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Energy Poverty: Exploring Households Energy Constraints and Coping Strategies. Case Study of Sekondi-Takoradi, Ghana

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Acronyms

CO2	Carbon Dioxide
EC	European Commission
ECG	Electricity Company of Ghana
EU	European Union
GHc	New Ghana Cedis
GHGs	Green House Gases
GDP	Gross Domestic Product
GNP	Gross National Product
GRIDCo	Ghana Grid Company
GSS	Ghana Statistical Service
HDI	Human Development Index
IEA	International Energy Agency
IMF	International Monetary Fund
ISSER	Institute of Statistical, Social and Economic Research
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goals
NDPC	National Development Planning Commission
NED	Northern Electricity Department
NES	National Electricification Scheme
OECD	Organisation of Economic Cooperation and Development
SSA	Sub Sahara Africa
TOR	Tema Oil Refinery
TV	Television
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
WEO	World Energy Outlook
WHO	World Health Organisation

WSSD	World Summit for Sustainable Development
WTO	World Trade Organisation
UN	United Nations
U.S.	United States
VRA	Volta River Authority

Abstract

Energy poverty has been recognised as one of the main impediments to achieving the Millennium Development Goals and reducing global poverty. In Africa two out of three households lack access to convenient, efficient and reliable forms of energy to satisfy their basic needs and to perform economic tasks. Many of the people rely on charcoal, firewood, residues, dung, kerosene and candles for cooking, heating and lighting. A business as usual scenario indicates that the situation is likely to remain unchanged in 2030 and may probably be made worse by climate change. The Thesis focuses on energy at the household. It explores households' experiences with energy in Sekondi-Takoradi, Ghana. It seeks to identify, understand and analyse households' energy problems and the strategies used by energy poor households to address their energy problems. I tried to understand how access or lack of access to energy for cooking, lighting, heating and cooling impacted on the wellbeing of the people. I also sought to understand how energy and gender interact at the household level. The study found that not only is infrastructure to deliver energy weak, but in cases where infrastructures are available, physical access to energy is hampered by frequent shortages of LPG, irregular supply of grid electricity, frequent power cut, high cost of energy appliances (gas burners, cylinders, improved cookstoves, prepaid meters) and affordability problems among others. These greatly affect the socio-economic activities of members of the households particularly women who have a duty to secure fuel for activities such as cooking.

Key words: energy poverty, energy security, households, gender, charcoal, gas, electricity, cooking, lighting, Sekondi-Takoradi, Ghana

CHAPTER ONE

"It is an alarming fact that today – in the 21st century there are still billions of people without access to electricity or clean cooking facilities. The ambitious goals that have been set to eradicate extreme poverty can never be fully realised without acknowledging and confronting this fact" (World Energy Outlook, 2010:3)

1.1. Introduction

This Thesis is about households' energy access, consumption and challenges in Ghana. Precisely it focuses on energy poverty and energy security related issues among households living in Sekondi-Takoradi, Ghana's fourth largest city. A major contention in the Thesis is that energy plays a critical role in a country's development and helps to improve the socio-economic conditions of the people. Therefore not having access could greatly impede not only the thermal comfort of the population but also their socioeconomic development.

The above statement in *italics* by World Energy Outlook (WEO) captures the growing interest worldwide in energy related issues. The growing interest in energy globally is due to the recognition that the global energy system is faced with three daunting and yet pressing challenges (Birol, 2007). First Energy Security is back on the global agenda fueled by massive energy demand from countries that are not members of the Organisation of Economic Cooperation and Development (OECD) such as China and India with many importing countries expressing serious concern about its impact on economic security, raising potential for conflict between major importers especially China and the United States. The second issue, which is the focus of my study, is that billions of people worldwide are energy/fuel poor and require access at affordable prices to maintain a minimum standard of living. Thirdly there is urgent need to adequately address the challenges posed by human-induced global warming and climate change so as to avert catastrophe in the future (Birol, 2007). From these

three perspectives, energy is seen as central to issues such as global security, human security, climate change, environmental security, food security, poverty reduction, job creation, health, education, and achieving the UN Millennium Development Goals (MDGs) (Tagoe, 2010). In other words energy has extraordinary relationships with all the three major components of sustainable development i.e. the economy, social welfare and the environment (Nussbaumer, et al., 2011:1). There is therefore recognition globally for a balance of these three dimensions. The quest for a balance has led to calls for countries to adopt sustainable energy initiatives; develop and deploy renewable energy and low carbon technologies; and to put together strategies that will enable societies globally to reduce energy demand, use energy more efficiently and use energy from renewable and low carbon sources.

1.2. Background to the Study: the Energy situation from Global to Africa to Ghana

As noted above one of the reasons why energy has come to dominate global agenda is the sheer number of people globally who live in "energy poverty" or "fuel poverty" defined as "inability to cook with modern cooking fuels and the lack of a bare minimum of electric lighting to read or for other household and productive activities at sunset" (Modi et al., 2005). This is the adopted definition in the Thesis. About 0.2% or 3 million people in OECD and transition economies do not have access to electricity at all. In Britain about seven million households or 18% of the total households face fuel poverty especially during winter. In the developing world electricity access rate is 72%. Altogether nearly two billion people (or about 20% of the global population) have no access to electricity and additional two billion people have access to unreliable electricity (Johansson, 2011:47). Those without access or with limited access to electricity rely on candles, kerosene and other traditional sources of fuels for lighting. Additionally, more than 2.6 billion people worldwide also cook and heat using biomass (charcoal, firewood, dung, coal, straws, grasses and other solid fuels) usually on open fires or traditional stoves (Hutton et al., 2007; WEO, 2010:9). These billions of people who have little or no access to electricity and clean cooking facilities do not benefit from the economic and social opportunities that access to modern energy brings. They rely on energy resources which while limiting their productivity and economic fortunes, also expose them to dangers, diseases and sometimes death. The social and economic inequality as well as the marginalisation they face are worsened by their lack of or limited access to modern energy services. Their lack of access to modern energy services therefore trap them in a vicious cycle of poverty too difficult for them to escape. This suggests that energy poverty and economic poverty negatively influences and impacts one another (Chevalier and Ouédraogo, 2009).

That is their lack of access to modern energy services limit their economic fortunes while their limited economic situation limit their ability to afford or access modern energy services. There are therefore calls for energy poor countries to address the problem (Modi et al, 2005; 2010; Nussbaumer, et al., 2011; Parajuli, 2011).

Africa is considered one of few places where energy poverty is dominant. The literature on energy indicates that in spite of abundant renewable and non-renewable energy resources including solar, wind, hydro, coal, crude oil, natural gas, bitumen, and uranium (Omorogbe, 2010:3), Africa is the second continent after Asia where huge populations are without access to electricity and modern cooking services. According to Prasad (2011: 248) eighty percent of the Sub-Sahara Africa's population still cooks with woodfuels on open fires because they have no access to modern fuels or cannot afford them. This represents 24% of people worldwide who cook with woodfuels.

Also two-thirds of SSA population has no access to electricity (WEO, 2010:9; Prasad 2011:248). This makes up about 41% of the world's total population who are without electricity. In 2009 for example about 587 million people in Africa were identified to have no access to electricity. Two million of those resided in North Africa while 585 million resided in Sub Sahara Africa (SSA) (WEO, 2010:9). It is projected that the overall number of people in SSA who will be without access to electricity will be 700 million by 2030. Compared to other regions, by 2030 SSA will remain the only major region with a substantial number of its population who will still be without access to electricity and modern cooking facilities, a problem that will present challenges to development aspirations and poverty alleviation efforts in the region (WEO, 2010:9; World Bank, 2010b).

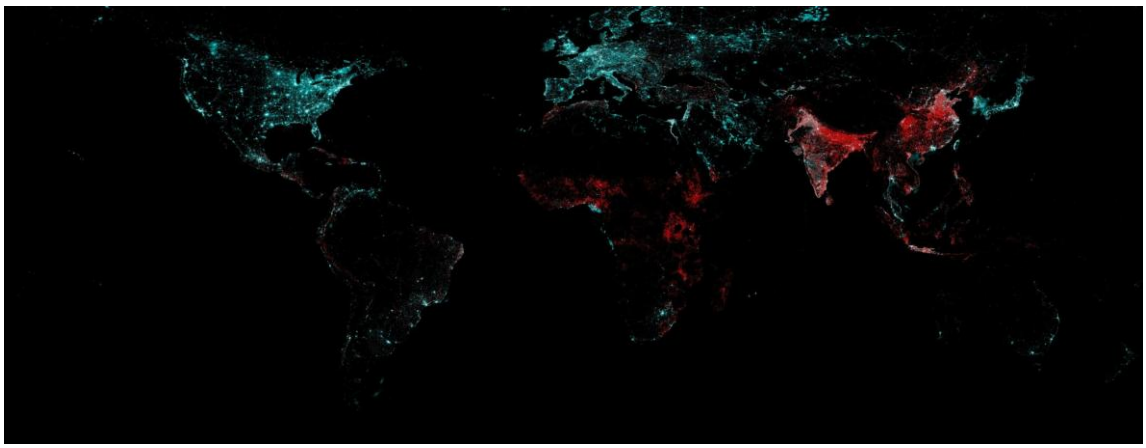

Figure 1:1 Adopted from Christopher D. Elvidge et al., (2010:25)

Thus when access to electricity is considered from perspective of regions around the world it is recognised that SSA as a region has the lowest access rate. (Figure 1:1 illustrates global energy access by region. Red colour represents population; green and blue represent lights).

On the average 31% of the population in SSA has access to electricity (WEO, 2010:11). However, when South Africa is excluded, electricity access in the region falls to 28%, a level that is approximately equivalent to electricity consumed in the city of New York, U.S.A. This situation stands in contrast with what exists in other developing regions. For example South Asia has electricity access rate of 65 percent, East Asia and the Pacific 90 percent, Middle East 91 percent, Latin America 93 percent, and North Africa 99 percent (Eberhard et al., 2011; Crousillat et al., 2010; WEO, 2010:11; Urmee et al., 2009).

A breakdown of the population into urban and rural indicates that 46% of those living in urban areas in SSA do not have access to electricity as against 89% of populations living in rural areas (UNDP and WHO, 2009:12). What the figures show is that although more populations in rural areas lack access to electricity compared to urban populations, the fact still remains that huge chunk of both urban and rural populations lack access to modern fuel and electricity, which has implications for their welfare. However, it is important to point out that SSA is not one homogeneous region. There are variations among the countries and also within the countries with regards to energy accessibility. For example households' access to electricity in 2008 stood at 100% in Mauritius; 70% in South Africa; 56% in Ghana (Brew-Hammond and Kemausuor, 2009); 11.1% in Democratic Republic of Congo, Ethiopia and Tanzania (WEO, 2010; Eberhard et al., 2011); 5% in Rwanda, Central Africa Republic and Sierra Leone and 3% in Burundi, Chad, and Liberia (UNDP and WHO, 2009:12).

The focus of this study is on energy issues in Ghana particularly in the households. As indicated above 56% of the population has access to electricity meaning nearly 45% do not. The lack of access to electricity and other modern fuel by the 45% of the population poses serious challenges to the effort by the country to improve the socio-economic wellbeing of the people. I will discuss this further in Chapter Three but before I do so I will like to focus on research problems and why it is important to focus on energy.

1.3. Research Problem and Relevance

Sekondi-Takoradi is one of the important cities in Ghana in terms of population, economic activities and revenue generation. In recent years and particularly since oil was discovered

there in 2007 and production began in December of 2010 the city's prominence has grown both locally and internationally with researchers and particularly the media (both local and international) visiting the city, discussing it and writing about it. So it appears researchers are warming up to socio-economic and cultural issues in the city. However, few studies can be found specifically targeting energy issues in the city. In fact with the exception of surveys carried out by Ghana Statistical Service (GSS) that captured energy issues in the city, my effort to get article on the city proved futile. While contributing to our knowledge of understanding of the nature of energy situation in the city, the Thesis is intended to contribute to fill the gap. The study will inform us about households' energy sources and the problems or otherwise associated with these sources; the problems households face as they try to access energy and the strategies they adopt to overcome the challenges.

1.3.2. Research Question and Research Objectives

There are four relevant research questions for the study which are: (1) What are the sources of households' energy in Sekondi Takoradi? (2) What problems do households in Sekondi Takoradi face regarding energy? (3) Does energy poverty exist in Sekondi-Takoradi? 4) What strategies do households use to handle their energy scarcity? The first objective is to explore problems associated with energy consumption in the city. The second objective which is linked to the first objective is to analyse energy security among households. The third objective is to see how energy consumption is pattern changing. The fourth objective is to explore households' perception about access to modern energy services.

1.4.1. The Study Area: Sekondi-Takoradi

The study takes the form of a case study. It is focused on the city of Sekondi-Takoradi which doubles as the capital of Sekondi-Takoradi Metropolitan Area and also the capital of Western Region, one of the ten administrative regions in Ghana. In 2010 the city's population was estimated to be about 379,385 with a household average of 4.7. Sekondi-Takoradi has a total land area of 337 square km and it is one of the 17 administrative districts in Western Region. It is bounded by Shama Ahanta District to the East, Wassa East District to the North, Ahanta West District to the West and the Gulf of Guinea to the South (Ghana Health Service, 2010:8). Sekondi-Takoradi is important for other reasons: it is the epicentre of Ghana's burgeoning oil and gas production industry. It is the fourth most important city in Ghana in terms of population and industrial activities. It is home to Ghana's second harbour. The discovery of oil along its shores in 2007 has added another dimension to its profile and is

currently called 'The Oil City'. Figure 1.2 below gives the national and regional location of the Sekondi-Takoradi.

