

**Climate change mitigation: An analysis of Liquefied Petroleum Gas (LPG)
as an alternative domestic energy source to charcoal in Zambia**

By

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DEDICATION

To the memory of my late parents, Mr. Gustav Neddy Mutale and Mrs. Margaret Chanda Mutale, who instilled in my siblings and I the value of education.

DECLARATION

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Climate Change Mitigation: An Analysis of Liquefied Petroleum Gas (LPG) as an Alternative Domestic Energy Source to Charcoal in Zambia

I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.



SIGNATURE

10th May, 2019

DATE

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ABSTRACT

This study analyses the possibility of introducing liquefied petroleum gas (LPG) as an alternative domestic energy source to charcoal in Zambia to mitigate climate change. The study, conducted in Lusaka, used questionnaires, focus group discussions, interviews and literature study to collect data. The study revealed that the introduction of LPG is possible. However, some challenges need to be addressed in order to actualise the change. Lack of knowledge about LPG; non-availability of LPG in most parts of the country; perceived danger of LPG; high prices of LPG and accessories; changing people's mind-sets about charcoal; social inequity and lack of government initiative, were the main challenges identified. Social-Ecology and sustainable livelihoods were used as theoretical frameworks to ground the study and analyse the results. The study recommends that government takes the lead to make the change possible and that further research be done on sustainable livelihoods for charcoal producers and traders.

Key words

Climate, climate change mitigation, greenhouse gases, global warming, LPG, charcoal, deforestation, alternative domestic energy source, Zambia, Sustainable Livelihoods Approach, Sustainable Development, Social Ecology.

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LIST OF ABBREVIATIONS AND ACRONYMS

AR4	Fourth Assessment Report of the Intergovernmental Panel on Climate Change
BBC	British Broadcasting Corporation
BDCs	Bulk Distribution Companies
BOCs	Bulk Oil Consumers
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CoP	Conference of Party
CSO	Central Statistical Office
DPSIR	Driving forces-Pressures-States-Impacts-Responses
ERB	Energy Regulation Board
FAO	Food and Agriculture Organisation
FD	Forestry Department
FIECORP	First Icon Energy Corporation
GHG	Greenhouse gases
GRZ	Government of the Republic of Zambia
IPCC	Intergovernmental Panel on Climate Change
KCJ	Kenyan Ceramic Jiko
LDCs	Least Developed Countries
LOBC	Lusaka Open Business College
LPG	Liquefied Petroleum Gas
LPGMCs	Liquefied Petroleum Gas Marketing Companies
MEWD	Ministry of Energy and Water Development
MLNREP	Ministry of Lands, Natural Resources and Environmental Protection
MMD	Movement for Multiparty Democracy
MoFNP	Ministry of Finance and National Planning
MTENR	Ministry of Tourism, Environment and Natural Resources
NAMA	Nationally Appropriate Mitigation Actions
NAPA	National Adaptation Programmes of Action

NGOs	Non-Governmental Organisations
NISIR	National Institute for Scientific and Industrial Research
OMCs	Oil Marketing Companies
REDD	Reducing Emissions from Deforestation and forest Degradation
SAP	Structural Adjustment Programme
SD	Sustainable Development
SLA	Sustainable Livelihoods Approach
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America
WHO	World Health Organisation
WMO	World Meteorological Organisation
ZAOU	Zambian Open University
ZEMA	Zambia Environmental Management Agency
ZESCO	Zambia Electricity Supply Corporation

CHAPTER 1

INTRODUCTION

1.1 Introduction

Climate change has become a global challenge. It is feared that unless concerted efforts are made globally to mitigate the effects of climate change, the rate at which the earth is warming will have devastating effects on people's lives. This will be even more devastating in the case of developing or least developed countries (LDCs), especially African ones (Tolba in Low, 2005:xxv; IPCC in Ngoma, 2008:1). These countries depend heavily on rain-fed agriculture and the climate variability effects such as global warming will adversely affect the livelihoods of the people who inhabit these countries. Climate change will impact adversely on all dimensions of human development and security in these countries because they lack the technology and financial resources needed to combat climate change (UNFCCC, 2007:5). According to Climate Ark (in Ngoma, 2008:1), there has been an increase of between 0.3 and 0.6°C in the global mean temperature since the 19th century and by between 0.2 and 0.3°C over the last 40 years. It is also predicted that the global average temperature will rise by between 1.4 and 5.8°C by 2100 and that rainfall, especially in tropical areas, will be unevenly distributed – some areas will receive more rainfall than others (BBC in Ngoma, 2008:1). This scenario, therefore, has grave implications for food security, other human security dimensions and human development in LDCs.

Climate change, also known as global warming, refers to “a change of climate, which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere, and which is additional to natural variability, and observed over comparable period of time” (GRZ MTENR, 2010:10). Climate change is mainly caused by industrialised western countries (Campbell-Lendrum & Corvalan, 2007:1; Mertz, Halsnaes, Olesen & Rasmussen, 2009:743). Industries in these countries use fossil fuels that emit fumes or greenhouse gases (GHGs) into the atmosphere. Developing countries are not as industrialised as developed ones. Therefore, their contributions to climate change, in terms of fossil fuel consumption, are very minimal (Institute for Security

Studies, 2010:1; Tolba in Low, 2005:xxv; Ban Ki-Moon in Mandleni, 2011:15). However, these countries do also contribute to climate change in various ways mainly through deforestation, which is so rampant that forests are dwindling at an alarming rate. According to Gorte and Sheikh (2010:1), deforestation is a significant source of CO₂ emissions. It is estimated that deforestation, globally, “releases about 5.9 GtCO₂ (gigatons or billion metric tons of CO₂) annually, about 17% of all annual anthropogenic GHG emissions”.

The deforestation rates in Zambia are very high. The country has actually been ranked among the top ten countries in the world where deforestation is highly rampant (FAO in Kaunda, 2011:1). Zambia heavily depends on charcoal as a domestic energy source and charcoal is one of the major drivers of deforestation.

1.2 Background to the problem

Zambia is a landlocked country situated in Southern Africa. It lies between latitudes 10°C and 18°C south and longitudes 22°C and 33°C east. The country spans 752,000 square kilometres and has eight neighbours: Congo DR to the northwest, Tanzania to the north east, Malawi to the east, Mozambique to the south east, Zimbabwe to the South, Botswana and Namibia to the south west and Angola to the west (zambiantourist.com 2015) (Figure 3.1).

Comparatively speaking, Zambia’s deforestation rates are the highest in the region as Slunge & Wingqvist (2010:1) explain, “[t]he deforestation rate (in Zambia) is well above the global and regional average ...” Zambia’s population is estimated at 13 million people (CSO, 2010). Sixty one percent (61%) of this population lives in rural Zambia and rural poverty in the country has been estimated at 77% (CSO, 2013:4; Sishekanu, 2013:2). These statistics put the majority of the Zambian people in the poverty-stricken category. This means that the majority of Zambians are vulnerable to the effects of climate change.

Zambia is one of the countries in the world that have been adversely affected by the effects of climate change. According to World Bank (in Ngoma, 2008:1), Zambia’s temperature has been increasing at the rate of 0.6°C per decade. This rate is considered



Figure 1.1 Zambia’s geographical position

Source: Zambiatourism.com, 2015

very high as it is ten times higher than the global or the Southern Africa rate (Slunge & Wingqvist, 2010:1). The effects of climate change in Zambia, like in most LDCs, have mainly manifested in floods and droughts (Tembo, 2011:7). Tembo further indicates that the frequent floods and droughts that the country has been experiencing have resulted in damage to crops and infrastructure thereby seriously affecting agriculture. Zambia, like many other LDCs, is mainly dependent on rain-fed agriculture for food security. Therefore, poor agriculture will not only bring about hunger, but will affect other economic activities. Most poor people in Zambia do not only depend on agriculture for food, they also sell farm produce to meet other needs such as education, health, shelter and other related needs. Therefore, in this regard, climate change in Zambia will affect human development as well as all dimensions of human security such as food security, economic security, health security, environmental security and political security (GRZ MTENR, 2007:i).

These effects of climate change are already evident in Zambia. The country’s economic growth has suffered a big setback since 2015. The World Bank (2015:9) refers to the downturn in the Zambian economy as “... the toughest economic challenges in at least a decade”, predicting the growth of the economy to drop below 4% in 2015 for the first time

since 1998. This has been caused by three main factors, the last two being climate change related: (1) the drop in the price of copper, the mainstay of the Zambian economy, due to less demand for the commodity by China arising from a slowdown of the Chinese economy (China buys 40% of the world's copper); (2) electricity load-shedding due to low water levels at hydro power stations associated with climate change; and (3) late onset of rains, as a result of climate change, which has impacted agriculture negatively and has reduced the agricultural incomes of 62% of the population living in poverty (World Bank, 2015:9).

In view of the scenario outlined above, there is a need for serious responses to climate change in Zambia in terms of mitigation and adaptation. Zambia ratified the UNFCCC in 1993 (GRZ MTENR, 2010:ii) therefore it is party to the climate change mitigation and adaptation efforts that are meant to achieve the UNFCCC objectives. Like the rest of the countries of the world, Zambia recognises the adverse effects that climate change is having and will have on the world in general and on Zambia in particular in the future. To this end, the Zambian government is trying to put in place measures related to climate change mitigation and adaptation. The country has introduced both Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Programmes of Action (NAPAs) in line with the UNFCCC recommendations (Tembo, 2011:17). This study is meant to complement these government efforts.

1.3 Problem Statement

Charcoal is the main domestic energy source for cooking in Zambia. According to Adam (2009:1), about one million tons of charcoal is consumed in Zambia per annum. Charcoal and firewood provide 75% of Zambia's energy supply (UN REDD Readiness Programme Document (Zambia), March 2010 in GRZ MTENR, 2010:37). The other energy source – electricity – is too expensive for the poor who are the majority in Zambia and is only accessible mainly to people in urban areas. Most rural areas in Zambia are not connected to the national power grid. Therefore, people in these areas depend heavily on charcoal and fuel-wood for cooking. Only 25% of the Zambian population has access to electricity, 49.3% of this population live in urban areas while 3.2% are in rural areas

(Zambia REDD Readiness Document, 2010 in GRZ MTENR, 2010:37).

Apart from being expensive and only being available to a small part of the population, electricity demand in Zambia far outstrips supply. This is mainly due to investment in heavy industries, such as mining, taking place in the country (Haanyika, 2008:1). The other factor is the population growth, especially in urban areas, which have experienced unprecedented rural-urban migration as the countryside remains underdeveloped. This inadequate power supply forces the only power provider, Zambia Electricity Supply Corporation (ZESCO), to ration (load-shed) power.

The above factors have contributed to a high demand for charcoal in the country, especially in urban areas. This has put a lot of pressure on the Zambian forests and has resulted in Zambia's deforestation rates being some of the highest in the world (Vinya, Syampungani, Kasamu, Monde & Kasubika, 2012:iv) causing climate change and threatening human development (Bwalya, 2010:v). Therefore, there is an urgent need to find alternatives to charcoal in order to mitigate the effects of climate change in Zambia. The proposed alternative, LPG, will go a long way in relieving the pressure currently being put on the Zambian forests and, at the same time, mitigate the effects of climate change.

1.4 Purpose of the study

The purpose of this study, therefore, was to establish the possibility of introducing liquefied petroleum gas (LPG) as an alternative domestic energy source to charcoal in Zambia so as to mitigate climate change. This is in line with the IPCC climate change mitigation recommendations of shifting to clean technologies and improved energy efficiency (UNFCCC, 2009:6). It is also in support of the UNFCCC itself, which considers action on deforestation and forest degradation as "a critical pathway for achieving the overall objective of mitigating climate change" (Vinya et al, 2012:1).

