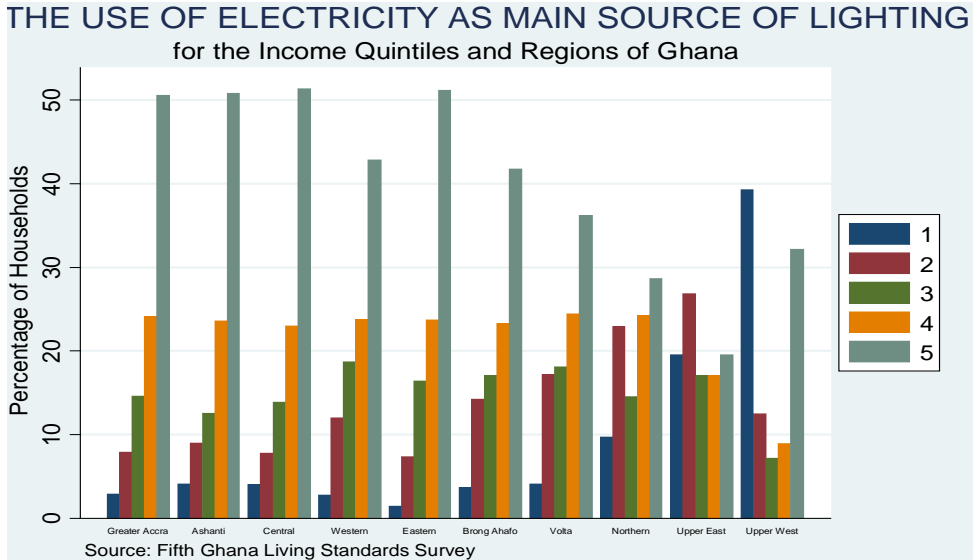


Figure 6: Percentage of households using electricity as main source of lighting for the income quintiles and regions of Ghana.

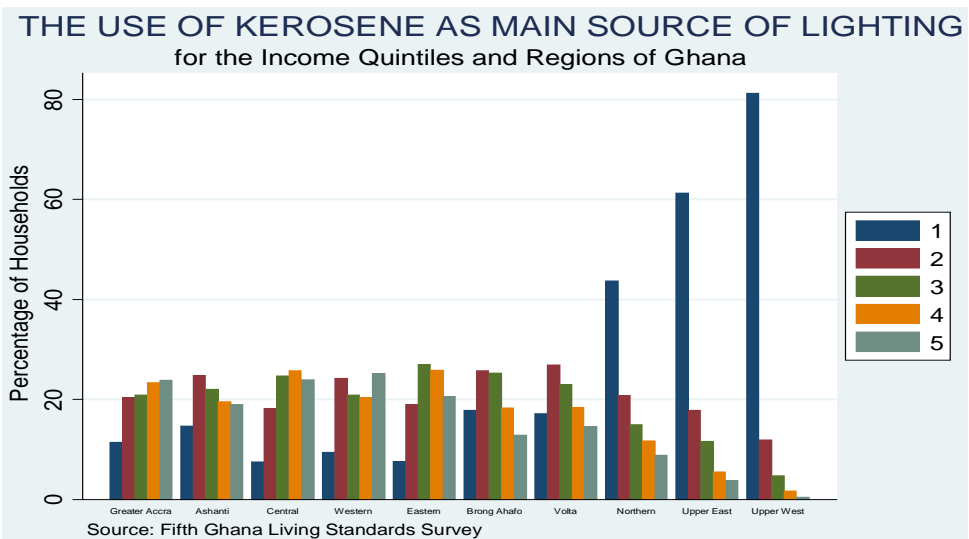


Figure 7: Percentage of households using kerosene as main source of lighting for the income quintiles and regions of Ghana.

Conclusions

The purpose of this study was to establish the relationship between energy consumption and income levels in Ghana. The central hypothesis in this study was whether the level of income influences the use of modern energy sources for cooking and lighting. Our results show that biomass remains the most used fuel for cooking in Ghana with wood being the most

preferred in the rural areas of the country. Charcoal and gas are predominantly used in the urban areas of Ghana. Similarly, the main source of lighting in rural areas of the country is kerosene as opposed to electricity in the urban areas.

These results imply that as the level of income increases the demand for modern forms of energy will simultaneously increase. Charcoal and gas for cooking and electricity for lighting follow this general trend. On the other hand, share of households using wood for cooking and kerosene for lighting decreases as income levels increases. These trends are also realized at the regional levels except for the three northern regions of the country.

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