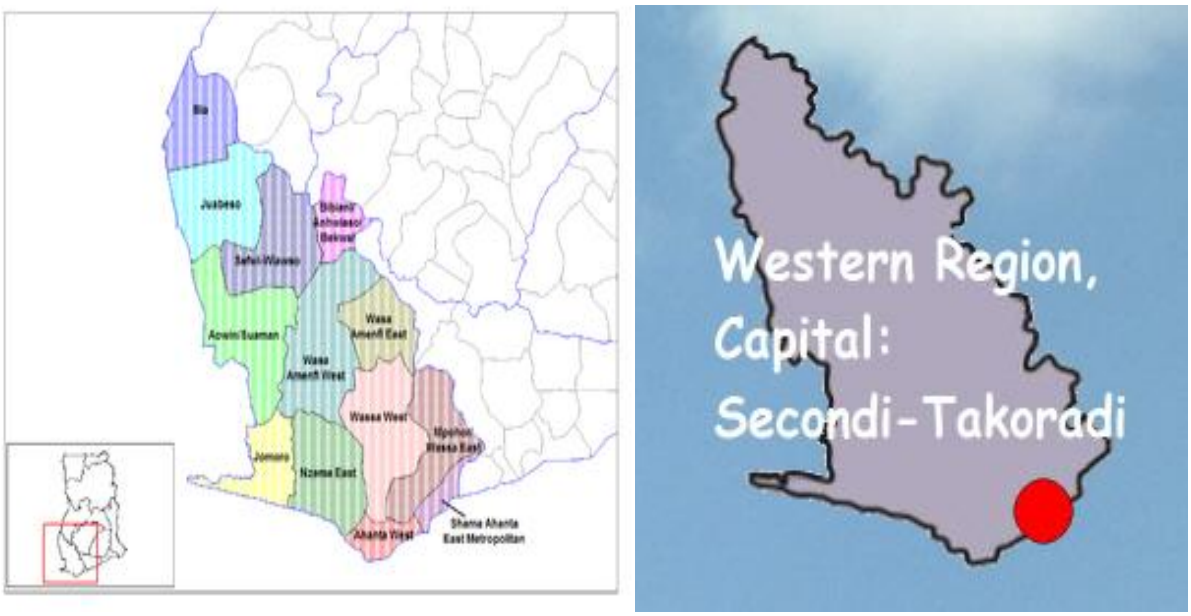

Figure 1:2 location of Sekondi-Takoradi in Ghana (Ghana Health Service, 2010)

Due to the oil and gas activities it is reported in the media to be the destination of migrants hoping to reap some of the benefits that oil and gas activities are bringing to the country. The focus on Sekondi-Takoradi emanates from my earlier experiences in the city during my trip to the city to conduct research on the visions of the stakeholders in the city regarding the new oil find and the way forward. In my first night in Takoradi in August of 2011, electricity in the hotel where I was staying was cut off in the middle of the night. The manager later explained that he had been having problems with the Electricity Company of Ghana (the main electricity retailer in Ghana) and had decided to use generator to complement power received from ECG. Unfortunately his generator could not work for hours without shutting itself down and so the rest of the night was spent in darkness. He therefore advised that I move to some other hotels whose electricity supply may be reliable which I did. My first night experience is something that is played out more often in many cities in Ghana even though officially the cities are supposed to be the best served in terms of electricity. During the six weeks that I stayed in the city I got to know that although households in Sekondi-Takoradi have physical energy infrastructures such as electric poles and cables connected to the national power grid they lacked electricity in their homes. This explains my reason to choose the city and to focus on households. The question I asked myself was if businesses like hotels are struggling with energy what is the situation like for households.

1.5.1. Methodology

I decided that the study would consider energy issues at the household level and therefore would not consider energy poverty at the business level. This I hoped would give me enough time to look in detail at what is happening in many homes and to analyse whether households are energy poor or not. At the household level two main indicators were considered: the lack of or no access to electricity; and lack of or access to modern cooking energy and technology or the reliance on the use of biomass and traditional technologies for cooking. By lack of cooking energy and technology I mean modern cooking stoves, which also include biofuels, gas and electric stoves as well as advanced biomass cookstoves or biomass gasifier-operated cooking stoves which run on solid biomass, such as wood chips and briquettes (WEO, 2010). I explored the sources of household energy (charcoal, gas, firewood, electricity, kerosene). I explored the problems that confront households as they try to access energy. I looked at whether households used traditional biomass or modern cooking techniques. The traditional use of biomass refers to the basic technology used such as a three-stone fire or inefficient cookstoves (WEO, 2010). Focus was placed on reliability of supply and affordability. I intended to tackle my research questions using both qualitative and quantitative as the main research method. I thought both methods are helpful for my study as it would be able to help address the questions raised in my research questions. Looking at my research objectives, I also thought both methods could help to reconcile the research questions with the research objectives. Qualitatively the method I used included semi structured interviews, 'participant' observation which was complemented with quantitative data from secondary sources. Thus I considered this approach to be effective to guarantee a good research results (Alvesson and Sköldberg, 2000:2). The analysis of the study adopts a methodology that is inclined towards descriptive analysis where I try to describe the energy situation in the city as expressed by respondents.

1.6.2. Ethical considerations

Ethical issues are important for every study and mine will not be different. There are many reasons for having a strong ethical framework for my project. One of them is that ethical consideration will have a protective function both for me and the research subjects. First of all to ensure that my research will not have negative impact on my study area including the people who provided me with information, I gave serious consideration to my choice of language, tone, intensions, assumptions and its effect on my subjects. One other reason why I

adhered to ethical framework was that as Cousin (2008) puts it would be 'facilitative' that is it would add credibility and acceptability to my studies and its findings. Bernard (2006:78) argues that researchers ought to be careful not to participate in research whose outcome will hurt people. He also advised the researcher to be honest and reflexive and ask questions about the research questions. Fonow and Cook (2005:2218) define reflexivity as the tendency of researchers to "reflect on, examine critically, and explore analytically the nature of the research process". Cloke et al., (2004:22) argue that being reflexive means the "researcher must reflect much more explicitly upon their own research endeavours than hitherto, giving careful consideration to precisely what it is that they are doing in their own projects: the conceptual, practical, political and ethical implications arising for these projects, for themselves, for the people and places under study, and perhaps even for society more generally". Taken Russell, Cloke et al., Fonow and Cook suggestions on reflexivity into consideration, I decided to reflect critically upon my own position, background, values, interest, attributes political views as bound up with my own personal geographies (the sites, localities and networks of my own biographies), vis-à-vis the people and the place under study (Cloke et al., 2004:29). As Alvesson and Sköldberg (2000:5) have argued researchers ought to be reflective about what they produce as knowledge. In this sense I have tried to be open, honest and sincere and careful about what I have written, how I wrote it, my interpretations, and what I have presented as findings as well as my assumptions, taken-for granted such as familiarity with culture and language. While on the field I tried to respect the values of the people. I thoroughly explained my research purpose to the people who participated in the study and promised to seek their consent should there be the need to mention their names and even that I will strongly weigh the impacts of mentioning their names in the thesis. I was aware of the positionality and power relations that existed between me and the researched and was careful not to take it for granted. In a nutshell I have reflected ethically throughout the whole process of the Thesis from planning to data collection, interpretation, analysis and writing.

1.6.3. Limitation of the study

The study was limited by several factors including the time. The study also focused entirely on households and therefore excludes businesses. An inclusion of businesses could have given deeper knowledge of the extent of energy problems or otherwise in the city. The findings in the Thesis cannot be generalized and hence are not a representation of the situation in the entire country. It may differ from region to region and from locality to other.

1.6.4. The structure of the Thesis

The rest of the Thesis is organised into five chapters. Chapter Two looks at the theoretical issues regarding the relationship between energy and development. It also looks at key conceptual issues including energy poverty, energy security, energy access, affordability and demand. Chapter Three focuses on the study area i.e. Ghana and Sekondi-Takoradi. It discusses electricity, gas and biomass, the main avenues through which households meet their basic energy needs. Chapter Four is about the field work. It captures the statements, expressions and views of households regarding fuel supply, accessibility, consumption, cost, challenges and other related issues. Chapter Five forms the analysis part of the Thesis. It reconciles the field work with the theories, concepts in the line with prevailing literature on energy poverty. Chapter Six is the concluding part of the Thesis and it summarises the work as presented in chapters one to five.

CHAPTER TWO Theoretical and Conceptual Discussions

In this chapter I look at the theoretical and conceptual issues within the Energy and Development discourse including the concepts of energy poverty and energy security; energy access, affordability and how they have been defined and interpreted.

2.1. Energy and Development

The relationship between "energy" (defined as "the ability to transform a system" (Smil, 2008a: 12–13)) and "development" (also defined as a "process of material improvement" (Caroll, 2010) or "improvements in well-being, living standards, and opportunities" (Edelman and Haugerud, 2007:86)) has been the subject of scholarly debate for decades. Some scholars hold the view that the link between energy and development dates back to some 5000 years ago (Carbonnier, 2011). Some of these scholars (who belong to the development school of thought) tried to establish the link between energy and economic development and human wellbeing by analysing the relationship between the exploitation of the various sources of energy and the economic development (particularly the stages of development). Their analyses led them to believe that human history could be divided into periods based on the kind of energy used (Wilk, 2002). They argued that the foundation of modern societies was laid when humankind began to employ their own energy (human energy/muscles) for their own development. As time progressed humankind began to domesticate fire, animals and plants and harnessed their energy for development. Humankind also harnessed wind, solar,

water energy and after several thousands of years developed steam engine and nuclear fission for the benefit of humankind. Netting (1993) notes that the "discoveries and inventions that tapped larger sources of energy were the prime engines of change providing not only more material goods but a higher standard of living". According to this line of thinking, humankind employed two strategies in their quest to develop. First they harnessed powerful forces of nature, brought them under their control, and made them to work for them. Second they harnessed energy using new technologies and also by improving the efficiency of old ones (Wilk, 2002). Some scholars of development school of thought believe that the use of technology for exploitation and utilisation of energy for development account for the differences and diversities in societies across the globe (Carbonnier, 2011).

Some other scholars (who belong to the development economics school of thought) tried to establish the link between energy and stages of a country's development by analysing the relationship between the exploitation of the various sources of energy and the development that is associated with it. Schurr (1984) and Toman and Jemelkova (2003) who belong to this school have tried to advanced the concept of energy and development arguing that energy development (referred to as increased availability of energy in quantity and quality) is central to the theory of economic development. In their conceptualisation of energy and development Toman and Jemelkova (2003) contend that increased availability of energy is a key stimulus of economic development at every stage of the development ladder. They point out that, at the lowest level economic development, energy sources tend to come from biological sources (wood, dung, sunlight for drying). Economic activities carried out by humans also tend to be humanly powered. Energy at this level remains abundant and cheap in terms of cost. At the intermediate stage of economic development the sources of energy tends to come from processed biofuels (charcoal), biogas, animal power, and some commercial energy. Energy production begins to undergo stages of development aided by technology which helps to deliver energy in the form desired by industry. At the more advanced stage of economic industrialisation and development commercial fossil energy (gas, coal, oil, nuclear) and ultimately electricity become the predominant source of energy.

From development theoretical strand energy is argued to be central to human society and therefore lack of it is seen as a problem that has to be overcome for a country and its people to make progress. It is argued that all things being equal, development or societal transformation is impossible to take place or will face uphill task if there is little or no access to energy (Omorogbe, 2011:122). Empirically, it is the industrial revolution (originating in the 19th

century) which unquestionably sealed the relationship between energy and development (Carbonnier, 2011). Looking closely at what Grinevald (2007) has called "thermo-industrial revolution" the developmentalists argue from socio-epistemological and anthropological standpoint that the industrial revolution would not have occurred without the twin pillars of energy and technology (Carbonnier, 2011). They argue that the development of the steam engine powered by coal or wood mounted on wheels and metal rails, marked the turning point in human progress especially in Western Europe and North America. The steam engine for example revolutionised land and sea transport, compressed space–time --just as air travel has reduced space–time in the 21st Century-- and eventually opened up Africa, Asia, and North and South America for colonisation (Carbonnier, 2011). In the early part of the 20th century, the processing of crude oil on an industrial scale and the development of engines that could run on refined oil added new momentum to the human experience. After the Second World War, the development of complex technologies combined with oil, gas has further deepened transformation of societies and brought the entire human race into one global village.