1.5 Research objectives

The main goal of this study was to determine the potential of LPG as an alternative domestic energy source to charcoal in Zambia. Specifically, the study sought to achieve the following objectives:

- (a) To explore the possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia.
- (b) To understand the challenges that may impede the introduction of LPG as an alternative energy source to charcoal in Zambia.
- (c) To recommend ways to overcome the identified challenges.

1.6 Research Questions

The study addressed the following research questions:

- (a) To what extent is LPG appropriate as an alternative domestic energy source to charcoal in Zambia?
- (b) What are the challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia?
- (c) What are the solutions to the challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia?

1.7 Importance of the study

Zambia has some of the highest deforestation rates in the world (FAO in Kaunda, 2011:1). According to FAO, Zambia is among the ten top countries in the world with the highest annual deforestation rates (Kaunda, 2011:1). It is estimated that Zambia loses between 250,000 and 300,000 hectares of forest per year (Vinya et al, 2012:iv; GRZ MTENR, 2010:29). Vinya et al (2012:iii) and GRZ MTENR (2010:29) categorise charcoal as being one of the top four leading drivers of deforestation in Zambia. Apart from the environmental degradation that deforestation brings about, it also contributes

significantly to climate change. According to Winkler (2005:355), deforestation together with energy production and use, are the two main contributors to greenhouse gas emissions into the atmosphere. This makes charcoal a culprit at another level. As charcoal is being produced and being used as a domestic energy source, it releases carbon into the atmosphere and further contributes to climate change. In view of the foregoing, there is a serious need to identify effective measures of controlling charcoal production and use so as to curb deforestation and thus mitigate climate change in Zambia. The study is also of international importance as the effects of climate change have no boundaries.

The government of Zambia has been trying to put in place such measures through NAPAs and NAMAs as recommended by the UNFCCC, but these measures do not include the introduction of LPG as an alternative domestic energy source to charcoal. Therefore, this climate change mitigation strategy has not been given the serious consideration it deserves. In addition, the NAPA and NAMA programmes themselves do not seem effective (Tembo, 2011:2). This study will thus supplement the efforts the Zambian government is making in as far as climate change mitigation is concerned. Knowledge of the possibility of introducing LPG as an alternative energy source to charcoal will enable the Zambian government and other policy makers to design programmes and projects to implement this change effectively.

A number of developing countries have successfully been using LPG as a domestic energy source. The best example is Botswana. Botswana is a semi-desert country and, therefore, it does not have much forest cover and surface water. This means that charcoal production and hydro-electricity production are not possible. Therefore, Botswana has mainly relied on LPG as a domestic energy source. LPG is used for cooking as well as cooling as LPG also powers refrigerators. Botswana does not produce LPG locally but imports it from South Africa unlike Zambia that produces LPG locally at Indeni. Therefore, the possibility of Zambia providing LPG at affordable prices is very high.

The introduction of LPG will not only save the Zambian forests and mitigate climate change, but will also bring about other benefits to the country. For instance, it will ease the pressure being put on the electricity supply and help alleviate the load shedding that is currently happening in the country. This will be so because both those relying on charcoal and those currently using electricity can be expected to switch to LPG. The latter category of people is likely to supplement electricity by using gas stoves and fridges leaving electricity mainly for lighting. The electricity that will be saved by the general switch to LPG will also improve productivity in industries as it will lessen the power cuts currently being experienced. This will ultimately improve the country's economy.

1.8 Limitations to and scope of the study

The study had two main limitations. These were the geographical areas in which the study took place, and the type of climate change mitigation investigated. Geographically, the study was restricted to Lusaka, the capital city of Zambia. This was mainly due to time constraints. However, this was somehow compensated for by the fact that data were collected from a reasonably large group of people from different relevant areas in Lusaka. Secondly, Lusaka is also home to a large percentage of the country's population and is the major market place for charcoal. Charcoal produced in the outskirts of Lusaka and far-flung towns is transported to Lusaka to be sold due to high demand for the commodity there resulting from the large population.

There are mainly two ways in which climate change can be controlled: mitigation and adaptation. The study restricted itself to climate change mitigation. While there are several possible alternative domestic energy sources that could be used to replace charcoal, the study restricted itself to LPG due to the reasons already explained elsewhere in this report.

1.9 Brief description of research design and methodology of the study

The study used the qualitative research design. This was appropriate for the study because it allows for in-depth understanding of the participants' context accurate analysis and interpretation of collected data, as well as validity (Collodel, De Beer & Kotze, 2012:37; Creswell, 2009:8; Taylor & Greenhalgh, 1997:2). Data were triangulated through the use various respondents and key informants from various locations of the research area; use of various sampling methods: semi-structured questionnaires for personal interviews and focus group discussions; and use of documentary reviews to complement primary data. The research instruments were pre-tested on a small group of respondents and adjusted accordingly. Triangulation and the piloting of the research instruments ensured the trustworthiness, validity and reliability of data collection and analysis, and the results obtained.

1.10 Clarification of terms/Definition of key concepts

This section defines key words and terms used in this report in order to clarify the context in which they are being used.

1.10.1 Climate

“Climate encompasses the statistics of meteorological conditions, that is, temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elements in a given region over long periods of time (usually 30 years)” (GRZ MTENR, 2010:10).

1.10.2 Climate change

This refers to “a change of climate, which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere, and which is additional to natural variability, and observed over comparable periods of time” (GRZ MTENR, 2010:10).

1.10.3 Greenhouse gases (GHGs)

“Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation. The Kyoto Protocol deals with six anthropogenic greenhouse gases, namely, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulphur hexafluoride (SF₆) and two groups of gases: hydrofluorocarbons (HFCs e.g. HFC-23) and perfluorocarbons (e.g. CF₄)”(GRZ MTENR, 2010:10).

1.10.4 Global warming

Global warming is “the intensification of the greenhouse effect, which results from anthropogenic actions, where the consequence is an increase in the concentration of greenhouse gases, aerosols and their predecessors in the atmosphere. These absorb and retain part of the infrared radiation emitted by the Earth’s surface, thus increasing the average temperature on the planet and causing adverse climatic phenomena” (GRZ MTENR, 2010:11).

1.10.5 Climate change mitigation

Climate change “mitigation refers to efforts that seek to prevent or slow down the increase of atmospheric GHG concentrations by limiting current and future emissions and enhancing potential sinks for greenhouse gases” (GRZ MTENR, 2010:10).

1.10.6 Climate change adaptation

Climate change adaptation “refers to actions aimed at coping with climatic changes that cannot be avoided and at reducing their negative effects. Adaptation measures include the prevention, tolerance or sharing of losses, changes in land use or activities, changes of location and restoration” (GRZ MTENR, 2010:10).

1.10.7 Charcoal

Charcoal refers to “carbonized materials, with varying combustion and dark properties” (Amanor et al in Stephen 2011:8). It is produced in a process called pyrolysis “by raising the temperature of wood beyond the point at which many of its organic compounds

become chemically unstable and begin to break down” (Stephen, 2011:8).

1.10.8 Liquefied petroleum gas (LPG)

Liquefied petroleum gas (LPG) is a kind of fuel that can be used for cooking and cooling. It is a mixture of propane and butane which is “liquefied under normal ambient temperature and moderate pressures” (Yatnalli, Huggi & Hiremath, 2012:1).

1.11 Chapter outline and contents

This report is organised in eight (8) chapters as follows:

Chapter 1: introduces the focus of this study. It covers the background to the study; problem statement; research questions; research objectives; importance of the study; limitations to and scope of the study; a brief description of research design and methodology; clarification of terms/definition of key concepts; and chapter outline and contents.

Chapter 2: discusses theoretical perspectives on environmental degradation and, charcoal production and use.

Chapter 3: discusses the environmental impact of deforestation and the climate change mitigation efforts being made in Zambia. It also reviews literature on studies on transition from charcoal to LPG conducted in some African countries.

Chapter 4: presents the location of the study, research design and methodology, data collection methods and sampling, and methods of data analysis. How the study ensured reliability and validity, the ethical issues and shortcomings and limitations of the study are also discussed in this chapter.

Chapter 5: presents the results on the dangers of charcoal production and use, alternatives to charcoal, and knowledge of LPG as an alternative domestic energy source.

Chapter 6: presents the results on the possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia, challenges and solutions.

Chapter 7: discusses and interprets the findings of the study.

Chapter 8: presents the summary of the study, conclusions drawn from the study and recommendations based on the findings.

1.12 Conclusion

This chapter gives an overview of the study. It outlines the objectives of the study and the research questions set in order to achieve its objectives which were to provide solutions to the research problem. The research design and methodology and the data collection methods have also been outlined in the chapter.

CHAPTER 2

THEORETICAL PERSPECTIVES ON ENVIRONMENTAL DEGRADATION AND CHARCOAL PRODUCTION AND USE

2.1 Introduction

Climate change is one of the global challenges of contemporary times (Tembo, 2011:8; Adeyemi, 2014:1; GRZ MTENR, 2010:2; Fumpa-Makano, 2011:7; Wachata, 2014:1). It threatens human existence as it disturbs people's livelihoods and human development in general. Much attention, especially in developing countries, is currently being paid to its devastating effects (Adeyemi, 2014:1; Yamaguchi, 2012:119; Tembo, 2011:8; Wachata, 2014:2; Berta, Soromessa & Belliethathan, 2015:1).

Efforts are being made globally to solve this problem. The main measures that have been identified involve climate change mitigation and adaptation (Wachata, 2014:1; Yamaguchi, 2012:117; UNFCCC, 2009:1; Berta et al, 2015:1). Climate change mitigation involves finding ways of reducing GHG emissions into the atmosphere while climate change adaptation involves finding ways of reducing vulnerability to the effects of climate change (Yamaguchi, 2012:117, 119; UNFCCC, 2009:1). These measures are thought to be important because, even if GHG emissions were completely stopped today, the GHG concentration already in the atmosphere is so high that it would take a long time to rid the atmosphere completely of the gases (GRZ MTENR, 2010:45).

Both strategies are required if climate change has to be tackled effectively. However, this study focused only on climate change mitigation related to deforestation which is driven by charcoal, the main domestic energy source in the country. Over-dependency on charcoal as a domestic energy source in Zambia is a cause for concern. Unsustainable charcoal production and use have resulted in wholesale cutting down of live trees (Trees for Zambia, 2014:2) causing deforestation, which is one of the major causes of climate change after fossil fuel burning (UNFCCC, 2009:2; Fumpa-Makano, 2011:18; Berta et al, 2015:1).

The chapter discusses the theoretical framework for environmental degradation and,

specifically, the conceptual framework for the impact that charcoal production and use have on forests. The chapter ends with a conclusion.

2.2 Theoretical framework for environmental degradation

Bhattacharjee (2012:2) refers to theories as “systematic explanations of the underlying phenomenon or behavior”. Bhattacharjee (2012:3) further argues that logic (theory) and evidence (observations) are the only pillars on which scientific knowledge is based and that, in science, theories and observations are so interrelated that they cannot exist without each other. “Theories provide meaning and significance to what we observe, and observations help validate or refine existing theory or construct new theory” (Bhattacharjee, 2012:3).

Grant & Osanloo (2014:13) define a theoretical framework as a blueprint for a research study which serves as the guide upon which the study is built and supported. They further indicate that the theoretical framework provides the structure which defines how a researcher will philosophically, epistemologically, methodologically and analytically approach the whole study. This resonates with Eisenhart’s (in Grant & Osanloo, 2014:13) definition which says that a theoretical framework is “a structure that guides research by relying on a formal theory ... constructed by using an established coherent explanation of certain phenomena and relationships”. In other words, a theoretical framework comprises the theory or theories that the researcher has selected that provide(s) the direction his research will take (Grant & Osanloo 2014:13). This direction includes the way collected data will be analysed (Shawa, 2010:24).