2.2. Critique of Energy and Development

Critiques of the energy and development concepts have questioned the role of energy in national development. For example scholars like Andre Gunder Frank argue that categorisation of countries into developed and underdeveloped fail to capture the complex historical, economic, political, social and cultural regimes and systems under which such nations have been governed in the past or are governed at present. Frank (1996) points out that "we cannot formulate adequate development theory and policy for the majority of the world's population who suffer from underdevelopment without first learning how their past economic and social history gave rise to their present underdevelopment". Thus we cannot exclude for example the political decision making process from the discourse of energy and development, neither can we ignore the global economic, political and social environment within which countries have to operate. For example global energy market is highly dominated by the rich consuming nations like U.S, Japan, Canada, and the E.U. Due to the size of their economies, its dependence on oil and gas and the need to ensure energy and economy security, the global energy market is influenced greatly by the actions and behaviour of the big energy consumers sometimes to the detriment of the poor countries. Pohjola (2006:xvi) for example notes that "10 per cent of the world's richest population receives 54 per cent of global income". This wealth allows them to build strategic oil and gas stocks and reserves that can last for about 114 days and therefore shrug off any negative impact as a

result of price increases. The poorer consuming countries like Ghana cannot afford such strategic stocks and reserves and therefore seriously bear the consequences of any price hikes. The best they can afford is 60 days or at best 90 days. Additionally speculative activities of oil and gas traders from the rich consuming countries (London and New York) and intense competition between them for energy resources always make prices volatile/unstable putting off gear planned budgets of the poor countries. The poor consuming countries cannot fairly compete with the rich countries in paying for energy. Some countries in the global south spend huge chunk of GDP on oil and gas imports, a problem that has led to trade imbalances and huge debts. The debts and trade imbalances have often resulted in small quantity of oil and gas being imported for energy generation. This further creates economic problems for the poor countries. Thus the existence of a world energy market dominated by few rich countries and their multinationals unfairly limits the capacity of the poor consuming countries to meet energy needs of their people. This partly accounts for the huge energy poverty in countries like Ghana.

The role of technology in eliminating fuel poverty has been acknowledged worldwide (Toman and Jemelkova, 2003). However, like oil and gas, most of the technologies in the energy sector are developed and the market controlled by countries in the global north particularly the U.S., E.U., Canada, Japan, and recently China. For example the development and production of wind and solar technologies-- that could potentially help to reduce energy poverty in the global south -- is dominated by major companies in the global north. These companies hide behind patent rights to demand higher prices and make the dissemination of the technologies to poor but needy countries impossible. Similarly most of the world's major oil and gas companies are based in the global north. They include the giants like Shell, British Petroleum, Chevron, ExxonMobil, Total, and Statoil among others. They use their immense financial, information and technological superiority to lobby their governments and the World Trade Organisation to support global energy policies that work to their advantage but which unfairly make it difficult for energy companies in the global south to operate. They for example dominate energy exploration, development, extraction, distribution and marketing not only in the global north which is their traditional domain but also in the global south.

At the same the existence of fuel subsidies in rich consuming countries and the removal of such subsidies in the poor countries-- at the insistence of the World Bank and the International Monetary Fund (IMF) -- increase fuel prices in poor consuming countries. This makes fuel a luxury for the few rich and explains why large populations in countries of the global south do

not have access to fuel for lighting and cooking. They simply cannot afford. Although a large majority of the population in the global south disapprove of their governments removing the subsidies as it endangers and threatens their livelihoods, the immense pressure, sanctions, and sometimes blackmail exerted by the IMF and World Bank on the governments makes it suicidal for them not to kowtow to the demands of the international financial institutions.

In other words the governance of the global energy architecture is dominated and controlled by actors of the global north whose immediate priority is to satisfy their constituencies and hence their national security. Thus the unequal global distribution of income, wealth, economic, technological and political power; neoliberal economic policies of the World Bank, IMF and the WTO has a greater role in determining energy accessibility and affordability especially in developing economies. These issues at the global level translate into energy insecurity and energy poverty at national and also the household levels.

2.3. Energy Poverty

Energy poverty is defined by Modi et al., (2005) as the "inability to cook with modern cooking fuels and the lack of a bare minimum of electric lighting to read or for other household and productive activities at sunset". Modi et al., definition clearly indicates people's willingness to cook their meals with modern cooking services but due to lack of it they cannot do so. It also refers to "absence of access to convenient, reliable, efficient and modern energy technologies to satisfy the basic needs that can support human and economic development" (Parajuli, 2011). They are without "access to modern energy services" defined as "household access to electricity and clean cooking facilities i.e. clean cooking fuels and stoves, advanced biomass cookstoves, and biogas systems" (WEO, 2010). However, it was particularly silent on the issue of affordability and reliability and how sustainable the energy should. Energy sustainability here refers to energy produced and used in ways that support human development over the long term, in all its social, economic and environmental dimensions (Ottinger, et al., 2000:11). These concerns were addressed by Reddy (2000:44) who defined Energy poverty as 'the absence of sufficient choice that allows access to adequate energy services, affordable, reliable, effective and sustainable in environmental terms to support the economic and human development' (Reddy 2000:44; Chevalier and Ouédraogo, 2009:115). With regards to above definitions a household is referred to as "Energy Poor" where supply of reliable and convenient source of energy is unavailable to carry out even the basic tasks (Parajuli, 2011). Energy poverty also applies to households that

rely heavily on biomass and who also depend on open fire and three-stone technology for cooking. In some other situation a household is described as energy poor if the income it spends on energy exceeds certain percentage of its total income after tax. In this regard income is the main determinant of whether a household is energy poor or not. In the United Kingdom for example government qualifiers fuel poverty households as "any household spending more than 10% of income (after tax) on energy" (Warmer Healthy Homes, 2011). Per the definitions, energy poverty can be seen as an obstacle to economic development and socio-economic wellbeing of the people who experience it, but it is also associated with economic poverty. It concerns people that have low income, low energy consumption and no or limited access to modern energy services (Chevalier and Ouédraogo, 2009:115). Socio-economically, households that face energy poverty face problems that limit their opportunity to increase productivity, improve their living condition, fight poverty and enjoy life to the fullest. For these households, the day finishes much earlier than those with access to electricity and modern lighting facilities and must do almost all their economic activities during the day. They spend precious hours grinding or pounding corn, wheat, millet, cassava, tomatoes, and pepper using stones or sticks (Birol, 2007:3). Sometimes they have to inconveniently travel several kilometres to towns where milling machines are available. They are unable to preserve food and essential medicines due to lack of electricity to power refrigeration equipments. Those appliances that they do have (e.g. radio and television) are powered by batteries, which eat up a large share of their incomes and time because they have to either constantly recharge or replace them when they cannot be recharged. The income generation efforts of the adults members of the household mostly women suffer as precious time is spent collecting firewood. Thus the lack of access to modern energy services and use of charcoal and firewood turns to exacerbate the income loss and income inequality between and within households. Moreover, the farther the women go in search of firewood the more the risk of attacks and assaults**.** Similarly education development and achievement also suffer as children join their mothers in the firewood gathering exercise. Students and teachers in such households struggle to study or prepare lessons by candle light. Devices such as computers, printers, scanners, photocopiers, that aid learning in schools are often not used due to absence of electricity to power them (Birol, 2007:3).

2.4. Energy Security

A key concept within the energy poverty discourse is "energy security". However, the term energy security is used by different people to mean different things and accordingly, it has

geopolitical, military, technical and economic dimensions (Bielecki 2002). The IEA (2001) defines Energy security as the reliable supply of energy at an affordable price. Bielecki (2002) defines it as "reliable and adequate supply of energy at reasonable prices" while Umbach (2008:1) refers to it as "adequate, affordable and reliable supplies of energy". Adequate and reliable supply means continuous or unterrupted supply of energy to meet demand. On the other hand reasonable price is a more difficult term which has no universal acceptability. In economic terms it would mean market-clearing price in a competitive market where supply and demand balances (Bhattacharyya, 2011:464). It can be observed that the above definitions look at energy security only from supply side and ignore energy security from demand side. At the same time it fails to differentiate between domestic supply security and external supply security. While Security of energy supply means, the capacity of any given country to have access to adequate, affordable and reliable supplies of energy (Geoffron and Rouhier 2009:68), security of demand means the availability of adequate, reliable and sustained market for energy produced. Thus energy security means not only energy at all times in various forms, in sufficient quantities, and at affordable prices but also having market for what is produced (Ottinger, et al., 2000:11). The above definitional concerns is addressed by the European Commission (EC) which defines energy security as "the ability to ensure that essential future energy needs can be met, both by means of adequate domestic resources worked under economically acceptable conditions or maintained as strategic reserves and by calling upon accessible and stable external sources supplemented where appropriate by strategic stocks." Thus EC's definition incorporates supply from both domestic and external sources. It also views building strategic reserves and stockpiling of energy resources (e.g. oil and gas) to meet future demand as very important to achieving security. As noted by Lin-Heng and Youngho (2004) energy security also means "ensuring a safe supply route for the import and export of oil, as well as ensuring a safe and adequate infrastructure for the import of natural gas; requiring sufficient stockpiles by power generation companies and suppliers of fuel oil; utilizing the market-based system in the generation and sale of electricity; ensuring the safe and efficient transmission and distribution of energy to the various sectors; ensuring the efficient use of energy and the elimination of wastage". Thus according to Song (1999) 'Energy security may be achieved when a state is able to minimize vulnerability to resource supply disruptions, access reliable energy at reasonable and/or market driven prices, and consume resources that least damage the environment and/or promote sustainable development'.

What can be observed from the various definitions is that there is vagueness in the definition of the concept of energy security, however key issues that cannot be overlooked are the issues of affordability or ability to pay; availability or adequate access at all times; and reliability of supply and sustained market for energy produced. Energy security includes not only security of domestic supply and security of foreign imports, but also security of demand, security of infrastructures, security of investments, security at production sites, security of power transmission lines and transportation lanes, security of personnel engaged in energy production as well as political climate. It involves replacing insecure supply sources with secure supply sources (Hughes, 2009:2460). It takes into account what in future is likely to occur including price volatility, market instabilities, system failures as well as threats to production, transportation and distribution infrastructures. The concept of energy security connotes the idea that households in Sekondi-Takoradi need regular and reliable supply of energy at all times but that they must also be able to afford the energy they consume which must be sustainable and must not lead to degradation or pollution of the environment.

2.5. Affordability

The concept of affordability is based on the premise that the ability to use any modern fuel is dependent on the energy-users' ability to afford not only the energy-using appliances but also their ability to pay for the fuel on a regular basis. For example having a gas cylinder (the appliance) is one thing and being able to buy gas on a regular basis is another thing. In another related example having your house wired is one thing and being able to pay your electricity on regular basis another. In poor households for example this can be an issue hence many of them tend to rely on cheap technology and cheap fuels to meet their energy needs (Bhattacharyya, 2011:509). Thus affordability can also create disruptions to supply. Affordability also limits companies' ability to expand their networks of infrastructure into areas where electricity and gas is most needed especially in the rural areas where population is scattered and ability to pay is relatively lower. Thus energy poverty is not only a problem of electricity or LPG not being available but also a problem of having the ability to afford it when it is available. Households that do not have the means to buy LPG will most probably rely on biomass as the alternative.

2.6. Energy and Gender

In this section I discuss the relationship between gender and energy as pertains to the study. Gender, as a concept, refers to the socially, culturally, and politically constructed ideas and

practices of what it is to be female or male. It contrasts with the concept of sex which uses biological attributes to categorise someone as male or female (Reeves and Baden, 2000; Clancy et al., 2011). According to Parikh (1995) the concept of gender and its relationship with energy is still hotly contested with some academics claiming that all human beings irrespective of whether "he is a he or she is a she" needs energy and that there should be no distinction between energy for women and men. Parikh (1995) some analysts and academic scholars argue that energy is there for all to use. Therefore if it is there for all to enjoy then hat difference does it make who uses it. Others, mostly feminists and development practitioners disagree arguing that energy needs for men and women are different and therefore policies must address these different needs. They contend for example that the energy required by men and women in the home and in the business environment is not the same and therefore policy must aim at taken care of energy needs by both genders (Karlsson, 2007). UN-Energy (2005) notes that access to energy services is particularly important for women, given that energy services and technologies are not gender neutral. The lack of modern fuels and electricity reinforces gender inequalities. Gender issues are therefore to be integrated in energy planning and implementation processes and infrastructure development programmes just as in for example health programmes. In other words gender sensitivity in energy needs to be considered. The feminist school of thought argues that energy is important for women's health, work and education and for reducing the time women spend on household tasks especially in societies where fuel provision is the duty of women (Parikh, 1995). Therefore policies must reflect these issues to ensure equity. Gender equity recognises that women and men have different needs and interests, and that to achieve equality in life outcomes, a redistribution of power and resources is required (Reeves and Baden, 2000; Clancy et al., 2011).

CHAPTER THREE The Study Area

3.4.1. Ghana and the Study Area (Ghana and Sekondi-Takoradi)

This chapter focuses on three leading energy sectors where information is available: electricity, LPG, and Biomass (charcoal and firewood).

3.4.2. Electricity

According to Institute of Statistical, Social and Economic Research (ISSER, 2005:2) in the last 20 years demand for electricity in Ghana grew at the rate of 10 to 15 per cent annually

and still continues to grow. Demand for the electricity produced comes from several sources including households, mining companies, Volta Aluminium Company (VALCO) as well as Benin, Burkina Faso and Togo. Power is first generated by Volta River Authority (VRA) who then sells it to Ghana Grid Company (GRIDCo) for transmission. GRIDCo then sells it to ECG and Northern Electricity Department (NED) distribution to households, commercial and industrial users. More than half of ECG and NED electricity is consumed by households who use it for such purposes as lighting, refrigeration, air conditioning, ironing, television, radio, water heating, and cooking using electric cookers. Majority of these appliances are used by the upper and middle income consumers in the urban areas (ISSER, 2005:1). According to ISSER (2005) and Sackey (2007) demand for electricity far exceed supply and to meet the growing demand the VRA imports about 250 MW from Ivory Coast to supplement generation.

In the late 1980s and early 1990s a commitment was made by the government to expand the coverage of electricity in the country over a 30 year period under National Electricification Scheme (NES). Several projects were established under the NES to ensure that the northern part of the country which previously had no connection to the national power grid would have access to electricity. Electricity access was thus increased from 28% in 1988, to 32% in 1992 and 43.7% in 2000 (Kemausuor et al., 2011). Access rate is estimated to have increased further to 54% in 2007, 55% in 2008 and 56% in 2009 (Brew-Hammond and Kemausuor, 2009) making Ghana the fourth country in sub-Saharan Africa, after Mauritius, South Africa, Cape Verde with higher access rate. A closer look at the current access rate reveals that in spite of the increased in access rate in the country, nearly about 45 per cent of the population does not have access to electricity. According to Ghana Statistical Service (GSS, 2008) a disaggregation of the 45 percent shows that about 27% of the people in rural areas have access to electricity as against 79% in cities, towns and other urban centres. However ISSER (2005:1) notes that there is a mark difference in access rate in rural areas as one move from the coast (27%) to forest zone (19%) and in northern savannah (4.3%). The reasons for low access to electricity in rural areas is explained in terms of dispersed nature of the rural population and low population density (particularly in Northern Ghana); low income levels in rural communities making return to investment unfavourable; significant distances required for medium-voltage lines; the costs of medium and low-voltage; cost of transformers, as well as lack of comprehensive policy to give priority to rural energy (Kemausuor et al., 2011:5148). The GSS (2008) noted that the 73% of households in rural areas who are without

electricity rely on kerosene as the main source of energy for lighting. Similarly about 19.7% of households in cities and towns who are without electricity also use kerosene for lighting, while 0.3% and 0.8 % of households also use gas lamp and candles/torches (flashlights) respectively (GSS, 2008:70). Thus from the GSS figures it is not difficult to notice that the effort to increase electricity access in the country was skewed in favour of the people living in towns, cities and other urban centres. However, the 79% access in towns and cities does not also give a true picture. The UN Habitat note that the access rate in cities are also skewed in favour of the rich with poor urban neighbourhoods, informal settlements and slum areas constituting a significant proportion of urban zones without access to electricity. This inequality in the cities between the poor and the rich is one of the reasons why this Thesis is focused on the city of Takoradi.

3.4.3. Liquefied petroleum gas (LPG) and cooking

The over exploitation of forest and its implications such as desertification, has seen Ghana adopting a proactive policy towards the development of LPG. The government in 1990 launched the National LPG Programme and the Tema Oil Refinery was drafted into the production of LPG in the country. A campaign was subsequently launched in the country with the aim to get urban households, public institutions requiring mass catering facilities and the informal commercial sector including small-scale food sellers to patronise the use of LPG as alternative to charcoal and firewood (Kemausuor et al., 2011). LPG consumption doubled in 1992 and by 2004 consumption had increased to more than 65,000 tonnes per year from nearly 45000 tonnes in 2000. By 2007 consumption had reached more than 103,000 tonnes. In 2003, there were 98 LPG filling stations in Ghana of which 64 were located in the Greater Accra region with Upper East and Upper West regions having only one station each. Thus the distribution of LPG filling stations was skewed in favour of Greater Accra and Ashanti regions (Kemausuor et al., 2011:5145). The wide gap in LPG distribution between regions in the north and south prompted the government to seek financial support from the United Nations Development Programme (UNDP) under its Rural LPG Challenge programme. This helped the government to relaunch the LPG campaign programme in 2004 with much of the emphasis being placed on the three northern regions. A national survey conducted by Kemausuor et al (2011) in early 2011 indicates that there are currently more than 200 LPG filling stations in the country. Although the campaign was described as successful (Kemausuor et al., 2011), only 6% in 2004, 9% in 2005 (GSS, 2007; Ministry of Energy, 2006) and 9.5% in 2008 nationwide had access to LPG (GSS, 2008). In 2008 a nationwide

survey by the Ghana Statistical Service (GSS, 2008:70) indicated that about 20% of urban households used LPG compared to 1.5% of rural households. Only Accra had a relatively better situation 34.5%. Of the total population in the country that use LPG as a primary source of energy for cooking 70% resided in Greater Accra and Ashanti regions. Thus as high as 80 to 90 percent of households in Ghana do not have access to liquefied petroleum gas (LPG) (UNDP Ghana, 2004; GSS, 2005; 2008; Kemausuor et al., 2011). The LPG programme was skewed in favour of the urban dwellers and within the urban centres access was skewed in favour of residents in Greater Accra and Ashanti Regions leaving residents in other urban centres including Sekondi-Takoradi the Western Regional capital with little access. Denton (2006) however, argues that the consumption of LPG in cities and towns was a positive development because it contributed to a considerable reduction of charcoal consumption and hence deforestation in the country.

3.4.4. Biomass

Given the little access the people have with regards to LPG, the biomass has become the main source of energy for many households in the country leading to over exploitation. Kemausuor et al., (2011) indicate that the over exploitation of firewood and charcoal and the endemic poverty levels in some parts of the country (particularly Upper East region) has led to scarcity of wood resources which has in turn led to agriculture residues being used as alternative to charcoal and other commercial fuels. The problem of firewood and charcoal scarcity in the country as indicated above has to do with rate at which woodfuel has been consumed over the years. According to Kemausuor et al., (2011:5145) as at 1985 an estimated total of 10.7 million tonnes of wood was consumed in Ghana of which 2.1 million tonnes (or 20%) was for commercial and industrial use, while 8.6 million tonnes (or 80%) was used for residential purposes. Out of the 8.6 million tonnes, production of charcoal accounted for 3.3 million tonnes while firewood took the remaining 5.3 million tonnes. Kemausuor et al., (2011) note that total primary woodfuel consumed increased from 12.1 million tonnes in 2000 to 13.1 million tonnes in 2007. The initial increase in biomass consumption was dominated by firewood whose consumption increased from 7.1 million tonnes in 2000 to 10.8 million tonnes in 2007. The consumption of charcoal however increased from 5 million tonnes in 2000 to 8.5 million tonnes in 2005 and then fell to 2.3 million tonnes in 2007. The fall in charcoal consumption could be attributed to the relaunch of the LPG campaign programme implemented by the government in 2004. The LPG campaign resulted in a fall of total

biomass consumption from 13.1 million tonnes in 2007 to 11.7 million tonnes in 2008 (that is 10.7% fall), an indication that the campaign was somehow successful National Development Planning Commission (NDPC, 2010:77). The indication is that the fall could even be greater if LPG is made accessible to households living in rural areas as well as the other major cities where biomass consumption continues to be prominent.

This is particularly important since residential consumption of biomass exceeds all other sectors which itself is an indication of the limited access to modern energy services in the country and especially in many homes. The residential sector dominates as the key sector that consumes most of the woodfuel. In 2000 for example residential consumption accounted for 72.3% as against 24.5 % by industry, 3.1% commercial and service and 0.1% by agriculture and fisheries. In 2001 the residential sector component fell to 71.8% as against industry 25.9%, 3.2% by commercial and service and 0.1% by agriculture and fisheries. To avoid the negative impact of biomass consumption on deforestation and also to reduce the disease burden (indoor air pollution) attempts have been made to encourage the production and dissemination of improved cookstoves around the country. Two of the cookstoves popular among Ghanaians are the Ahibenso and the Gyapa. According to Kemausuor et al. (2011) when used the Ahibenso stove which was introduced to the market in the 1990s is able to conserve 18.4% of charcoal consumption compared to the three stone traditional stoves. Available figures indicate that as at 1993 more than 40,000 has been sold. However the introduction of the Gyapa stove in 2002 appears to have stolen the limelight from the Ahibenso. Kemausuor et al. (2011) note that as at 2006 more than 200,000 of the Gyapa have been sold, however given the rate of consumption of biomass and its impact on deforestation it is believed that more effort need to be done to get people to patronise the products. Thus in spite of the reform Ghana faces several challenges which frustrate her efforts to achieve national energy access targets and goals. These challenges include inadequate energy infrastructure to support the delivery of modern energy services and meet the growing demand; high cost of fuel for electricity generation; inadequate regulatory capacity and enforcement; operational and management difficulties in utility companies; potential vulnerability to climate change decreasing reliability of power supply; inadequate grid electricity network; low adoption of energy efficiency technology among domestic users; low involvement of private capital in the energy sector (NDPC, 2010:170).

CHAPTER FOUR Field Study

4.1. Introduction

In this section I present the field work conducted in Sekondi-Takoradi. The major themes and nuances as given by interviewees are presented. It is organised into two broad themes: energy for cooking and energy for lighting. It explores the views shared or expressed by interviewees regarding their sources of energy, the importance of energy in the households, their selection of a particular type of energy and reasons for doing so, the difficulties, challenges or otherwise of accessing energy for the most basic needs i.e. lighting and cooking.

4.2. Sources of energy for cooking and lighting

Households' energy source that is the sources from which households get their energy is one of the fundamental significant issues when considering whether they are energy poor and whether they have energy security problems. Therefore to get an idea about households' energy sources, what kind or form of energy households' use for cooking, lighting and other household activities, respondents were asked to comment on energy use in the household.

4.2.1 Sources of energy for cooking

This section deals specifically with energy for cooking. It was gathered from respondents that energy used for cooking come from three main sources gas, charcoal and electricity. These three fuel sources play a key role in all households. However gas and charcoal dominate as the two most important fuel types used by households for cooking with electricity playing a very limited role in households that chose to use electricity for cooking. Electricity for cooking is restricted to households with appliances such as rice cookers, blenders, and kettles but very few households interviewed possessed these appliances and those possessing them making very limited use of them. The limited use of electricity is due mainly to cost associated with the tariff. Because of the limited use of the electricity as fuel for cooking most of the discussion of energy for cooking is limited to gas and charcoal. It has to be pointed out also that although some households indicated that previously they used to use kerosene-stove for cooking however due to cost reasons, they decided to abandon it in favour of gas and so none of the respondents made reference to the use of kerosene as a cooking fuel. Based on the two dominant energy sources for cooking (charcoal and gas) four types of households were identified among the respondents: 1) those that use both LPG/gas and charcoal but use gas as a primary energy while charcoal is used as secondary energy source; 2) those that use both gas and charcoal but use charcoal as a primary energy while gas is used complementarily; 3)

those that use only gas; and 4) those that use only charcoal. Primary energy, as explained by respondents means using one particular type of energy more regularly except on some occasions when another type is used. No other sources of energy such as biogas were mentioned or were identified as being used by the respondents as energy source for cooking. We identified from our interviews that the households that use only gas as well as those that use only charcoal were in the minority. Yet for other households they prefer to use both gas and charcoal alternatively. The majority of the households interviewed fall into the category that use both charcoal and gas together.

4.2.2. Factors underlying household choice of energy for cooking

We tried to explore factors that underpin households' choice of fuel for cooking and we present these factors below. For many households their choice of either charcoal or gas or both depended on how much money they have (their budget), their taste and preferences, as well as their needs. Other critical factors that determined households' energy portfolio included the time, cost, suitability of appliance and technique of food preparation, the sizes of the households and its composition, the cost of appliances, cost of the fuel type, security of supply, cleanliness after use, safety issues associated with the use of certain forms of energy (e.g. gas), the quality of energy being produced (e.g. charcoal); whether or not a particular form of fuel is convenience and economical to use, and the easiness with which a particular form of fuel could be used for cooking. These factors also make households to prefer one form of energy over others. These are elaborated below.