This study discusses the relationship between deforestation and climate change and how the former can be controlled in order to mitigate the latter. It is, therefore, grounded in a theoretical framework that explains the human-environment nexus or human behaviours related to unsustainable exploitation and protection of the environment, which is the main concern of climate change mitigation. The theoretical framework also provides approaches that could be used to solve the problem of deforestation and ultimately that of climate change itself.

The development paradigm that is concerned about the unsustainable exploitation and protection of the environment is sustainable development (SD), a term that was coined by the World Commission on Environment and Development (WCED). The term first appeared in the Commission's 1987 report called "Our Common Future" also known as the "The Brundtland Report" (Drexhage & Murphy, 2010:2) because the Commission which produced it was led by Gro Harlem Brundtland. The Commission defines sustainable development as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (Drexhage & Murphy, 2010:2). This is in sharp contrast to economic development, the development paradigm on which Western development has hitherto been based and which developing countries are expected to emulate. Notwithstanding the foregoing, economic development is one of the three pillars of sustainable development. However, for it to fit in the sustainable development paradigm, it needs to be done in the context of the other two pillars, which are social equity and environmental protection (Drexhage & Murphy, 2010:2; Wildenberg, 2005:5), that have been dominated by economic development.

Although sustainable development is supposed to encompass three pillars, it has often been compartmentalized as an environmental issue. Development has always been associated with economic growth and this has been the development framework for developed countries in attaining their unprecedented levels of wealth, and major and rapidly developing countries are following the same course. Economic development exhausts and compromises the quality of natural resources. This threatens current biodiversity and natural environments (Drexhage & Murphy, 2010:2).

The consequences of economic development actually go far beyond the threat to biodiversity and natural environments; they also affect the climate system in a way that threatens human existence. There is, therefore, a close link between sustainable development, climate change and climate change mitigation (Sathaye & Najam, 2007:696; Drexhage & Murphy, 2010:2). Sathaye & Najam (2007:696) explain that this link, which they call the two-way relationship between sustainable development and climate change, implies that "policies pursuing sustainable development and climate

change mitigation can be mutually reinforcing”. Sathaye & Najam (2007:696) further explain that, if sustainable development is viewed in the climate change lens, it leads to the integration of sustainable development goals into the climate change policy framework. For example, if GHG emissions are reduced, there will also be a reduction in the rate of death and illness arising from air pollution and, in addition, it will also benefit ecosystem integrity, which are both elements of sustainable development. This clearly shows how “sustainable economic development” and environmental protection, the two pillars of sustainable development, can be integrated to achieve sustainable development. Sathaye & Najam (2007:696) also show how the third pillar of sustainable development, social equity, can also help to achieve sustainable development. They argue that

for a development path to be sustainable over a long period, wealth resources and opportunity must be shared so that all citizens have access to minimum standards of security, human rights, and social benefits, such as food, health, education, shelter, and opportunity for self-development.

The absence of social equity, as we will see from the theoretical framework of this study, impoverishes a certain section of society, which resorts to overexploitation of the environment as a source of their livelihood, which, in turn, results in environmental degradation. Sathaye & Najam (2007:696) support this point by indicating that several strategies and measures that would advance sustainable development would also enhance not only mitigative capacities but also adaptive capacities. They further argue that there is a close connection between mitigative and adaptive capacities and underlying socio-economic and technological development paths that give rise to those capacities.

The foregoing literature provides a sound background for the theoretical framework chosen for this study which is Social Ecology. The theory of Social Ecology, propounded by Bookchin (1993), posits that all our ecological problems are a result of social problems. Therefore, to solve ecological problems, we must first deal with problems within society. The theory further explains that nature and social structures are

interlinked and that the environmental crisis is a result of the hierarchical organisation of power and the authoritarian nature of the structures of society. The theory, therefore, proposes the restructuring of social relations on an equitable basis if anthropogenic activity is to have a desirable impact on the environment (Shawa, 2010:22). Laurent (2015:2) explains that environmental challenges are a result of income and power inequality. “This inequality is an environmental issue just as environmental degradation is a social issue (forming a ‘social-ecological nexus’), and solutions must address them jointly through principles and institutions rooted in justice” (Laurent, 2015:2).

Laurent (2015:2) argues that social cooperation, in as much as it has enabled humans to dominate earth systems, has the potential to ensure the planet’s continued hospitality. “What is at stake is not to ‘save the planet’ but to save the planet’s hospitality for humans and to preserve the most vulnerable among us from the severe consequences of our collective in consequence” (Laurent, 2015:2). Laurent (2015:3) blames environmental degradation on the gap between the rich and the poor. The interaction between the two groups, he argues, worsens environmental degradations and ecological crises and this affects every member of society. Social equity, which is one of the pillars of sustainable development as indicated above, becomes crucial in this regard. The AR5 IPCC Report underscores this argument by noting with “high confidence” that “equity is an integral part of sustainable development” and that the three pillars of sustainable development, economic, ecology and social, should be integrated in both mitigation and adaptation climate policy (Laurent, 2015:5).

2.3 Conceptual framework for impact of charcoal production on forests

Regoniel (2010: online) draws a distinction between a theoretical framework and a conceptual framework. According to him, a theoretical framework is more general and broader than a conceptual framework. It is a general representation of relationships between things in a given phenomenon. It is based on time-tested theories and encompasses the findings of a number of investigations on the occurrence of phenomena. A conceptual framework, on the other hand, is more specific. It is the researcher’s idea of how the research problem can be analysed (Regoniel, 2010: online;

Aabeyir, 2016:12).The conceptual framework, therefore, is based on the theoretical framework of a study and provides a description of the relationship between specific variables in the study.

This study has adopted the Driving forces-Pressures-States-Impacts-Responses (DPSIR) conceptual framework that was developed by the European Environment Agency (EEA).The EEA has adopted the conceptual framework for integrated environment assessment (Kristensen, 2004:1). Aabeyir (2016:12) explains that the conceptual framework “is used in analyzing environmental problems by identifying the cause-effect relationships between environment and various anthropogenic activities in the wider socio-economic context”. The framework describes the human-environment nexus starting with ‘Driving forces’ (economic sectors, socio-economic and cultural forces, and human activities). These put ‘Pressures’ (emissions, waste) on the environment. This is followed by ‘States’ (physical, chemical, biological), followed by ‘Impacts’ (on ecosystems, human health and functions, development) that leads to political ‘Responses’ (prioritisation, target setting, indicators) (Kristensen, 2004:1; Aabeyir, 2016:12).

Figure 2.1 below illustrates the generic DPSIR assessment framework.

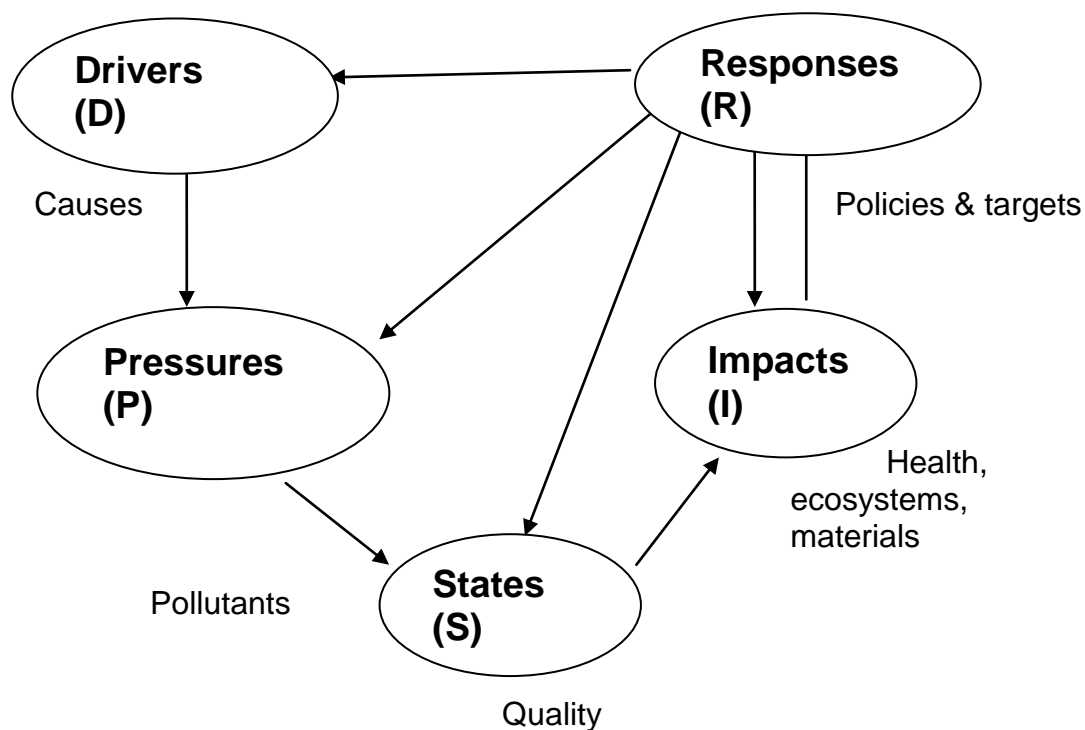


Figure 2.1: The generic DPSIR assessment framework

Source: Kristensen (2004:1)

The conceptual framework fits perfectly in the selected theoretical framework of Social Ecology. This study used the framework to analyse the research problem and the data collected. The recommendations that the study makes at the end of this report are also in line with this conceptual framework. Charcoal production and use, which are a result of socio-economic factors such as poverty in general, energy poverty and lack of empowerment with alternative sustainable livelihoods drive (D), the cutting down of trees for charcoal production, which puts pressure (P) on the forests. This changes the state (S) of the environment resulting in environmental degradation (deforestation, desertification), which has adverse impacts (I) on ecosystems, human health and development in general, as a result of climate change and its concomitant adverse effects on all sectors of the economy. The impacts should prompt the government to respond (R) with policies that ameliorate these impacts such as climate change mitigation (for instance, the introduction of LPG as an alternative source of domestic

energy to charcoal), adaptation and the empowerment of people, such as charcoal producers and traders, with sustainable alternative livelihoods. These interventions will allow charcoal producers and traders to end their dependency on charcoal production/trade as a source of livelihood.

Figure 2.2 below shows how the DPSIR conceptual framework has been adapted to this study to analyse the research problem and how the introduction of LPG, as an alternative energy source to charcoal, can be used by the government as a climate change mitigative response.