4.2.3. Safety concern

Safety concerns, whether real or imagined underpins the reason why some households would use only charcoal or reduce the intensity in which gas is used to prepare food. Some of the households interviewed indicated that the only energy they use for cooking was charcoal. These households indicated that there are safety issues concerning LPG which informed their choice to use charcoal only. The interviewees pointed out that they were afraid to use of LPG because they had children who were not well informed or lack the knowledge as to how to safely use gas and therefore for safety reasons and to avoid any accidents they chose to use charcoal. For these households the fear that gas could cause accident which would endanger life and property underlined their choice to use only charcoal. The fear towards the use of LPG is summed up by Madam Fatima:

> "We have never used gas. We have children and they are difficult to control so for the sake of the children we do not use gas. We are afraid of the negative consequences of the gas and the children" (interview with Fatima)

4.2.4. Time, cost, suitability of appliance and technique of food preparation

According to the respondents the skills required and the appliances needed to prepare the food also determines what type of fuel to use. Additionally, the time it takes for a particular food to be prepared and the amount and cost of fuel needed also determines whether households are to use gas or charcoal. According to respondents the preparation of certain type of food including banku (prepared from a mixture of fermented corn and fresh cassava dough), palm nut soup, groundnut soup, grilling or smoking fish among others require special skills also need the use of suitable appliance. According to respondents these food types takes a long time (man hours) to prepare and also consumes a lot of fuel (both gas and charcoal). It therefore requires more fuel to be able to prepare it. Since LPG is relatively expensive, households prefer to use charcoal instead of LPG to prepare banku, palm nut and groundnut soup, grill and smoke fish. In other words households like to conserve LPG for foodstuffs that can be prepared within a short time and which does not also consume more fuel. For larger households preparing these types of food require more fuel which place financial burden on them. With regards to banku (a mixture of corn and cassava dough), palm nut soup, groundnut soup many households pointed out that they use charcoal because it enables them to better cook the food. Although LPG can equally cook these foods, the amount of time and fuel needed make the LPG not a favourable candidate for such foods. In the case of banku the skill needed, procedure and method required for preparation in order to make it edible makes it difficult for it to be prepared using gas burner. This is because the gas burner does not have the supportive equipment that coal pot has. To better prepare banku, fermented corn dough and fresh cassava is mixed with water and placed on fire and while on fire the watery cassava dough and maize product has to be continuously stirred to make sure it mixes well. After several minutes of stirring, the watery mixed-dough becomes thick which needs further stirring to make sure it becomes smooth when eating. It is at this stage that the use of the gas burner becomes difficult. Households wishing to prepare banku using the burner will have to do so by using one hand to hold the pot firm while the other is used to stir. For larger households preparing banku on a gas burner can be very stressful, frustrating and difficult. The difficulty in stirring the thick banku on gas burner makes many households to opt for charcoal-fired coal pot that can be supported with two iron metal on each side of the cooking pot. Linda, a 34 year old trader argues that she does not use gas to prepare certain types of

food such as banku because it requires more energy. According to her using gas to prepare food takes a long time to cook causes the gas to run out fast and therefore charcoal is used as a strategy to conserve gas.

> "I use charcoal to prepare banku, because it requires more energy if you use gas. The gas burner is down but you cannot use the two metals that are usually used to support the cooking pot [iron cast] when stirring the banku. You cannot put the cooking pot on the gas burner and stir it with one hand. Even if the gas burner is on the table you cannot unless you use place it on coal pot with those two metals supporting it so that it will help you to be able to mix the banku well so that it does not spoil. If you want to use the gas burner to prepare banku, you can only do so bit by bit because you are using your hand to support it while stirring it. It is not easy when you use gas to prepare banku but the moment you place it on coal pot oh it becomes easy. I think that is one advantage that charcoal has over gas" (interview with Linda).

Thus depending on the type of food being prepared and the amount of energy to be consumed LPG or charcoal may be used.

4.2.5. The sizes of the families or households

It is observed from the interviews that the sizes of the families or households play an important role in determining whether a household will use particularly only gas or both gas and charcoal. Many of the respondents indicated that single families and smaller households do not usually prepare large meals and therefore foods such as banku can be prepared using the gas burner. In this case these households usually stick to only one source of energy until during times of shortages when they try to find alternatives. On the other hand large families require large meals to be prepared and foods such as banku cannot be prepared on gas burners unless prepared in smaller quantities. In such households a combination of gas and charcoal is used depending on what type of food is being prepared. From the interviews larger households would use coal pot and charcoal to prepare banku, palm nut and groundnut soup and smoke fish because according to them it is less stressful and more convenience than using the gas burner.

4.2.6. Taste and preferences

As indicated above majority of households interviewed indicated that they use both gas and charcoal for cooking. Even that the interviewees indicated that they have their own preference even though charcoal and gas are used regularly in the household. Majority of households that use both charcoal and gas preferred gas over charcoal. This category of household also argued that the use of charcoal frustrate them and give them a lot of stress. They also argued that the ash produced during the use of charcoal causes dirt in the house which give them additional

work to do after cooking. Furthermore they pointed out that the smoke usually generated by charcoal creates inconvenience in the house and therefore they have to bring the food preparation outside to reduce its harmful effect. Many of those interviewed also pointed out that they prefer to use gas over other types of energy for cooking including charcoal, and kerosene citing reasons such as gas being convenient, being fast in food preparation, being clean (meaning it does not dirty the kitchen after use), and being cost effective and economical (gas last more than charcoal and amount of money spent on charcoal is more than gas for the same period). These factors based on preference are elaborated below.

4.2.7. Economic, cost effectiveness and duration of the fuel

Other households based their choice and use of fuel on the economics, cost effectiveness and duration of the fuel. For these households however LPG is their preferred choice of fuel for cooking. According to these households the need to save money is at the heart of their decision. Linda referred above, pointed out that she and her household prefer the use of gas over charcoal for cooking other foods other than banku, soup because:

> "Gas is cost effective because for example if I buy a small cylinder of gas let us say 15.20 GHC I could use it for two months but comparing charcoal everyday if you buy 1 cedi that two months is how much. Let us take it like 60 days. 1 cedi multiply by 60 days is equal to 60 GHC new Ghana cedis. This is more than what one pays for gas. Another thing is that nowadays the charcoal is very scarce and is dear [expensive]. If you buy one cedi worth of charcoal you cannot use it to prepare even soup and at the same time boil yam, cassava, rice or something like that. You have to buy at least 1.50 cedis or 2 cedis before you can be able to do whatever you want to do. But if you use gas papapapa then you go" (interview with Linda)

According to Mrs. Anene her household prefers the use of gas because it lasts longer than charcoal i.e. it is economical. However for some interviewees gas is not all that economical when the cost of appliances (cylinder, gas burner) and lack of buying in smaller quantities are married together. For low income households they prefer charcoal because it meets their budget. For most poor households coming up with the initial funds to buy the gas cylinder and the burner can sometimes be the most difficult moment in their attempt to access LPG. The issue of how cost is a factor is highlighted below under the heading 'Energy Cost and cost of appliances'.

4.2.9. Gas as a modern fuel

Some households prefer to use LPG only for the simple reason that they consider it to be modern while charcoal was considered to be outmoded and old fashioned. According to Ms.

Doris a 45 year old trader her choice of gas as fuel for cooking is due to the fact that she considered charcoal to be old fashioned:

> "First of all I think charcoal is outmoded. Secondly the use of gas is very economical" (interview with Ms. Doris)

4.3.1. Having control (regulate) over fuel during use

Much of the energy generated using charcoal is wasted because the coal pot appliance is not covered heat generated is lost. It is one of the major reasons why many households have to buy more charcoal. Although some households are adopting the much improved coal pot, the cost of the improved coal pot put the low income households off. The inefficient use of charcoal makes it less economical compared to gas making some households to opt for gas. Ms. Emelia her household prefers the use of gas not only because it is economical and lasts longer but also it is easy to control or regulate when cooking. She is able to turn the valve on and off at will without having to stress herself. According to Ms. Emelia her household prefers the use of gas not only because it is economical and lasts longer but also it is easy to control or regulate gas when cooking. She is able to turn the valve on and off at will without having to stress herself.

4.3.2. Cleanliness after use

Other households also based their choice of fuel for cooking on its cleanliness after use. Many of the respondents indicated that any time they use charcoal they have to constantly clear the ash from the kitchen. The charcoal too could stain the kitchen walls (see figure 4:1) while the smoke could turn the kitchen wall into thick dark. This problem of dirt associated with charcoal led many respondents to prefer gas.

Figure 4:1 Charcoal makes the kitchen dirty/black (picture by author)

On why she prefers gas over say charcoal, Ms. Doris, a 45 year trader at the Market Circle, argued that her household prefers gas because "charcoal makes kitchen dirty". Nana Adwoa, Mary and Anene and two unmarried brothers Steven and James argued that they prefer the use of gas to charcoal because the latter generates smoke and dirt in the house.

> "Charcoal brings a lot of dirt to the house. The ash makes the kitchen and veranda dirty. As soon as you start cooking then the place begins to the get dirty" (interview with Nana Adwoa). "The use of charcoal brings smoke inside the house but when we put the coal pot outside it does not bring much problem" (interview with Mary and Anene).

4.3.3. The use of gas is fast and convenient

For some households the use of charcoal is not only time consuming but can be frustrating and that let them prefer gas over charcoal. The amount of time and energy used by households to prepare charcoal for cooking was found to be of great concern to households. Many households cited time and the long process required to prepare charcoal as a major reason why they preferred LPG. Mrs. Johnson, Emelia, Comfort and Linda offered their opinion about the convenience of gas.

> "Using gas makes it quicker for me to prepare food. If I want to use charcoal for example I will have to use kerosene, pour it on the charcoal before lighting it and then wait for the fire to grow before I can cook or I will have to find some old rag and use it to light the charcoal. But if I use gas I am able to finish whatever I am doing on time and then go to the market to start trading. The children too are able to go to school on time. So in my opinion the gas is good for me" (interview with Mrs. Johnson).

Thus for households their preference of fuel for cooking is informed by the time they will have to use in preparing food. Linda further indicated that her household uses gas because of the environmental benefit. "Gas is convenient and its use also contributes in saving the forest" she says. Thus according to the Linda, the use of gas also has environmental benefit. However from conversations with households and interviewees environmental benefit of using gas did not appear as a major reason for households and neither the health benefit of any form of energy was cited as a reason for choosing a particular form of fuel.

4.3.4. Low quality of charcoal in the Market

For other households however, it is the quality of charcoal being sold in the market that let them prefer gas. According to some households the quality of charcoal on the market is so low that they need to buy more to be able to prepare food. According to Mrs. Emelia the quality of charcoal being sold in the market has degraded in quality over the years. She claimed that all kinds of wood are being used to produce charcoal with some of the wood

being of very low quality. She argued that the problem is due to shortage of wood and government restriction on cutting wood for the purpose of making charcoal. Corroborating Emelia's point, Maame Kesewaa notes that:

> "Some of the charcoals are made from poor wood and so burn very quickly. Even if you buy 10,000 old Ghana cedis [1 GHC new Ghana cedis] it cannot cook your palm nut soup for you. No matter how much you buy it cannot help you to cook your food. Some of the charcoal too takes a very long time to light up. You can be frustrated by it" (interview with Maame Kesewaa)

Some however see the use of gas as enhancement of social status in society. Asked why she preferred gas to charcoal Ms. Doris mentioned above said: "charcoal is outmoded".

4.3.5. Some households prefer Charcoal over gas

However not everyone is enthused by the charm of gas. There are households which indicated that they preferred the use of charcoal. The households offered several reasons which included availability of improved cook stoves as alternative to gas, safety use of charcoal, regular supply of charcoal, taste of food prepared, and ease of purchase, (customised or able to buy in bits according to ones budget). The availability of the improved cook-stoves (figure 4:2B) on the market including Gyapa, Ahibenso which eliminate some of the problems associated with the old cook stoves (figure 4:2A) make some households to use charcoal. The improved cookstoves reduce households' fuel expenditure, allows food to be prepared on time, prevent the spread of ash and dirt and above all give households ability to regulate/control the heat. Some households also argued that they preferred charcoal because its supply is relatively regular compared to gas. Ms. Barnerman argued that she prefers using charcoal because the food tastes better than when gas is used.

> "I prefer the charcoal than gas because when you use it to prepare food the taste is completely different than when you use gas. The taste of food prepared using charcoal is better than gas. Again if I use Gyapa [improved cook-stove] to boil water and use gas to boil water there is clear difference. That of the Gyapa last longer before it cools down. I must say that I like food prepared on Gyapa more than gas. I use gas when I am in hurry or if want to warm food" (interview with Ms. Barnerman).

Figure 4:2A inefficient cook-stove (pictures by author) Figure 4:2B improved cook-stove

However households that prefer charcoal over gas were in the minority. Other households also prefer charcoal because unlike gas which cannot be bought in smaller quantities, households can buy any amount or quantity of charcoal they want which makes it the ideal choice for low income households. These issues are further elaborated under the heading Energy Supply security issues**.**

4.4.1. Electricity

This section looks at electricity related issues in the city. It focuses on the sources of energy for lighting, households' access to electricity, security of supply, cost, and appliances used using electricity, and households' perception about the quality of service received from electricity providers.

4.4.2. Sources of energy for lighting

According to the data presented in chapter four there are six main sources from which households get their lighting from including electricity which is supplied by the Electricity Company of Ghana through the national power grid. In addition to the power from ECG households also use gasoline and diesel to power their generators. Others also use solar lamps which are recharged using energy from the sun (see figure 4:3). The fourth source of energy used for lighting is by means of rechargeable electric batteries. Households have bought electric lamps which are recharged using electricity and then used during power outages. Candles and traditional lamps/paraffin are also used for lighting. The use of generators, solar lamps, rechargeable lamps, candles and paraffin are income specific i.e. poor households resort to the use of low forms of energy such as candles and paraffin while those with higher incomes use generators.

Figure 4:3. Solar lamp being used to address insecurity of electricity supply (picture by author)

4.4.3. Appliances used by households

In addition to lighting the interviewees indicated that they also use electricity for other purposes including watching television, refrigeration, and ironing. Thus access to electricity enables them to have access to information and entertainment and also preserve essential foods and medicines using the fridge. According to the respondents electricity is very convenient especially when used to prepare food.