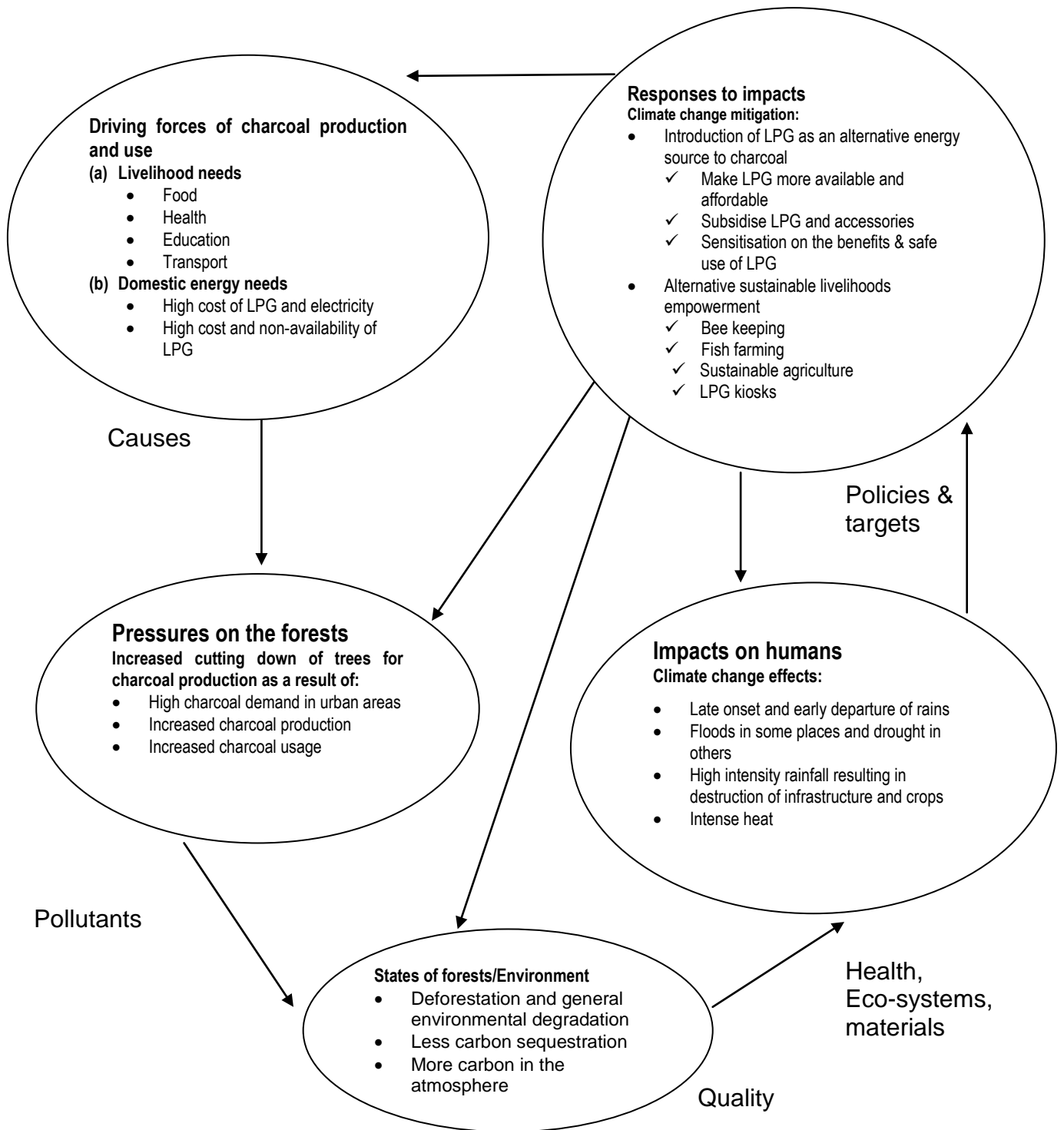


Figure 2.2: Conceptual framework for impact of charcoal production and use on forests

Source: Framework ideas: Aabeyir, 2016:1& Kristensen, 2004:1

Sustainable alternative livelihoods, implemented together with LPG, can make the switch

from charcoal to LPG more effective and sustainable as charcoal producers and traders would have no reason to revert back to the charcoal business. With charcoal not being available on the market, charcoal users would also have no alternative other than to adapt to the use of LPG.

The Sustainable Livelihoods Framework comprises five components that are used to analyse livelihoods holistically in order to make them sustainable. They are: (1) Vulnerability Context; (2) Livelihood Assets; (3) Transforming Structures and Processes; (4) Livelihood Strategies; and (5) Livelihood Outcomes. The Sustainable Livelihoods Approach is commonly used under sustainable development to provide sustainable livelihoods that will ensure that the natural environment is not compromised so that it loses its ability to provide for the future generations. “The SLA has been recently feted as cable of addressing the development agenda while integrating people centric approaches, governance, pro-poor marketing, social protection, disaster risk reduction climate change and adaptation” (IDS in Mwasaa, 2012:17). Mwasaa (2012:17) argues that SLA is a robust livelihoods assessment and interventions design tool because it is able to incorporate all these challenges and approaches to development.

The five components of SLA function as follows: (1) the vulnerability context analyses the existing risks and proneness to shocks; (2) livelihood assets refer to the resources a community has which include human, natural, physical, social and financial capitals; (3) transforming Processes, Institutions and Policies refer to systems and policies that define and determine how the available assets are used to earn a living; (4) livelihood strategies refer to the efforts that a community makes to transform the assets it has thus determining its living standards; (5) the livelihood outcomes refer to the ultimate result of the livelihood efforts that could lead to improved wealth and living standards (Mwasaa, 2012:17).

Figure 2.3 below is the graphical representation of the sustainable livelihoods framework.

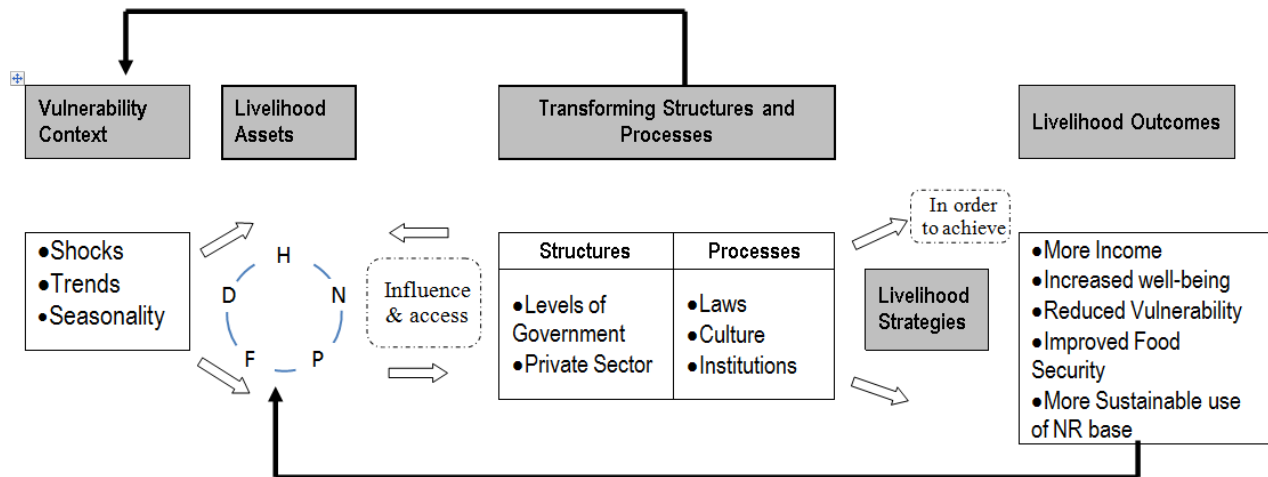


Figure 2.3: Sustainable Livelihoods Framework

Source: Krantz 2001 (in Mwasaa 2012:18)

The framework can be applied to climate change mitigation. Charcoal producers mainly depend on the selling of charcoal for their livelihoods. Therefore, to make them switch from this source of livelihood to a more sustainable one or to make charcoal production a sustainable source of livelihood, a holistic analysis, as depicted in the framework, needs to be carried out. Various stakeholders would need to be involved: charcoal producers, charcoal traders, charcoal users, the government, NGOs and forestry officials, among others. The government should take the lead in as far as sensitisation and formulation of policies and regulations to guide the change is concerned. The process should be as participatory as possible and should involve a thorough analysis of all the systems that drive charcoal production and consumption. Some of the systems to be analysed, in this case, may include electricity providers, LPG manufacturers and suppliers to find out what factors keep charcoal users, for example, away from using these cleaner sources of domestic energy.

This is in line with the multi-stakeholder engagement approach that promotes methods of solving problems that involve changing people's attitudes in a participatory manner by involving them in trying to solve the problem at hand.

De Chiaria (2015:2) argues that sustainability is a multi-stakeholder concept. This

argument is corroborated by Drexhage & Murphy (2010:2) who argue that sustainable development, as a development paradigm, has not made real progress because there has been lack of political leadership and citizen engagement on the part of developed countries that have the wealth and technical capacity to implement more sustainable policies and measures. These arguments support the theory of multi-stakeholder engagement which emanates from the social capital theory. Noland & Phillips (in Ni, Wang, De la Flor & Penafior, 2015:1-2) define (multi) stakeholder engagement as “a type of interaction that involves, at minimum, recognition and respect of common humanity and the ways in which the actions of each may affect the other”. Social capital refers to “connections among individuals to social networks and the norms of reciprocity and trustworthiness that arise from them” (Putnam in De Chiara, 2015:3).

As if in response to Drexhage & Murphy’s concern about the lack of citizen engagement to execute the sustainable development agenda, the United Nations has recognised the importance of multi-stakeholder engagement as a driver of sustainable development. To this end, the Post-2015 Development Agenda has, in principle, adopted multi-stakeholder engagement as a tool to implement the agenda because “multi-stakeholder partnerships between business, NGOs, Governments, the United Nations and other actors will play an important role in the implementation of the agenda” (Dodds, 2015:3). The Post-2015 Agenda is the realisation of the failure by developing countries to achieve the Millennium Development Goals (MDGs) that were set in 2000 by the United Nations with “the aim of reducing to the barest minimum, by 2015, global poverty and hunger; illiteracy; gender inequalities; child and maternal mortality; HIV/AIDS and other world development challenges” (Okeke & Nwali, 2013:1). One of the causes of this failure is lack of strong multi-stakeholder relationships (Dodds, 2015:3).

This method of solving problems can also be applied at national level. For instance, the problem of deforestation and pollution, resulting from charcoal production and use, can best be solved this way. National governments need to engage all the stakeholders: charcoal producers, charcoal users, the general public and NGOs, amongst others, in order to find a sustainable way of solving the problem. The proposed introduction of LPG

as an alternative domestic energy source to charcoal would also require the same approach if it was to succeed. People would need to be sensitised on the dangers of producing and using charcoal and the various alternative sources of energy.

2.4 Conclusion

This chapter shows the nexus not only between human activity and environmental degradation, but between deforestation and climate change. The chapter also shows that to address the complex problem of deforestation, there is a need for not only government intervention, but also engagement of various stakeholders. Responses to deforestation and climate could include introduction of alternative domestic sources of energy like LPG and provision of alternative sustainable livelihoods to charcoal producers and traders.

CHAPTER 3

ENVIRONMENTAL IMPACT OF DEFORESTATION AND CLIMATE CHANGE MITIGATION EFFORTS IN ZAMBIA

3.1 Introduction

Zambia, like other developing countries, is highly susceptible to the devastating effects of climate change which have been observed in the country for a number of years. These effects have had telling consequences on agriculture, infrastructure, food security and many other sectors (Tembo, 2011:8; GRZ MTENR, 2007:8; Kotir, 2011:588; Wachata, 2014:1). It is feared that, if the effects of climate change are not mitigated as a matter of urgency, they will reverse the developmental gains the country has achieved so far (Fumpa-Makano, 2011:1). There is, therefore, a need to address this problem urgently and seriously.

This chapter discusses the environmental impact deforestation has had in Zambia. The chapter also links deforestation to climate change and gives an overview of the climate change mitigation efforts that the Zambian government has been making. The chapter argues that LPG could be the best climate change mitigation strategy in so far as domestic energy is concerned and supports this by a number of related studies carried out in some African countries.

3.2 Environmental impact of charcoal production and use in Zambia

According to Keddy (2003:1), Zambia's total land area is about 752,614 km². About 60 to 67% (about 50 million hectares) of this land is under forest cover (Keddy, 2003:1; Fumpa-Makano, 2011:8; Wachata, 2014:2; Tembo, Mulenga & Sitko, 2015:24; GRZ MEWD, 2008:2), which makes Zambia one of the most highly forested countries in Africa that is also very rich in flora and fauna. However, Zambia's forests are under serious threat from deforestation, which is a serious drawback to climate change mitigation (Fumpa-Makano, 2011:8). Globally, Zambia has been identified as one of the top ten greenhouse gas (GHG) emitting countries due to deforestation and degradation (FAO in

Tembo, 2011:1; Tembo et al, 2015:24). The period between 1990 and 2000 saw the highest rate of deforestation in Zambia which was 851,000 hectares per annum (Fumpa-Makano, 2011:8; Keddy, 2003:2; Wachata, 2014:2). This rate was the highest in Southern Africa and accounted for almost half of the deforestation that occurred in the SADC region (Fumpa-Makano, 2011:8; Wachata, 2014:2). Currently, Zambia's annual deforestation rate is estimated at 300,000 hectares per annum (Fumpa-Makano, 2011:8; Tembo et al, 2015:24). "Given the role deforestation plays in raising greenhouse gas emissions (GHG), this is clearly an area of great concern" (Fumpa-Makano, 2011:8).

There are a number of factors that contribute to the high rates of deforestation in Zambia. According to GRZ & UN-REDD (in Tembo et al, 2015:24), the main causes of deforestation in Zambia include: charcoal and wood-fuel production, logging for timber, expansion of small-scale agriculture and unsustainable agricultural practices. Charcoal production is a major driver of deforestation in the country. Low-income communities, especially in rural areas, depend heavily on forests for their livelihoods and charcoal production is one such source of rural income. Charcoal is produced in these areas and transported to towns and cities where it is in high demand. According to Fumpa-Makano (2011:9), about 250,000 tonnes of charcoal, which is equivalent to 1.4 million tonnes of wood, are consumed annually in Lusaka City alone. Tembo et al (2015:24) estimate an area of 23,268 hectares of forest cover is lost annually due to charcoal consumption by urban households alone. This kind of consumption of forests has not only resulted in environmental degradation and pollution, but certainly contributes to climate change. The use of inefficient kilns and charcoal stoves for charcoal production and utilisation respectively, exacerbates the situation. These methods of charcoal production and use consume a lot of wood and create pollution resulting in unnecessary forest loss.

3.3 Rationale for climate change mitigation in Zambia

Zambia has, for some time now, experienced the adverse effects of climate change. As has already been indicated, if these effects are not mitigated, they will continue to stifle development and threaten all facets of human security. There are a number of climate change indicators in the country. These include rainfall variability, temperature increases,

and extreme events that impact adversely on people's livelihoods and all other dimensions of human development and security.

3.3.1 Rainfall variability

The last 30 years or so have seen decreases in annual rainfall (MTENR 2010 in Funder, Mweemba & Nyambe 2013:7). According to Sishekanu (2013:4), there has been a 2.3% per decade decrease in mean rainfall. MTENR 2010 (in Funder et al, 2013:7) further indicates that rainy seasons have become increasingly shorter since the 1980s. The onset of the rains has changed from the usual October/early November to the second or third week of November (Kasali in Funder et al, 2013:7). However, this has actually worsened. The year 2015 saw unprecedented delays in the onset of rains, especially in Lusaka, where rains did not start until late December 2015/early January 2016 and even when they did, they were erratic. The few times it rained at onset, it left a trail of destruction that removed roofs of houses, collapsed houses and wall fences and killed a number of people. These events and, perhaps, much more serious events will continue to affect the country. Sishekanu (2013:3) argues that, unless serious interventions are put in place, rainfall variability could keep an additional 300,000 more Zambians below the poverty line.

3.3.2 Temperature increases

Another characteristic of climate change in Zambia has been increases in temperature. According to the assessment carried out by the UNDP Climate Change Country Profile of Zambia between 1960 and 2003, the mean annual temperature in Zambia has increased by 1.3°C since 1960, an average rate of 0.26°C per decade (Funder et al, 2013:8; Fumpa-Makano, 2011:8; Sishekanu, 2013:5) and it is predicted to rise by 3.5°C by 2100 (Sishekanu, 2013:5). Studies have also shown that cold seasons in Zambia have become warmer over the years. According to Fumpa-Makano (2011:8), studies carried out “between 1961 and 2000 showed a decrease in extreme cold days and nights ... by -3.7 and -6.0 days per decade, respectively. Over the same period, heat occurrence during the day and night increased by 8.2 and 8.6 days per decade, respectively” (cf. Sishekanu, 2013:5). June used to be the coldest month in the country.

However, this month is no longer as cold as it used to be in the past.

3.3.3 Extreme events

Climate change in Zambia has also manifested itself in extreme events in the form of floods and droughts. The past two to three decades have witnessed severe floods and droughts that have affected a large number of people in the country (Funder et al, 2013:9). Sishekanu (2013:3) indicates that, over the past 30 years, floods and droughts have cost Zambia US\$13.8 billion, which is equivalent to 0.4% of annual GDP growth. Sishekanu (2013:3) predicts that climate variability could cost Zambia US\$4.3 billion in lost GDP over the next decade, which would reduce annual growth by 0.9%. He further predicts more floods and droughts in the years to come.

Extreme events that have taken place in the country during the past three decades include the 1991/92 drought; the 2006/7 floods that affected over one million people in 41 districts across the country; the 2005/06 drought, which caused irreversible damage to crops in two thirds of the country and forced the country to import food; and the 2009/10 floods, which affected 238,709 households (Wachata, 2014:1; Fumpa-Makano, 2011:10). Perhaps the most serious incident that the country has experienced recently, and continues to experience, is the failure by the national electricity utility company, ZESCO, to generate enough power for the country due to low water levels associated with climate change at the various hydro-power stations in the country. This has resulted in unprecedented load-shedding which is affecting the economy of the country negatively. The exchange rate of the Zambian Kwacha against the American Dollar shot from K7.00 to a Dollar, at the beginning of 2015, to an all-time high rate of K15.00, towards the end of the same year. Prices of essential commodities doubled as a result.

3.3.4 The impacts of climate change

Much of agriculture in Zambia is done on a small scale. This type of agriculture is rain fed. Irrigation is practised by only a small percentage of farmers in the country. This translates into only 5% of cultivated land (Funder et al, 2013:9). The rainfall patterns that have been brought about by climate change, including late onset and early departure of

rain and shorter rainy seasons, have adversely affected small-scale farmers. Floods and droughts have had other impacts on people’s livelihoods (Figures 3.1 and 3.2). These include: the loss of human life and livestock; an increase in human diseases that thrive in hot conditions; the destruction of crops resulting in food insecurity; damage to roads and bridges; damage to housing; damage to power infrastructure; and damage of water infrastructure (including boreholes) (Funder et al, 2013:9; Fumpa-Makano, 2011:15). According to Fumpa-Makano (2011:15), climate change in Zambia has reduced areas suitable for staple food by 80%.



Figure 3.1: A flooded maize field



Figure 3.2: A failed maize crop due to drought

3.3.5 Implications for sustainable development

The forgoing section has given an overview of how adversely people's livelihoods are being affected by climate change in Zambia. Unless sustainable ways of earning livelihoods are encouraged in the country, the effects of climate change will become even worse. This is in line with climate change mitigation that calls for the use of natural resources in a sustainable way so as not to deplete them and in a manner that does not harm the environment. One way of doing this is through the use of clean energy. Apart from not being a clean source of domestic energy, charcoal does not support the sustainable use of natural resources as it promotes deforestation and pollutes the environment during its production and use. It, therefore, frustrates sustainable development, which promotes the careful use of natural resources so that the future generations can benefit from them. As we have already seen, there is a very close link between climate change, climate mitigation and sustainable development.

3.4 Overview of climate change mitigation efforts made in Zambia

Since the government of Zambia realised the effects of climate change, it has made quite significant efforts towards mitigating these effects. One of these efforts involves sustainable forest management that has been well articulated in all policy frameworks (Fumpa-Makano, 2011:15) including the National Conservation Policy and the National Policy on Environment. Sustainable forest management has also been captured in various strategic plans and legal statutes such as the Forest Act of 1973, the Forest Bill of 1999, Environmental Protection and Pollution Control Act of 1990, Land Act of 1996 and Agricultural Lands Act of 1960 (Fumpa-Makano, 2011:15).

Zambia is also party to international conventions on climate change, such as the UNFCCC, which provide guidance on how forests should be protected. According to Fumpa-Makano (2011:15), protection of forests has actually been the primary climate change mitigation intervention in Zambia, where the 60% forest cover has great potential for future carbon sequestration. The other mitigation options include sustainable agriculture, the use of bio-energy from waste, energy efficiency and alternative sources of supply.

However, all the above efforts have not achieved much. According to Fumpa-Makano (2011:15), the main problem has been poor funding. “Despite the general consensus on the important role forests play in climate change mitigation, forestry programmes related to climate change receive the lowest allocation compared to other departments”, she explains. Fumpa-Makano (2011:18) further indicates that, since wood energy consumption is the major contributor to deforestation in the country, development of alternative, environment-friendly energy sources would release pressure on forests. She gives an example of the energy efficient SAVE 80 Stove being produced under the Lusaka CDM that is anticipated to reduce wood consumption by 61.5%. “This saving will retain carbon stock needed for climate change mitigation. Therefore, the investment into and development of alternative energy sources must be taken as an urgent intervention towards climate change mitigation” (Fumpa-Makano, 2011:18).

Figure 3.3 below shows the SAVE 80 cook-stove. The stove is an energy efficient one and uses less wood compared to the amount of wood needed in terms of charcoal to cook a meal. The stove, therefore, is an example of stoves that use alternative sources of energy that could be switched to, to mitigate climate change.



Figure 3.3: The SAVE 80 cook-stove

Source: cleancookstove.org

Fumpa-Makano (2011:18) is of the opinion that depending on the Forestry Department, which is poorly funded, will not yield the desired results. She argues that climate change matters fall squarely under the domain of the Energy Policy and, to some extent, the Science and Technology Policy. Therefore, climate change interventions call for a multi-sectoral approach. There is a need for policy synergy among different sectors. This resonates well with the approaches of multi-stakeholder engagement and sustainable livelihoods discussed above.

Notwithstanding all the above shortcomings, it is clear that Zambia is committed to climate change interventions such as mitigation. This can be evidenced by the fact that the national vision, Vision 2030, is anchored on this. The Vision reads, “A Prosperous Middle Income and Climate-Resilient Economy by 2030”. The Objective of the Vision is:

“To mainstream Climate Change into the most economically and vulnerable sectors of the economy in order to ensure sustainable economic development towards the attainment of Zambia’s Vision 2030” (Sishekanu, 2013:11). The Vision has five pillars:

- (1) Adaptation and Risk Reduction;
- (2) Low Emissions Development;
- (3) Proposed Long Term Institutional Arrangements;
- (4) Finance and Investment Framework and Cross cutting Issues, which include:
 - (a) Research and Development;
 - (b) Technology Development and Transfer;
 - (c) Climate Change Communication and Education and Awareness;
 - (d) Gender and HIV/AIDS;
- (5) Decentralisation and Localised Planning.

Climate change has also been mainstreamed in Zambia’s latest national development plan, the Sixth National Development Plan. It is therefore hoped that, with the country’s cooperating partners, over forty of whom have shown keen interest in the country’s new climate change programme (Sishekanu, 2013:12), most of the pillars of the Vision could be achieved by 2030.