> "I use the electricity for lighting, I have electric cooker, and I also use kettle. The use of electricity for cooking is very convenience" (interview with Emelia)

4.4.4. Electricity tariff

Many of the interviewees indicated that they do not use electricity for other activities such as refrigeration and ironing because of the tariff they have to pay. Some of the households do have the appliances such as fridge, iron and TV but they have intentionally refused to use it because of cost of energy. Sister Akosua cites high tariffs as the main reason why she does not use her fridge:

> "Electricity is a major issue when it comes to bills especially when you do not have your own meter and have to share with others. For example we do not have our own meter. There was a lot of disagreement as to how much each household should pay. We sat down and talked about it and apportioned the bill depending on the number of appliances one uses. As we speak now I do not use the fridge in my room simply because after we met and talked the amount of money they want me to pay is too much for me" (interview with Sister Akosua).

Explaining why she does not use TV and iron although she has them, Madam Fatima said she prefers not to use them for the reason that using them would add to her cost. "Do not talk about electricity. We spend awful lot of money buying electricity" (interview Fatima). Cost of electricity and limited household budget were identified to be some of the critical factors that determine what appliances households chose to use.

4.4.5. Electricity Access

All households interviewed indicated that they have access to electricity by virtue of their connection to the national electricity grid. Apart from lighting, the access to electricity enables them to use appliances such as television, fridges, blenders, electric cookers, which greatly enhanced the quality of life in the city. Although the physical infrastructures are there alright the sufficiency, adequacy, quality of supply, affordability, cost of appliances (e.g. prepaid meters) were raised as factors that constrain households' access to electricity. Some of these issues are considered below.

4.4.6. Prepaid meter

Some of the respondents indicated that they use prepaid meter which enables them consume according to their income. They indicated that they are never worried about tariffs at the end of the month since they pay before they consume. However, they pointed out that the prepaid meter is expensive to buy. Although it comes in sizes and in different prices the prices are beyond the reach of many of them. They said they had to struggle to raise money for the purchase. They also indicated that the process to acquire the prepaid meter is too long which creates the condition for corruption. They indicated that when the prepaid meter breaks down one could sleep in darkness or could be without electricity for months before the company comes to fix it. This creates huge inconvenience for the households and brings extra cost to them. These views are summarised in Mrs. Cynthia statement below:

> "We are now using prepaid but last month we suffered a lot. There was a fault. We did not know there must be credit on our card all the time. We used all the credit and then tried to top it up and then there was a problem. It gave us a lot of problem" (interview with Cynthia)

4.4.7. Energy Cost and cost of appliances

Cost of energy and the cost of appliances are some of the major factors that underpin households' choice of which type of energy and appliance to use for cooking. One central issue at the heart of households' energy security is being able to afford energy appliances as well as able to pay constantly pay for the fuel used by the appliance. If households cannot pay their tariffs for using electricity or cannot refill their cylinders after use then there is a problem which may affect their continuous access to energy.

Interview with households revealed that many of them have been concerned with not only their ability to buy the appliances such as prepaid meters, cylinders and gas burners but also

how to refill their cylinders and top up their prepaid cards. Many households spoke about the cost of appliances. They also spoke about high cost of electricity, as well as charcoal. The concerns they have about cost of fuel therefore influenced their choice of fuel type and in the case of gas cylinders and burners the size of the cylinders and burners. That is the money available to households (budget) determines whether they will be able to buy large, medium or small size cylinder. The same is true for the size of the burner. That is their budget determines whether they are able to afford a four–phase burner or a six-phase burner. For most poor households coming up with the initial funds to buy the gas cylinder and the burner can sometimes be the most difficult moment in their attempt to access LPG.

> "Gas burner is expensive. They come in sizes. If you want the bigger size you need more than one million cedis to be able to buy. It is about 1.3 million cedis [130 new Ghana cedis/US$65]. The smaller one cost about 600,000 cedis [60 new Ghana cedis]. It is very expensive indeed" (interview with Maame Kesewaa)

At the same time the amount of money used for electricity connections and to settle electricity bills determine whether a household could use electricity and electric appliance continuously/regularly or not. For many households high electricity tariffs restrict them from regularly using their appliances. For example before she finally settled on LPG, Madam Comfort and her household had used both electricity and kerosene for cooking. She pointed out that her electricity bills were too much for her household to pay and therefore the household made a decision to shift to kerosene which they considered economical. They further switched to gas after considering it more economical than kerosene. Many respondents pointed out that increasing cost of fuel has forced them to readjust to be able to live within their means. Madam Abiba pointed out that the cost of electricity affects her household's ability to pay. When asked to comment on her expenditure on electricity vis-à-vis LPG Madam Abiba simply responded by saying that electricity is not something she was happy to talk about. As a measure to reduce the bills on energy some households have taken steps to deny themselves the use of certain appliances which in their view add to the cost of electricity. These devices include blenders, fridges, iron and television. As pointed out by Mrs. Johnson she decided to reduce energy bills by not using certain appliances regularly or completely denying themselves the use of these devices.

Electricity is not the only form of energy where tariff has been rising. Many households indicated that gas prices have also been rising forcing them to use gas with caution. Some households pointed out that because of high cost of gas they are forced to use gas carefully so that it does not run out quickly. Also the cost of charcoal and the available household budget

determines whether a household will be able to purchase small size, medium size large size bag of charcoal. The budget of the household also determines whether they will buy in small cans. Households that can afford a full bag usually buy while those that cannot also buy in bits. In other words being able to afford is crucial to households' ability to access charcoal. Majority of the households that rely on charcoal claimed that relative to their income, cost of charcoal on the market is expensive. Mary indicates that in a typical day when they prepare food for the household they usually buy three cedis worth of charcoal which given their income they consider over the top. According to Nana Adwoa the high cost of charcoal usually compels her household to buy in small cans but also buy a full bag of charcoal when their finances are good.

> "Charcoal is expensive compared to gas. Sometimes I buy charcoal in bits but I also buy it in bags. If I buy one bag it will last about a month. The price of the bag of charcoal is 130,000 cedis [13 GHC new Ghana cedis]. The problem with the charcoal is that sometimes what you find in the bag may be too small which doesn't help at all. But buying in bags is better than buying is small little cans" (interview with Nana Adwoa)

Many of the households blame the high cost of charcoal on its scarcity. In other words unlike in the past where charcoal was abundant in the market which made the price to be relatively stable, currently the commodity is very scarce which is always pushing up prices. The scarcity is also blamed on the inability of charcoal producers to get enough wood to produce the charcoal which is also blamed on deforestation and government restriction. Thus in many households regular supply and availability of energy also forms an integral part of their choice of which energy to choose for cooking. Due to supply related problems for both charcoal and gas many households have chosen to diversify their choices by combining charcoal and gas. Almost all households interviewed indicated that to offset the supply problems linked to charcoal and gas both charcoal and gas are used as a strategy. Households that have gas as the primary energy always have at least half a bag full of charcoal and vise versa.

4.5.1. Energy Supply security issues

The definition of energy security for households places important emphasis on adequate, affordable and regular supply of energy as essential ingredients to maintaining stability in socio-economic activities of households. This is because regular supply and being able to afford have the ability not to disrupt the socio-economic life of members of the household. According to respondents regular and uninterrupted supply of energy enables them to pursue their socio-economic activities without any worry about whether they would be able to cook

food, heat, or light their homes. However, irregular supply of gas, charcoal or electricity puts households in uncomfortable position as is indicated by Ms. Barnerman who is a seamstress.

> "Three days today I was sewing [clothes] and all of a sudden the power went off. I had to stop sewing at once. Due to the irregular power supply I have also bought hand machine that I use anytime the power is disrupted" (Ms. Barnerman).

During shortages, members of the households must leave their work, education or businesses to go in search of energy for cooking and lighting. Those whose job requirement places huge demand on their time are unable to make time for this task. They are not able to join the long queues which build up at gas stations. This undoubtedly affects the quality of life. Majority of respondents indicated that their biggest worry with regards to LPG consumption comes from security of supply and cost. They asserted that they have always had problems with LPG supply, a problem they attributed to inadequate infrastructure including production, storage, transportation and distribution. Respondents also argued that supply of electricity to their homes has been irregular. Some claim that in a day they could experience electricity disruptions not less than three times, a problem they blame on the inefficiencies, mismanagement by the electricity providers. These sentiments expressed by households regarding energy insecurity (mostly supply insecurity) are captured below. Mr. Boakye, Chairman of Tailors Association for instance spoke about how the nature of his work does not permit him to join queues during periods of gas shortage. He argues that if he were to leave his business and join the queues for gas it would greatly affect his livelihood. Several households complained bitterly about frequent gas shortages and inadequate supplies which places huge burden on them and forces them adopt measures that took much of their time. The interviewees pointed out that they decided to use both charcoal and gas because sometimes they find it difficult to get gas to buy when their cylinders become empty. Thus they would shift to charcoal as soon as gas becomes unavailable or they would use both gas and energy at the same time in order to maintain constant supply of energy in the house. They added that the combination of gas and charcoal help them to avoid the problems associated with using only gas or charcoal.

> Gas makes food preparation faster but the shortage associated with it makes it use frustrating. When shortages occur, sometimes it could be about a month before supply will return. About three years ago they used to fill the cylinders and would be selling to households and supply was regular, but right now we are told that vehicles are also patronising the use of gas and have therefore raised consumption which is why shortages have become frequent (Ms. Barnerman).

According to Emelia she likes to use gas but the problem of inadequate supply makes her to use charcoal as well. She attributed her use of both gas and charcoal to her inability to get gas when her cylinder is empty. Several households at one of the suburbs of the city called the Manganese Quarters added that the infrequent supply of gas to the market forces them to shift to charcoal whose supply is relatively regular. According to Mary, she and her household have had bitter experiences with the use of gas because of supply related problems. Steven and James, two unmarried brothers argue that irregular supply of gas affects their livelihood greatly. They pointed out that although they do not cook everyday but they always have a problem getting gas to cook anytime their cylinder got empty.

> "Anytime our gas would finish there would be shortage throughout the city. The shortage is always acute when our gas finishes. We would be going looking for it but when we try and we do not get we would just come home…We simply do not cook. If we had married we would be using charcoal" (interview with James and Steven)

The problem of energy supply insecurity is not limited to gas alone. There are also problems with supply of charcoal and electricity. Electricity consumers for example indicated that their problem with electricity access is more of guaranteed and reliable supply at all times other than physical access. Many households pointed out that the erratic supply of electricity affects their programmes. Many of the households pointed out that in a typical day power could go off not less than three times.

Mr. Boafo noted that anytime his electricity supply is cut he has to send his children to buy candles. His greater worry was that irregular supply of electricity and the associated darkness creates the enabling environment for criminals and particularly armed robbers to operate in his community. He pointed out that with regards to electricity supply disruptions, his entire programme together with that of his household gets disrupted: his children cannot read, use the internet and must go to bed early. To him the insecurity associated with electricity supply creates inconveniences as well as security challenges not only for his household but also for the community. According to him with such irregular supply of electricity poor households must always have their candles and their matches ready. Sometimes the power will go off very deep in the night which causes toddlers and children to cry. Nursing mothers therefore have difficult times restraining their toddlers who are not used to darkness from crying. Some of the households blame the limited use of the available energy infrastructure and were unhappy why in spite of having the infrastructure gas and electricity supply were still inadequate. Mr. Mensah a member of Jehovah Witness commented that:

> "We have gas pipelines from Nigeria that is supposed to supply gas to the country but as we speak whether it is functioning or not nobody knows. We are still burning oil, oil, and oil at the thermal plant which is making cost of production of electricity very expensive. You can go to the thermal plant site at Aboadze; there is a brother there who can give you information about the gas and electricity situation in the city" (interview with Mr. Mensah)

The irregular supply according to the interviewees affects their social as well as economic life. Some complained of having their appliances destroyed due to the frequent yet unannounced power outages. According to the respondents they do not expect the erratic supply problem to go away soon since ECG is still grappling with major problems including funding, infrastructure, and expertise. I gathered from officials of ECG that legally the company can allow power shedding in one particular area for up to only 48 hours a year but because of difficulties some of the areas in the country have experienced power shedding for 400 hours a year. The problems according to the energy providers emanate from inadequate infrastructure, obsolete infrastructure, lack of working capital to expand infrastructure and build the capacities of their workers to increase production and efficiency in the electricity sector. For gas supply insecurity the problem we gathered had to do with problems at Tema Oil Refinery (TOR) that has the mandate to produce and supply LPG in the country. TOR has complained of lack of funds to import the raw material needed to produce LPG and therefore has not been able to keep the tap flowing all the time. Officials at TOR also indicated that there has been major competition between households, commercial drivers and businesses for use of gas. They noted that the number of drivers converting their vehicles from petrol and diesel to gas has been on the increase putting pressure on LPG which should have gone to households. Many of the interviewees also complained about poor quality of charcoal in the market as well as supply security problems. For example they expressed opinion that the quality of charcoal they use for cooking has decreased in value over the last couple of years. This they argue stems from the low quality of materials used in preparing charcoal which reduces the quality of charcoal produced. They claim since the quality of the charcoal is low it is not able to last longer when lighted. In other words the charcoal runs very fast while their food was still not cooked. This forces them to buy more charcoal which eats into their finances. They argued that charcoal producers have switched to the use of low quality wood to make charcoal due to unavailability of the once abundant better wood products. They also argued that government policies which prohibit or limit the activities of charcoal producers have played a part in the shortage of charcoal and its high cost on the market. Thus the irregular supply of energy including gas, electricity and charcoal act as a disruption for

households who are then forced to strategise in order to limit the impact the energy insecurity have on their lives.