3.4.1 Climate change institutional framework development

That Zambia has been making efforts towards climate change mitigation can also be evidenced by the way the Zambian climate change institutional framework has developed over the years. The year 1966 saw the establishment of the Contingent Planning Unit (Funder et al, 2013:12). The Unit was located in the Office of the Prime Minister and was responsible for dealing with emergencies. Following the 1992 drought which was so severe that it was referred to as “the worst drought in 100 years” in the region (Funder et al, 2013:12), the Unit was replaced by the Disaster Management and Mitigation Unit (DMMU) in 1994 under the Office of the President. This was done because there was a need for better state preparedness in disaster situations. However, due to its centralised nature, the DMMU was not very effective. It was hence decentralised and was later complemented by the creation of the Ministry of Tourism,

Environment and Natural Resources (MTENR). The Ministry was formed in 2002 following the Rio Declaration on Environment and Development or Earth Summit (1992) and has been charged with the responsibilities for climate change activities (Funder et al, 2013:12). In the following year, 1993, Zambia ratified the UNFCCC and later, in 2006, the Kyoto Protocol. The MTENR has been the focal point for both the UNFCCC and the Kyoto Protocol. The Ministry's main responsibilities include: leading climate change negotiations; providing the National Communications on Climate Change to the UNFCCC; developing the National Adaptation Programme of Action (NAPA); coordinating the Climate Change Facilitation Unit (CCFU); and running the Forestry Department (FD) (now under the Ministry of Lands, Natural Resources and Environmental Protection (MLNREP), which has recently become instrumental in climate change matters regarding the Reducing Emissions from Deforestation and forest Degradation (REDD) programme in the country (Funder et al, 2013:12-13).

There are other players in the climate change issues. The Ministry of Finance and National Planning (MoFNP) has, of late, become very active in matters related to climate change. It has been engaged in the promotion of the mainstreaming of climate change in various government Ministries. The Strategic Programme on Climate Resilience (SPCR), which is financed through the Climate Change Investment Fund (CIF), is housed by the Ministry. The other key player is the National Climate Change and Development Council (NCCDC), which has been proposed by the National Climate Change Response Strategy (NCCRS). The Council will be mandated to coordinate and harmonise climate change mitigation and adaptation policies and programmes (Funder et al, 2013:12-13).

3.4.2 Climate change policies and plans

Apart from developing institutional frameworks, Zambia has also made, and continues to make, efforts to formulate policies related to the combating of the effects of climate change. A number of mitigation and adaptation measures have been put in place. These include the following: the National Adaptation Programme (NAPA2007) on climate change; the National Climate Change Response Strategy (NCCRS2010), whose main recommendation, as indicated in the preceding section, is the establishment of the

National Climate Change and Development Council (NCCDC), which would be the new institutional framework for overseeing climate change activities nationally; and the Interim Inter-Ministerial Climate Change Secretariat, whose mandate is to facilitate the establishment of the Council (Wachata, 2014:2). Another policy is the National Forestry Policy (2009) ratified in 2014. A major aim of the policy is “to re-direct and vigorously motivate responsible forestry management and feasible stakeholder interventions in forestry development for the good of Zambia” (GRZ-MTENR, 2009:2).

Halting deforestation is the country’s primary mitigation intervention (Wachata, 2014:2). The Forestry Department (FD) is making an effort towards achieving this because the revised National Forestry Policy recognises the importance of stakeholder engagement, as implied in the major aim of the policy cited above. This is in sharp contrast with the authoritative laws that have hitherto been used to try and control deforestation (Vinya et al, 2012:3). A complex problem like deforestation needs a variety of methods to solve it. Some of the methods that can be used to solve the problem are: Multi-stakeholder engagement; provision of alternative sustainable livelihoods; sustainable methods of charcoal production and use; sustainable forest management; and the introduction of alternative clean domestic energy sources such LPG, wind energy and solar energy.

3.5 Liquefied petroleum gas as a climate change mitigation strategy in Zambia

The preceding section has given an overview of the general institutional frameworks, policies and plans that have been developed in the country to advance climate change mitigation. This section deals with clean domestic energy as a mitigating measure for climate change.

Efforts are being made by the Zambian government to promote clean domestic energy. The government is aware of the devastating effects that charcoal production and use are having on forests and the atmosphere (Fumpa-Makano, 2011:18). In terms of reducing the amount of wood being consumed as a result of charcoal production and use, projects related to energy efficient charcoal stoves are being undertaken. One such project is the SAVE 80 Stove which is being produced under the Lusaka Clean Mechanism Project

(CDM). It is envisaged that the use of the stove would reduce wood consumption by 61.5% per year because the stove has an 80% improvement in energy efficiency (Fumpa-Makano, 2011:24), hence the name. This reduction is quite significant in reducing deforestation and indeed promoting climate change mitigation.

This does not, however, make charcoal or wood any cleaner. The need to advance domestic energy sources that are both cleaner and do not use wood still remains. The Zambian government has plans to promote bio-gas which could be produced from waste. According to Fumpa-Makano (2011:23), the National Institute of Scientific and Industrial Research (NISIR) has developed the technology for methane production but it still requires commercial adoption. The other option in this regard would be LPG.

LPG promotion, however, is barely mentioned in climate change mitigation policy documents in the country. In spite of LPG being cleaner than charcoal and being produced in the country, the government does not seem to promote it as one of the alternative domestic energy sources. According to Chinambu (2011:35), some pilot projects on the use of LPG for domestic purposes in Zambia have been carried out by the Zambian government in the past but the projects “have not resulted in continued use of LPG beyond the project life”. Therefore, this study will re-visit the subject and will hopefully ignite new interest in this viable and potential climate change mitigation strategy.

3.6 Making the case for liquefied petroleum gas as the best alternative domestic energy source to charcoal in Zambia

There are a number of clean alternative energy sources that could be used to replace charcoal in Zambia. However, LPG is the most suitable alternative in the country. Firstly, it is a clean energy source. Secondly, it is locally produced in Zambia and does not need the construction of new infrastructure. Thirdly, domestic consumers would not be required to install any equipment in their homes. Finally, it is used affordably in a number of other developing countries. Recommending LPG as a good alternative domestic energy source to charcoal and biomass in general, Salih (2006:31) argues that “LPG is portable, clean, safe and extremely efficient in generating heat. LPG is a major step up

on the energy ladder and presents an excellent option for delivering energy services in rural areas where few viable alternatives exist”.

Salih’s views are supported by Broni-Bediako & Dankwa (2013:6) who also maintain that LPG, or propane, is a clean burning fuel. They further argue that, although it is a product of fossil fuel, LPG is not considered to be a GHG as corroborated by Hood (2010:22) who indicates that the IPCC does not regard LPG as a greenhouse gas. LPG is produced from crude oil. Zambia refines crude oil at Indeni Petroleum Refinery located in Ndola and LPG is supplied locally from this refinery. To increase the distribution of the commodity, Oryx Oil Zambia recently invested in LPG infrastructure in Ndola (All Africa, 2011:1). Other sources, in case of short supply, include the neighbouring countries of South Africa and Mozambique (Total Zambia Ltd, [Sa]). However, in Zambia, LPG is currently mainly used for commercial purposes, such as heating raw materials, boilers, soldering and chemical processing, rather than domestic purposes (Total Zambia Ltd, [Sa]; Musonda, 2005:4).

LPG is being used affordably as a supplement to electricity and other energy sources in a number of developing countries that include Botswana (UNDP/Botswana government, 2012:1), Ghana (Broni-Bediako & Dankwa, 2013:6), South Africa (Parallax Online), Mozambique (SNV, 2012:1) and Thailand (Khumlaithong & Kunchornrat, 2013:104). Botswana has no oil refinery and imports most of its LPG from South Africa. Ironically, however, LPG in Botswana is cheaper than in South Africa (Parallax Online). Therefore, Zambia has an advantage over countries like Botswana and, with a well thought out policy and strategy, it can easily supply LPG to domestic users at an affordable price.

3.6.1 Studies on the possibility of introducing LPG as an alternative domestic energy source to charcoal in some African countries

LPG is definitely a cleaner source of domestic energy than charcoal. Studies have been done in a number of countries other than Zambia that have recommended this source of domestic energy as a possible alternative to charcoal (Broni-Bediako & Dankwa, 2013 (Ghana); Hood, 2010 (Sudan); Chilemba, 2005; Falzon, Vignati, Halstea, Linden & Pols, 2013 (Mozambique); SNV Niger, 2013 (Niger)). These studies are testimony that the

same can be replicated in Zambia.

In Ghana, efforts to shift from the traditional fuel sources of firewood and charcoal have been successful. The Ghanaian government adopted the LPG policy in 1992 to curb the problems posed by fuel-wood and charcoal production (Acharibasam & Apatinga, 2014:1). LPG has increasingly gained popularity as an alternative fuel for industrial, commercial and domestic use, although wood and charcoal still account for about 73.9% of housing cooking fuel used in the country (Broni-Bediako & Dankwa, 2013:6). Broni-Bediako & Dankwa (2013) conducted a study to assess the utilisation of LPG in Tarkwa, Ghana. The study revealed that, because LPG was in demand, there were sporadic shortages of the commodity (cf. Acharibasam & Apatinga, 2014:4). The preference for LPG was attributed to its reliability, efficiency, portability, clean burning and low pollutant emission levels. The study indicates that LPG's clean characteristics reduce indoor air pollution and it is, therefore, a major contributor to better health and sanitation compared to wood and charcoal.

The shortages, however, make most Ghanaians revert to fuel wood and charcoal that leads to worsening deforestation and global warming, the very problem LPG was promoted to solve. According to the study, 72% of the respondents switch back to firewood and charcoal when there is an LPG shortage. Acharibasam & Apatinga (2014:4) attribute these switches to bad implementation of the policy by the Ghanaian government. They argue that "government policies may result in unexpected outcomes when all possibilities are not exhausted before implementation". The other problem they cite is the fact that the subsidies that were put on LPG, compounded by the regular shortages, was not high enough to convince people to switch from the strongly preferred fuels of wood and charcoal.

To curb the shortages created by the high demand for LPG, Broni-Bediako & Dankwa (2013) recommend, inter alia, that the government should secure private sector participation to supplement the midstream refining sector and that key players in the supply chain should take the initiative by being made aware of their responsibilities. The key distribution players include Bulk Distribution Companies (BDCs), Oil Marketing

Companies (OMCs) Liquefied Petroleum Gas Marketing Companies (LPGMCs) and Bulk Oil Consumers (BOCs).

Deforestation is a major challenge in Sudan. It is estimated that the north and central states of the country have lost about 70% of their forest cover since independence (UNEP in Hood, 2010:6; Buchanan-Smith, Umbadda, Fadul & Bagadi, 2009:4). One of the major root causes for this degradation is charcoal production (Hood, 2010:6; Buchanan-Smith et al, 2009:4). Therefore, the Sudanese Government of National Unity opted for LPG as the best alternative to charcoal due to its clean characteristics (Hood, 2010:6). The decision was mainly informed by the fact that Sudan, like Zambia, had started producing its own LPG (Hood, 2010:6; Buchanan-Smith et al, 2009:4) after the discovery of oil in the country and the subsequent establishment of the Aljaily refinery on the outskirts of Khartoum (Buchanan-Smith et al, 2009:7). The Sudanese government adopted a fuel-switching policy to increase the uptake of LPG amongst the population. The price of LPG was reduced by 50 percent and LPG appliances were exempted from import duty tax (Hood, 2010:6; Buchanan-Smith et al, 2009:6). As a result of this intervention, the use of LPG, particularly in the domestic sector, increased from about 31,000 metric tonnes in 2000 to 274,000 metric tonnes in 2006 (Hood, 2010:6) while the firewood and charcoal trade steadily declined (Buchanan-Smith et al, 2009:6).

Hood's (2010) study, however, reveals that LPG use was only concentrated in the central region of the country (cf. Buchanan-Smith et al, 2009:6). The study identifies the main barriers to widespread national use of LPG in the country as: (1) the relatively large initial investment needed to acquire LPG appliances (cylinders and stoves); (2) the higher price of LPG compared to wood-fuel prices in parts of the country; (3) the lack of infrastructure for LPG distribution; (4) a general lack of information; and (5) social and cultural issues (Hood, 2010:7).