4.5.2. Safety concerns about the use of gas

The definition of energy security also place emphasis on the safety of appliances as well as the safe use of particular resource as energy. A number of respondents interviewed indicated that they had safety concerns about the use of gas. Because of the safety fears associated with the use of LPG some households have decided altogether not to use it, while others have addressed their fears by learning how to handle gas. Those that appear to entertain much fear appear to have had personal experience about gas accidents. While some respondents claimed they have received education regarding how best to ensure safety others claim to have received no education. However there is an understanding among LPG users that care must always be taken when using gas so as to avoid accidents. According to Madam Fatima, her household has never used gas because of safety concerns.

4.6.1. Strategies to combat irregular supply of energy

So what do households do to address the energy insecurity challenges that confront them and what actions/measures do they resort to? Due to supply security difficulties several of the households interviewed spoke about the strategy they use to address the irregular supply and shortages of energy (electricity, gas, charcoal). For lighting those who can afford buy generators and then use either petrol or diesel to run it in order to generate electricity. Those with limited budget also use solar lamps that can be recharged. Others go in for rechargeable batteries that use electricity. They would charge the batteries when they have electricity so that as soon as the power goes off then it can be used in the evening. The use of candles is also popular with households especially those with low budgets. According to Mrs. Johnson some households formerly used paraffin lamps powered by kerosene to provide light and were the preferred choice by low income households but manufacturers have stopped its production which has forced the households to turn to solar and rechargeable lamps as alternative. For cooking however, the respondents indicated they use the two widely available energy resources: gas and charcoal. Since it is usually the LPG whose supply is infrequent, many of the households indicated that they use charcoal to offset the supply inadequacies associated with gas. Mr. Mensah a member of the Jehovah Witness argues that all households that use gas also use charcoal as a precautionary measure against gas shortage. He opined that frequent

shortage of gas in the city has forced households to buy charcoal in anticipation of gas shortage.

> "Every person who uses gas in the city also uses a certain amount of charcoal so that when there is no gas they can easily go back to their charcoal. Most households keep about half a bag of charcoal for the reason that the supply of gas in the market is irregular. Sometimes you can go round and round from one place to another looking for gas to buy and you will not get it. Sometimes you would look for gas for three months and you will not get it" (interview with Mr. Mensah)

To ensure regular supply of gas some households have gone extra mile to buy additional cylinders which enable them to have gas all the time.

> "I have two cylinders and I try to fill both of them. So anytime there is a shortage I do not experience it. I always have gas because of that" (interview with Kezia)

As indicated by interviewees the use of charcoal and gas, rechargeable lamps and solar lamps are strategies to reduce the inconvenience and hardship that insecurity of supply brings to them. Many of the respondents pointed out that they have been using these strategies for a very long time. Due to erratic supply of electricity many of the households have undertaken measures that will limit the impact of the irregular supply of power. The strategy employ by households to combat the persistent power supply is to acquire equipments such as small generators, rechargeable solar lantern, rechargeable electric lamps and candles. However the use of these alternatives has its own demerits. For example it brings additional financial burden to households. At the same time the rechargeable lamps that need electricity to recharge can only be used so far as there is electricity to recharge the battery. As pointed out by Mrs. Johnson above her rechargeable lamp has limited use. In other words power outages that last for more than one day could have serious impact for household especially the education needs of the kids.

4.6.2. Energy and Gender

Energy issues in the households are still women business. The women were found to responsible for ensuring that there is constant supply of energy especially gas and charcoal for cooking and lighting in the households. However, conversations with the households indicated that men are becoming involved in decision making regarding what type of energy should be used in the house and how the energy is brought to the house to be used. In particular it is observed from interviews with female members of some of the households that men were taking the responsibility of taking empty gas cylinders to the gas station, filling it and bringing them home after they have been filled. In an interview with Madam Abiba I

wanted to know how much her household spent on gas in a month but said she had no idea since it had been her husband's role. She said:

> "I do not know the price of a cylinder of gas because it is my husband who always fills it when the cylinder is empty" (interview with Madam Abiba)

There are also examples that indicate men are involved in the making decision regarding the type and kind of energy to be used. It shows that decisions of energy in the households are not entirely left to the women to make.

> "…We used to buy a bag of charcoal for about GHc5. Later on my husband said we should go and buy gas and use. When we bought the gas it lasted very long time compared to charcoal. It also helped with the preparation of food for the children so we realised it was good for us and we have since continued to use it" (interview with Mrs. Johnson)

However, the role of men in household energy decision making are still limited since women are mostly responsible for most activities requiring the use of energy particularly cooking and smoking fish.

CHAPTER FIVE Analysis

In this chapter I analyse the data presented in chapter four in line with my four main research questions mentioned in chapter two.

5.1. What are the sources of households' energy in Sekondi-Takoradi?

Households' lighting sources come from six main sources. These include grid electricity, small generators, rechargeable lamps, solar lamps and candles and traditional lamps/paraffin. Electricity is the main source of energy used by all the households captured in the study. In addition to electricity some of the households also use generators to provide electricity during power outages. Others also use rechargeable lamps, solar lamps and candles during periods of power outages. A household is able to access electricity by buying any amount it wants on its prepaid card and slot it into the prepaid meter. Thus while electricity is the main source of energy for lighting, other energy services such as generators, lamps and candles are employed by consumers especially during times of power outages. It must however be stated that the use of generators, lamps and candles by households is dependent on the income or budget of the household. High income households are able to afford small generators while middle income households rely on rechargeable and solar lamps with lower income households using candles as a supplement for electricity. Also whereas the rechargeable lamps need electricity to be able to recharge, the solar lamps can be recharged using energy from the sun. Therefore the

rechargeable lamps are of limited use since it must be recharged and absence of electricity makes it difficult for it to be recharged.

Energy for cooking also comes from two main sources: gas and charcoal though grid electricity has a limited use. Charcoal, considered to be a low fuel product because of the smoke and pollution characteristics (UN-Energy 2005; UNDP and WHO 2009) is still a dominant commodity in the energy portfolio of consumers. Majority of households either use it as primary energy or in combination with LPG. From economic development perspective the dominant use of charcoal, candles and traditional lamps/paraffin signify the development stage at which Ghana is in the economic development ladder. The limited use of electricity especially in powering appliances such as blenders mean that most task the demand the use of such appliances are done manually using human energy (Schurr, 1984; Johansson, 2011). Toman and Jemelkova (2003) note in theory of economic development that at the intermediate stage of economic development the sources of energy tend to come from processed biofuels (charcoal), biogas, animal power, and some commercial energy which in this case LPG. According to recent studies Ghana is now a lower middle income country (ISSER 2005; Sackey (2007) which conforms to the energy use in the country. Toman and Jemelkova (2003) also argue that most countries that have reached industrialisation today started by exploiting first low forms of energy sources such as human, animal and plant before moving on to others with the aid of technology. From this theoretical position it is likely that the dominance of charcoal will give way to the adoption of much improved technologies. In fact the adoption of improved cook stoves (Gyapa) in the study appears to lay credence to concept of energy transition which involves consumers moving from a low energy product to high efficient energy with the help of technology. In the study area this evolution (transition) can be observed where people formerly using kerosene have moved to gas and those previously using old cook-stoves have switched to improved cook stoves. Also some people who previously used charcoal have switched to gas and as gas safety improves those relying on charcoal may also switch to gas. This gradual switch to technologically efficient energy products (Gyapa, gas, prepaid meters) may continue as households continue to search for better technologies to deliver fuel for them. This gradual transition can be dramatic if prices of energy appliances come down. This will have positive impact on energy conservation, resource conservation and climate change.

5.2.1. What problems do households in Sekondi Takoradi face regarding access to energy?

Several problems were identified with the respondents which are similar to problems that face most households in the low income countries. These problems are analysed below. They include security of supply; access, affordability and high cost of gas, electricity and appliances.

5.2.2. Energy security

One of the major problems households raised in their conversation has to do with energy supply security. It ranges from inadequate, insufficient supply and interrupted supply of electricity, to shortages of gas and charcoal. Per the description of energy supply related problems by respondents, energy security, defined as the "adequate, affordable and reliable supplies of energy" (Umbach, 2008:1) can be considered to be a major problem in Sekondi-Takoradi. Supply of both electricity and gas, the two main modern energy sources were found to be highly irregular and unreliable and neither was it affordable to many consumers. Even charcoal whose supply is considered relatively regular, cannot be obtained by households due to shortages of wood which is the main raw material. However it is important for us to understand that the supply security problem is not limited to households. In fact the supply insecurity at the households' level is a microcosm of the bigger supply insecurity problem at the national, regional and global level (Birol, 2012). At the national level Braimah et al., (2012) identified irregular supply of electricity as a major problems complained about by industries in Ghana. Braimah et al., (2012) indicated that industries in Ghana ranked irregular and interrupted power supply as the biggest among thirteen other problems. At the global level energy supply insecurity is the driving force for higher energy prices which has in turn sparked the intense competition between major energy consumers i.e. U.S., China, and the E.U.

With regards to irregular LPG supply and higher cost as complained by the respondents, the problem comes directly from TOR which has the mandate to refine oil and produce gas for distribution. TOR like other power companies like VRA, ECG, and GRIDCo is beset with financial, technical, human and management problems that make it unable to supply LPG regularly to the market. Some of the respondents could not understand why Ghana still uses oil to generate electricity when gas pipeline has been constructed from Nigeria. The problem is that as I discussed in energy security concept in chapter two, energy security also means that in a situation where a country (say Ghana) imports its energy from another country (say Nigeria) security at the source of supply (Nigeria) must be guaranteed. Nigeria has been a

major gas supplier to Ghana through the West Africa Gas Pipeline. However, due to challenges facing Nigeria including terrorism, militancy, sabotage, technical and infrastructural problems in the energy production sector, Nigeria has not been able to honour its contract with Ghana, forcing Ghana to close down the Aboadze Thermal Plants which has affected electricity generation, transmission and distribution in the country. For Ghana to guarantee regular supply of energy to all consumers there will be the need for the country to diversify its energy mix (resources) as well as the sources of supply. Depending on Nigerian with its huge internal security challenges and regular attacks on oil and gas pipelines may continue to present challenges to Ghana. In other words the supply insecurity in Ghana comes from a myriad of sources both internal and external and must be dealt with before the insecurity could be solved.

5.2.3. Cost of energy, appliances and affordability

Another problem that came up regularly with regards to energy consumption was affordability. Affordability includes being able to buy cylinders, burners, improved cook-stoves, generators, rechargeable lamps, solar lamps, prepaid meters, charcoal. Households' affordability problems also included being able to pay for repairs or replace old appliances and also pay for the electricity consumed, as well as being able to buy kerosene, gasoline and diesel used to run the generators. The demand side of the concept of energy security argues that consumers should be able to afford the energy they consume otherwise it could ensure doom for energy providers and subsequently households. As a result affordability i.e. being able to pay for energy consumed is a greater guarantee for continuous supply of energy (Bhattacharyya, 2011). To guarantee regular returns to investment households are expected to pay reasonable prices for the energy they consume. Reasonable prices here mean prices that ensure return to investment. However, reasonable price is a contextual issue that does not apply universally (Schurr, 1984:411). For many households paying reasonable price could be the ideal situation but their socioeconomic status prevents that from happening. While efforts to get households to pay reasonable price may help energy producers to break even and even make some profit it has the potential to deny access to low income households and may switch from higher cost energy products (e.g. LPG) to lower cost but polluting energy resources (charcoal). For instance in my study Mrs. Comfort's decision to shift from the use of electricity for cooking purposes to kerosene and finally to gas as well as the decision by Madam Abiba, Mrs. Johnson, and Fatima not to use certain appliances for fear of incurring huge energy bills is a message that runs throughout the study which is also common with low

income households. It indicates that fuel-switching behaviour among the interviewees is seen to be regulated by household economic welfare relative to the costs of various energy and appliances (Hiemstra-van der Horst and Hovorka, 2008).

5.3. Does energy poverty exist in the Sekondi-Takoradi?

The third question the Thesis sought to address was whether or not energy poverty exists in the city. Energy poverty (fuel poverty) i.e. the "inability to cook with modern cooking fuels and the lack of a bare minimum of electric lighting to read or for other household and productive activities at sunset" Modi et al., (2005) does exist in the city. Frequent LPG shortages, erratic supply of electricity, high cost of appliances and affordability problems make it difficult for households to access energy for the two most basic tasks: cooking and lighting (Reddy, 2000:44). Tagoe (2010:5) partly diagnoses the problem and its impact on the nation and households. "There have been some phenomenon outside the control of household which have affected and influenced household income in Ghana. In the beginning of 2007, there were concerns over the electricity supply from the Akosombo Hydroelectric dam due to lower water levels in the Lake Volta reservoir. A situation attributed partly to climate change which has become a reality worldwide (Global warming). The situation in the Akosombo Hydroelectric power plant led to power rushing resulting in reduction in most industrial production. The resultant is layoff of employees all over the country and loss of income to many household particularly those in the lower income bracket. While urban households are affected by loss of jobs and employment opportunities, rural households are affected by loss of agricultural productivity" (Tagoe, 2010:5).