On the basis of the above barriers, the study proposes the implementation of the following recommendations: (1) public awareness and consumer education on the benefits of LPG and safety precautions of LPG use; (2) government policies and initiatives to promote LPG market development, including strategy for full application of

subsidies and national price stabilisation; (3) increased focus on women as primary beneficiaries in LPG scale-up activities; and (4) development of full cost recovery microfinance options to facilitate household access to LPG (Hood, 2010:7).

The study concludes that LPG has clear benefits over charcoal and other biomass sources of energy. These include “improved environmental conservation and reduced deforestation, climate change mitigation, improved women and children health and wider socio-economic development” (Hood, 2010:6).

Mozambique, like many other African countries, relies heavily on biomass–charcoal and firewood –as a domestic energy source. Biomass fuels account for 80-90% of the country’s domestic energy supply. This high consumption of biomass translates into 16,000,000 cubic metres of wood per annum. This has exerted pressure on the country’s forests resulting in widespread deforestation (Chilemba, 2005:6). Deforestation in Mozambique has had adverse consequences for the country, for instance, it exacerbated the level of devastation during the 2000 floods, which left thousands of people dead and cost millions of dollars in rescue and restoration efforts (Chilemba, 2005:6). Therefore, “the severe health, economic and environmental implications of deforestation and burning of biomass fuels makes it critical to promote household switching to cleaner, more environmentally friendly sustainable fuels such as liquefied petroleum gas (LPG)” (Chilemba, 2005:6).

On this basis, Chilemba (2005) carried out a study to understand the barriers to expanding the LPG market in Pemba, one of Mozambique’s provincial capitals. The study also aimed at developing appropriate strategies to promote switching to LPG (Chilemba, 2005:7). Some of the main barriers identified by the study included the following: (1) cultural habits of using charcoal for cooking; (2) unfamiliarity with LPG; (3) the wider availability of biomass fuels; (4) the relatively high cost of LPG and equipment; and (5) the inadequate training of retailers of LPG and accessories.

The study also identified a lack of legislation and rules on the storage, bottling, handling, distribution and use of LPG as another challenge. The study observes,

Though the market for LPG is presently very small and may not warrant a regulatory body to monitor its supply and use, there is a need for an institutional and legal framework with the capacity to monitor and supervise the activities of the entities operating in the sector. If the country is serious about developing its LPG market, it is critical that the LPG companies in the country work with the government to develop rules and regulations to regulate and govern all aspects of supply and use. The development of a regulatory framework and benchmarks is fundamental to create and establish parameters of supply and product quality, covering the many steps of distribution process, as well as for customer protection (Chilemba, 2005:12).

The study recommends the following strategies, inter alia, for LPG promotion: (1) consumer profiling and effective marketing; (2) awareness and education programmes; (3) promotional programmes; (4) staff training; (5) payment terms and micro-credit facilities; (6) instalment payments; (7) subsidies; (8) introduction of smaller LPG canisters; (9) LPG regulation; and (10) introducing new LPG appliances in the marketplace such as LPG operated electricity generators, LPG operated air conditioning systems and LPG operated refrigerators and freezers (Chilemba, 2005:72-79).

A similar study was carried out by Falzon et al (2013) to establish the possibility of introducing LPG as an alternative energy source to charcoal in Mozambique. The study revealed that the market for LPG was attractive. According to the study, 63% of the respondents were aware that LPG was an ideal alternative for cooking. The study, however, also revealed that the use of LPG in Mozambique was focused mainly at the top of the income pyramid (Falzon et al, 2013:3; cf. Chilemba, 2005:6). The study, therefore, recommended ways of unlocking the latent demand for LPG at the bottom of the pyramid. This change, the study argues, will reduce consumption of charcoal “which has a significant impact on the environment, leading to degradation of forests...” (Falzon et al, 2013:3).

The study identifies main barriers on both the demand and supply sides on which the recommendations are based. The main barriers on the demand side are: (1) marketing strategies not effective at reaching the bottom of the pyramid; (2) strong preference from

consumers for charcoal; (3) failure of current distribution systems to reach the bottom of the pyramid; and (4) financial constraints on the part of consumers (Falzon et al, 2013:4). Based on these barriers, the study recommends the following interventions on the demand side: (1) public information campaigns, market awareness raising and advocacy; (2) support for LPG supply business model innovation/investment with key actors; and (3) support of initiatives from the private sector or microfinance initiatives (Falzon et al, 2013:4).

The main barriers on the supply side include the following: (1) price cap limiting investment; (2) lack of infrastructure; and (3) supply constraints from South Africa. Based on these barriers on the supply side, the study recommends the following interventions: (1) further study into pricing of LPG for domestic cooking markets; (2) to investigate feasibility of local refinery; and (3) to investigate additional infrastructure requirements (Falzon et al, 2013:4).

Niger became an oil and gas producer in 2010 (SNV Niger, 2013:12). This prompted the government to develop an ambitious programme to promote LPG as a household energy source. In 2012, the government embarked on an aggressive LPG promotion campaign in some major cities. The campaign yielded very positive results as LPG usage soared from 3,000 tonnes in 2011 to 10,000 tonnes by December, 2012. (SNV Niger, 2013:12). “Gas (LPG) is unanimously seen as a serious alternative to wood and charcoal consumption and Niger presents a very favourable situation: the need is evident and the product is available in sufficient quantities” (SNV Niger, 2013:12).

The main objective of the 2013 SNV Niger study was to provide recommendations and guidance on the development of an enabling environment for renewable energy for Niger. LPG was one of the alternative domestic energy sources recommended by the study.

3.6.2 Strategies of LPG adoption in Zambia

The success stories of LPG promotion in the developing countries discussed above give hope for the successful replication of the proposed change in Zambia. The studies reviewed offer strategies that may be adopted by the Zambian government to implement the proposed change. The Zambian government is also able to learn from the mistakes made and challenges faced by the governments in the studies reviewed. The overriding strategy in the reviewed studies is the involvement of all stakeholders. This resonates with the theoretical underpinnings of the study which are stakeholder engagement and sustainable livelihoods.

Alternative sustainable livelihoods for charcoal producers and traders would need to be created to make them switch from charcoal production and trade. The government could empower them to become small scale dealers in LPG, supplying the commodity to their communities. This would be more beneficial in rural areas where suppliers may not be available. "The LPG rural energy challenge provides rural communities with the means to generate a wide range of consumptive and productive services in order to deliver vastly improved living conditions" (Salih, 2006:31). Other alternative sustainable livelihoods include fish farming, bee-keeping, carpentry and conservation farming (It's Wild! 2013:1).

3.7 Conclusion

From the above literature review, it is evident that carrying out this study is justifiable. The literature review showed that, to implement the proposed introduction of LPG in Zambia successfully, policy makers will need to learn from the mistakes made and challenges faced by the countries in which the studies reviewed were carried out. The study will, of course, reveal strengths and challenges peculiar to the Zambian situation. However, solutions to the possible challenges could be similar to those used in the countries reviewed.

The literature review has also revealed that there has been little or no serious research on the possibility of promoting LPG as an alternative energy source to charcoal in Zambia. Therefore, this study is intended to fill this gap. The study will reveal, inter alia,

why past attempts to promote LPG as a domestic energy source in the country have failed and what needs to be done to make fresh attempts successful.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

This chapter discusses the research design and methodology employed by the study. The study adopted the qualitative research design. The research design informed the methods or strategies of data collection, analysis and interpretation which included semi-structured questionnaires, personal interviews, focus group discussions and thematic content/framework analysis of questionnaires and focus group discussion data. Data were also collected through reviewing the literature that contained relevant information.

The chapter starts by describing Lusaka City, where the study is located. Detailed discussion of the research design and methodology of the study follows next. The chapter then discusses how the key variables of the study were conceptualised, operationalised and defined. The other issues dealt with in the chapter include measuring instruments and design; sampling design and methods; data collection methods; data capturing and editing; data analysis; reliability and validity; ethical consideration; and shortcomings and limitations.

Lusaka, the capital city of Zambia, is the most populous town in Zambia. Of the total 13 million people (specifically, 13,092,666 (CSO, 2010)) in Zambia, close to two million (specifically, 1,747,152 (CSO 2010)) live in Lusaka City. The size of the population of Lusaka is mainly due to rural urban migration, which was exacerbated by the IMF/World Bank instituted privatisation under the Structural Adjustment Programme (SAP) in the 1990s (Shitima, 2005:1). Privatisation resulted in the discharge of an unprecedented number of workers in the mines and the closure of many firms on the Copperbelt, especially those which depended on the mines. Many of those who were laid off migrated to Lusaka City in search of new livelihoods. These migrants settled in informal and semi-formal settlements, popularly known as “compounds”, dotted around Lusaka City.

These compounds inhabited by the migrants include Mtendere, Kalingalinga, Kanyama, Chawama and Mandevu, some of the specific research areas of this study. The compounds are among the most populous residential areas of Lusaka City and charcoal is the main source of domestic energy for cooking in these compounds. The other specific research areas of the study included some formal settlements of Lusaka City, called townships, where charcoal is also a main source of cooking energy. These include: Chilenje, Matero, Chelstone and Kaunda Square. The total population of all the above research areas is 641,755 (CSO, 2010), which is 37% of the population of Lusaka City. The specific population of each research area is as follows: Chawama 70,181; Chilenje 52,220; Kanyama 169,253; Matero 55,629; Mtendere 106,128; Kalingalinga 39,139; Mandevu 66,205; Chelstone 38,000 and Kaunda Square 45,000 (CSO, 2010).

Figure 4.1 below shows Lusaka City and the geographical position of the compounds where the study was conducted. Figure 4.2 shows the geographical position of Lusaka Province, relative to the other provinces in the country, as well as the geographical position of Lusaka City.