Due to lack of or limited access to efficient energy services, households and individuals have to rely on charcoal, kerosene, candles for cooking and lighting which negatively affect their welfare and human security as well as a range of social issues including unemployment, poverty alleviation, population growth, health, education, and a lack of opportunities for women and children. Irregular supply of both grid electricity and high cost of electricity limit households' access and use of energy appliances and hence the thermal comfort that is derived from such appliances including refrigeration that can keep medicine and food safe. Their poverty further curtails the development and expansion of energy services (Ottinger, et al., 2000). In his analysis of energy poverty Johansson (2011:47) notes that two billion people globally have access to unreliable electricity. These two billion people clearly include households in the Sekondi-Takoradi who are frustrated about erratic supply of gas and

electricity. The supply disruptions make it difficult for households to cook with LPG when they want. Additionally power outages also make it difficult for reading to be done in the night and for other activities to be conducted in the evening. Households' inability to read or perform other task using grid electricity in the evening rightly fit into the definition of energy poverty. The lack of regular supply of electricity either to power bulbs directly or to recharge batteries leaves households to resort to the use of candles and paraffin. Additionally, affordability problems also limit households' ability to use even the appliances they have bought such as TV, fridges, blender and iron. Affordability problems prevent households' from buying appliances such as cylinders, burners, improved cook-stoves, generators, rechargeable lamps. This is indeed a problem of the vicious cycle of energy poverty: lack of energy affects the economic activities of households and in turn limits their ability to make use of energy services (Pachauri et al., 2004).

5.4.1. What strategies do households use to handle their energy scarcity?

The fourth question the Thesis sought to explore was how households handled their energy scarcity. The problems such as irregular supply of energy, higher prices of energy, and high cost of energy appliances among others have informed households' decision on which energy to use for cooking and lighting. In many households gas and charcoal are combined to address the supply security problems associated with LPG. In some other households, buying bits of charcoal is used as strategy to address the huge amount of money required to refill gas. In some households improved cook-stoves (Gyapa) that use charcoal are used as alternative to gas cylinders and burners. Some households have also acquired two cylinders which are always filled to ensure that LPG will always be available for cooking when shortages occur. For electricity the strategies used include buying generators, rechargeable lamps, solar lamps that can be recharged and using candles and paraffin (Chevalier, 2009:115; Ottinger, et al., 2000). Some have bought prepaid meters to reduce their bills and also to make it convenience for them to consume electricity. While these strategies may be convenience for some of the households the use of biomass (charcoal) has serious implication for the country's forest stock. At the same time the negative implications of these measures (i.e. dependence on charcoal, cook-stoves) by households are that it increases the time and human energy used in preparing food (Parajuli, 2011:2300). Additionally, the continuous reliance on charcoal for cooking has implications for the health and welfare of households, particularly women and children (Ministry of Energy, 2010:27). The use of low form and inefficient energy sources such as charcoal, candles, paraffin have negative effect for labour productively and economic

growth of Ghana since (Schurr, 1984; Toman and Jemelkova, 2003). The strategies used to address the lighting needs also bring additional cost burden to households. For those who use generators, they must set aside part of their income to buy gasoline and diesel which may mean forgoing other needs. Besides the use of gasoline and diesel also have consequences for the environment and the climate.

5.3.1. Energy and Gender

In the work presented in chapter four the responses of men and women especially about what they do when electricity is disrupted or when gas is empty show that both men and women do not attach the same kind of urgency when energy is disrupted. Since women are those who usually cook they are first to know that the gas cylinder is empty or charcoal is finished and need to be refilled. Men who are not married for example appear not care much about gas shortages than women spinsters. James and Steven for example indicated they would simply stop cooking when they cannot find gas but admitted that if they were married they would probably use charcoal. "We simply do not cook. If we had married we would be using charcoal". One might think that if Steven and his brother would not cook then they would probably go to bed on empty stomach. No. As bachelors James and Steven can easily go to what is usually called chop bars to fill their stomach but most unmarried women would hesitate to go to the chop bar for simple reason that they would be branded as lazy by their peers and cotenants and even the operators of those chop bars. They would surely find charcoal if they cannot get gas while James and his brother can easily close their mind and walk to the chop bar and fill their belly. This is why energy is so central to women (UN-Energy, 2005).

Women still play crucial role in the households when it comes to energy particularly in terms of their contact, use and management of energy sources at the household level (Ministry of Energy, 2010:7). As I said they are the first to know when there is no gas in the house by virtue of the fact that food preparation is done by them. Conversation with my respondents including Mrs. Akosua, Abiba, Fatima, Barnerman and Johnson indicate that their role as mothers also come with responsibility of making sure food is ready for themselves, children, husbands and the household. When energy is disrupted it affects the time they have to go to the market to trade. The study in Sekondi-Takoradi finds credence with the claim that use of modern energy services such as LPG, electricity and the appliances associated with them (cylinder, gas burner, kettle, rice cookers) reduces the time spent by women on cooking and

preparing food. My study indicates that women who have access to LPG for instance feel liberated from the frustration, stress and the difficulty of having to spend hours preparing, lighting charcoal and cleaning the ash during and after food preparation. Traditionally, household activities including food preparation have often acted as a stumbling block to women participation and public engagement in politics, economic activities and socio-economic mobility. However, with the relatively stress-free LPG the women are able to finish house chores early which enable them to focus on their businesses and other activities. This feeling was captured in the statement above by Mrs. Johnson who indicated gas enable her to finish her household shores and then go to the market to do her business. She also indicated that her children are also able to go to school on time. This could mean more in terms of economic opportunities for the women to break free from the yoke of poverty, social underachievement and marginalisation.

My conversation with households regarding energy indicates that men are getting actively involved. They carry empty gas cylinders to the filling stations, fill them and carry them to the house. This challenges the traditional notion expressed by Cecelski (1995:562) that women are the collectors, producers and users of energy. A critical look at the role play by men also show that they make most of the critical decisions regarding what type of energy to buy, what type of appliance to buy, when to buy and how much to buy. As Abiba indicated above she does not know how much a gas of cylinder cost. On the surface this can be interpreted as the men taking active interest in the household energy issues. However on the deeper level it could mean the man exercising control and power over the household finances. Many women do not appear to take decision unless their husbands say so indicating that there is imbalance of power in favour of the men. This stems from the fact that, in Ghana men are the breadwinners in the house and therefore the controller of financial resources used to secure energy. This situation may change in future if access to modern energy services continues to free women from spending more time in the kitchen and to focus on economic activities.

CHAPTER SIX Conclusion

Energy is a critical resource necessary for improving the living conditions of the people and for maintaining economic growth and development. In fact energy is essential for a number of human aspirations including job creation, food security, health services, housing (rural or urban), education, transportation, running water, sewage, communication services, and good environment. Life in Sekondi-Takoradi as it is in many cities around the world would have

little meaning without these resources taken for granted in certain parts of the globe. Many are those who cannot do without access to electricity, charcoal and gas. As a matter of fact, recent research into energy and development points to a correlation between energy consumption and social indicators such as infant mortality, illiteracy, and fertility. Therefore improving households' access to energy and maintaining regular supply is considered central not only to achieving the MDGs goals but also to sustaining the socio-economic conditions of the people especially for women who are burdened with securing energy in most households.

Households' energy for cooking is mainly LPG and charcoal although occasionally electricity is used for cooking. Biomass (charcoal) is still very important in the energy mix of all households interviewed: both rich and poor. The importance of charcoal is not attributable to supply challenges associated with gas but also because of the fact that households can buy according to their income, easiness of preparing certain types of food such as (grilling and smoking fish, preparing groundnut and palm nut soup) and relatively accidents free associated with charcoal use. According to respondents electricity (for lighting) is the most dominant form of fuel used by households for lighting. Depending on their income/budget, all households also use one of these for lighting: generators, solar lamps, rechargeable lamps and candles. These types of energy are used when electricity supply is disrupted. The key problems faced by households in their quest to access energy come from several sources but the most cited problems have to do with adequate, reliable and safe supply of electricity, frequent shortages of LPG, high cost of energy and appliances, low quality of charcoal among others. These problems force the households to experience energy poverty. Energy poverty is not only about availability of energy but also safe and reliable supply, and being able to afford. The problems recounted by the respondents in this study show that energy poverty is widespread. The energy poverty they face forces them to adopt strategies such as the use of traditional and relatively low form of energy (charcoal and candles) for cooking and lighting.

Conversation with the respondents indicated they have preference for different fuels more importantly for gas. This is due to the fact that gas is considered to be clean, makes food preparation faster, and being convenience. However, supply security problems, safety security concerns, cost of gas related appliances (gas burners, cylinders), cost of LPG and inability of consumers to buy in customised form makes charcoal hugely popular among all the households. This is partly due to the factors such as irregular supply of gas, the high cost of gas, the relative availability of charcoal, and the ability of consumers to buy charcoal in whatever amount and quantity they want. Unlike gas where consumers will have to fill one

cylinder at a go and therefore have to have at least 150,000 cedis [$7.5] to be able to buy, households can easily purchase 1000 cedis at a time. Although majority of the households indicated they have access to fuels such gas, electricity there is a problem when it comes to supply. The quality of supply is very low. Cost of energy is a critical factor that determines the choice of energy by households. Whether a household would buy small, medium, or large bag of charcoal is dependent on the prevailing market price and the budget of households. Additionally whether households would buy small, medium, and large size cylinder or two, three, four or six phase burner is dependent on their income and prevailing market price for these appliances. The use of solar lamps is limited although some households are using it as a strategy to address the irregular supply and security challenges associated with the use of electricity. There is a however a potential of solar to be tapped to address the supply inadequacies of electricity. Energy supply security is a major issue that influences not only the choice of the households use but also indicates the strategy used by households to address these challenges. Safety of the energy (accidents) also informs households' choice of fuel. Gas is the preferred fuel of choice for many households for several reasons including it being fast, being clean, able to last longer, being economical, and being convenient to use. Households are careful about which energy to use for cooking and lighting. For example because of huge tariff encountered by households when electricity is used for cooking several households with cooking gadgets that use electricity preferred not to use them. The fears expressed by some of the respondents regarding LPG safety is a sign that further vigorous education that target children and adults may be needed.

Evidence from the study indicates that access and regular supply of energy at affordable prices could enable households to make judicious use of their time. Women in particular who perform most of the household chores including food preparation save time when supply of grid electrcity and LPG is regular. Regular supply of energy enables households to become flexible in the allocation of time for both household and economic activities during the day and also in the evening. In other words the productive capacity and social (leisure) of households' in Sekondi-Takoradi particularly women is likely to improve as a result of being able to use electricity to perform business activities after sunset. The women indicated that because they are able to prepare food on time when LPG is available the children too are able to go to school early. This could have important implication for the children particularly students regarding their education fortunes and future socio-economic prospects.

Therefore irregular supply of electricity, gas and charcoal undoubtedly create huge inconvenience not only for those who work in the offices but also to traders, students and nursing mothers. The supply insecurity especially the shortages of gas and electricity lead to disruptions of the social, economic, leisure and cultural activities of all households' members. Students go to bed early when there are power disruptions. Many tasks cannot be performed by both men and women in the evening. Traders must take time off trading hours to search for LPG when shortages occur. When they are not able to get the relatively-economical LPG, they fall on charcoal whose use is not only labour demanding but is a driving force for deforestation. In short the energy poverty faced by members of the households hugely inconveniences and constrains their effort to go about their daily activities. The shortages of gas and electricity disruptions have economic implications for Sister Akosua, Mrs. Barnerman and other traders who use energy to operate their businesses. Moving towards the adoption of small and simple wind, hydro and solar energy resources that are renewable and sustainable can be part of the solution to address frequent power outages and disruptions. Similarly adoption of modern biomass, waste, residues to generate liquid fuel, electricity and heat can contribute to reverse the insecurity associated with fuel for cooking. The adoption of off grid, simple solar and wind electric systems can reduce households' frustration and contribute to increasing the quality of life at cost that is relatively lower than what households spend. In other words better technology based on the use of renewable energy resources and advanced materials can reduce costs and improve both the performance and reliability of household energy supply.

The use of more energy efficient technology and appliances such as the improved cook-stove, LPG, and electrcity could have health related benefits. Smoke reduction resulting from the use of improved cook stoves, LPG and electrcity could contribute to saving lives and improving productivity. It must be mentioned that although LPG is cleaner than coal and oil, it still belongs to the fossil fuel group whose consumption is linked to the much debated and talked about global warming and climate change.

Affordability i.e. being able to buy appliances and being able to buy the fuel needed to power them is a major constraint for most low income households. Due to their characteristic of being convenience and easy to use, many households would want to use LPG and electricity for most of their activities, however the limited budget of households constrain them to buy the appliances and fuel whose prices they consider to be above their budget. The critical question is how to balance affordability with realistic prices for the appliances and fuel to

ensure both regular supply and accessibility. This is a very difficult balancing act given the fact that majority of the respondents are of low income status but with good policies and programmes from government and commitment of all actors a compromise can be found whereby energy could be delivered to households on regular bases and at affordable prices. That can be a sure beginning at eliminating energy poverty from the city of Sekondi-Takoradi.

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