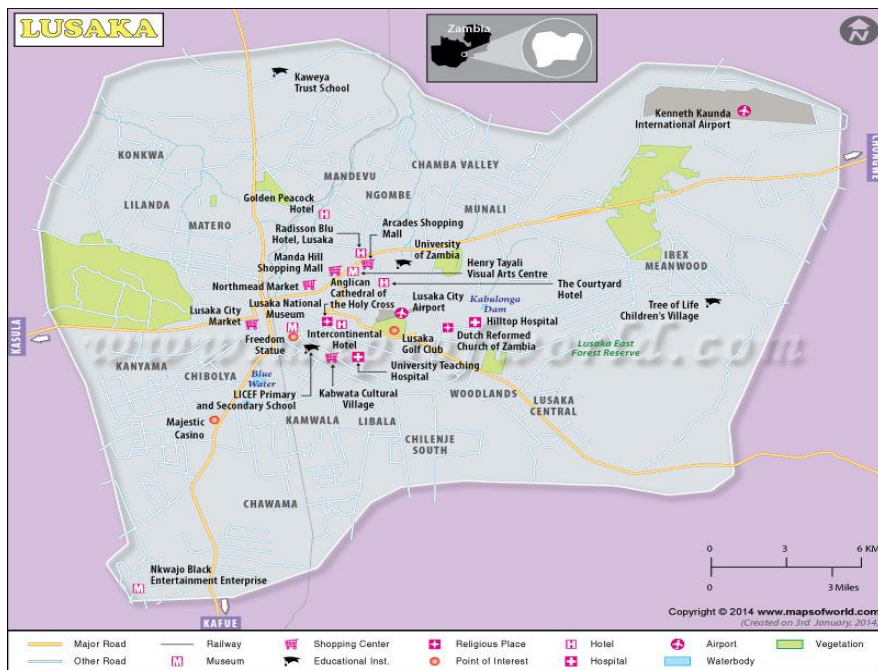
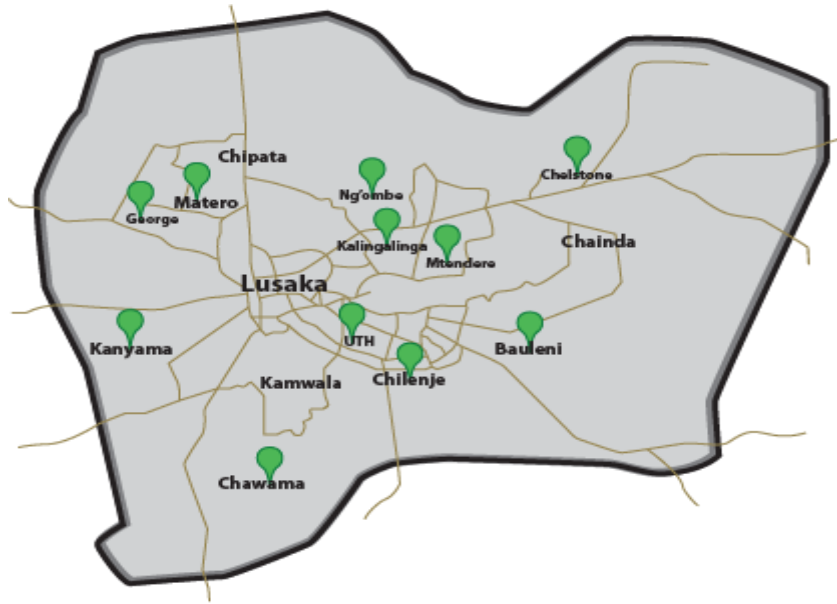


Figure 4.1: Maps of Lusaka City showing the geographical positions of Chilenje, Chawama, Kanyama, Matero, Mandevu Chelstone, Kalingalinga and Mtendere (Kaunda Square – not on either map – is to the west of Chelstone)

Source: mapsoftheworld.com, 2017

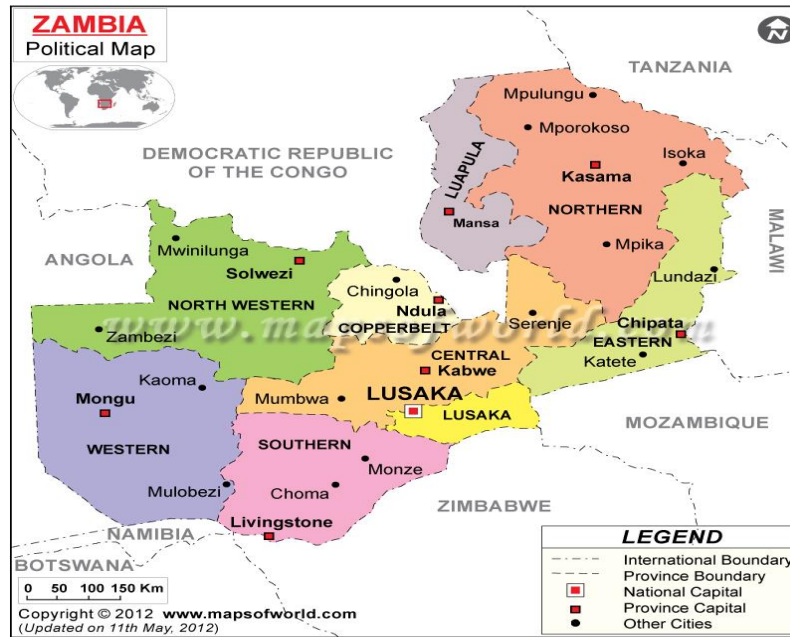


Figure 4.2 Map of Zambia showing the geographical position of Lusaka City

Source: mapsofworld.com, 2017

4.2 Research design and methodology

4.2.1 Research approach

The study used the qualitative research design. The study required the researcher to visit people in their natural settings in order to collect the required information and also to answer questionnaires. This provided a form of triangulation, as the questionnaires yield both quantitative and qualitative data. The researcher visited participants in the target locations, who were selected purposively, personally, in order to collect the required information. This method of collecting data made the researcher achieve an in-depth understanding of the participants' contexts and thus enabled him to analyse and interpret the data collected accurately. The qualitative design, therefore, was the most appropriate design for this part of the study. Firstly, it is founded on the phenomenological/interpretivist/constructivist tradition, which places emphasis on people as well as their constant endeavours to make sense out of their world (Collodel et al, 2012:37; Creswell, 2009:8). Secondly, it was chosen because of its validity – its closeness to the truth, its flexibility (Taylor & Greenhalgh, 1997:2) and its main concern

of understanding the complexity of human experience.

The study area was Lusaka City, the capital city of Zambia. Lusaka City was very suitable for the study because it provides a very good market for charcoal. Firstly, because of its high population that uses charcoal and, secondly, because of the high demand for charcoal created by this population, which is concentrated in informal and semi-formal settlements. Charcoal produced in the outskirts of the city and in other towns is transported to Lusaka to be sold there. Thirdly, people who live in the informal and semi-formal settlements depend exclusively on charcoal for cooking.

4.3 Conceptualisation and definition of key variables of the study

Social research is scientific. This involves accurate measurement of concepts that enable the researcher to identify social phenomena and convey meaning (Collodel et al, 2012:24). This also implies that abstract concepts that cannot be easily measured have to be operationalised into concrete and measurable concepts. In social research, this is achieved through the system of variables and attributes (Collodel et al, 2012:24). Blanche et al (in Khumalo, 2013:88) define a variable as a concept that is attached to a unit of analysis and that has two or more values. Babbie (2010:14) refers to these values as attributes and defines an attribute as “[a] characteristic of a person or thing” and a variable as “[a]logical set of attributes”.

In this study, variables were measured in terms of charcoal traders and users, and key informants. The variables included the following: (1) perception levels on the dangers of charcoal production and use; (2) perception levels on the various possible alternatives to charcoal; (3) knowledge levels on LPG as a domestic energy source; (4) perception levels on the possibility of introducing LPG as an alternative domestic energy source; (5) perception levels on the challenges that may impede the introduction of LPG as an alternative domestic energy source in Zambia; and (6) perception levels on how the challenges may be addressed.

Table 4.1 below gives an analysis or definition of the various variables and how the definition of each variable helped in terms of fulfilling the objectives of the study and in

answering the research questions.

Table 4.1 Research variables: Definition and purpose

Serial No.	Variable	Definition/Indicators	Purpose
1	Perception levels on the dangers of charcoal production and use	How many, in terms of percentage, charcoal traders and individual users are aware of the dangers of charcoal production and use.	This helped the researcher establish charcoal traders and individual users' knowledge of the dangers of charcoal production and use, which could be used by policy makers to persuade the traders and users to switch to LPG.
2	Perception levels on the various possible alternatives to charcoal	How many, in terms of percentage, charcoal traders and individual users are aware of the various possible alternatives to charcoal.	This helped the researcher establish the amount of education that would be required to convince charcoal traders and individual charcoal users that there are many domestic energy sources other than charcoal and that switching to one of them is possible.
3	Knowledge levels of LPG as a domestic energy source.	How many, in terms of percentage, charcoal traders and individual charcoal users know that LPG is a domestic energy source.	This helped the researcher establish the amount of sensitisation that would be required to persuade charcoal traders and individual charcoal users to switch to LPG.
4	Perception levels on the possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia.	How many, in terms of percentage, charcoal traders, individual charcoal users and key informants think introducing LPG as an alternative energy source to charcoal in Zambia is possible.	This helped the researcher establish the possibility, or otherwise, of introducing LPG as an alternative domestic energy source in Zambia. This also helped the researcher to answer research question (a).
5	Perception levels on the challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia.	How many, in terms of percentage, charcoal traders, individual charcoal users and key informants are aware of the possible challenges that would make the proposed switch from charcoal to LPG difficult.	This helped the researcher establish what challenges needed to be addressed by policy makers in order to make the proposed change possible. This also helped the researcher to answer research question (b).
6	Perception levels on the possible solutions to the challenges.	How many, in terms of percentage, charcoal traders, individual users and key informants are aware of the possible solutions to the challenges.	This helped the researcher establish what measures policy makers would take to address the challenges. This also helped the researcher to answer research question (c).

Source: Table structure and ideas: Stephen, 2011:29

4.4 Measuring instruments and design

Yaya (2014: online) defines measurement instruments as “various methods through which a researcher obtains data from respondents for research work”. He argues that the trustworthiness of the data collected depends on the effectiveness of the measuring instruments a study uses as the conclusions of the study are based on the results that the data reveal.

The measuring instruments used in this study were focus group discussions, self-administered questionnaires and interviews for target groups and key informants. All these measuring instruments fall under the qualitative research design. The use of these various measuring instruments made the data collected more trustworthy as this is a form of triangulation which allows various methods to compensate each other as every method has both strengths and weaknesses (Henry, 2015:2).

The instruments were piloted using a few participants, some of whom commented on some sections of the questionnaires and the introductory letter, which were adjusted accordingly. This is in line with Welman, Kruger & Mitchele’s (in Ngwenya, 2015:40) argument that a newly developed instrument should be tested before it is administered to the actual sample. The units of analysis for the study were charcoal traders and users, and key informants.

Focus group discussion is a very effective method of collecting qualitative data. Some of the advantages of the focus group discussion method include facilitation of collection of data from several people at the same time and allowing for group interaction which, in turn, facilitates an exchange of ideas where participants comment on each other’s experiences as well as their points of view (Kitzinger, 1995:299). Kitzinger(1995:299) further argues that “[t]he method is particularly useful for exploring people’s knowledge and experiences and can be used to examine not only what people think but how they think and why they think that way”. The study conducted focus group discussions in four of the nine research areas.

Yaya (2014:online) argues that the questionnaire method is the commonest method of

data collection. The main advantages of the questionnaire are the fact that it guarantees the anonymity of the respondents and allows for the collection of large amounts of data in a relatively short period.

Yaya (2014:online) refers to an interview as “an oral questionnaire”. He argues that the main advantages of an interview are that (1) it has a high response rate; and (2) it allows for the explanation of confusing and ambiguous questions. In this study, therefore, interviews complemented the self-administered questionnaire which has weaknesses in the two areas cited by Yaya above.

4.5 Sampling design and sampling methods

4.5.1 Study population

One thousand questionnaires were distributed. This number of questionnaires was informed by the fact that the typical questionnaire return rate is usually 30-60% (Beutell, 2017:online; Fraser, 2017:online). Therefore, one thousand questionnaires would achieve a reasonable return rate of at least 300 respondents. The study response rate was 45.3% as four hundred and fifty three (453) responses were achieved. This is a good response rate as it is within the typical return range and quite close to the top percentage in the range. This number included charcoal traders, charcoal users and key informants from the energy and environmental protection sectors. This was complemented by 7 focus group discussions, involving charcoal traders and users, conducted in 4 of the 9 research areas. The study population was selected purposively and included individuals relevant to the phenomenon under investigation.

Table 4.2 below shows the sample break down by data collection method.

Table 4.2: Questionnaire returns by data collection method

Serial Number	Data collection method	Number of respondents		
		Charcoal traders and users	Key informants	Total
1	Self-administered questionnaires	293	60	353
2	Interviews	99	01	100
	Total	392	61	453
3	Focus group discussions	07	-	07

4.5.2 Sampling technique

Purposive sampling was employed in the study. The research areas were purposively selected due to their relevance to the study because they have a high prevalence of charcoal usage. Specific respondents were also purposively selected. One thousand questionnaires were distributed this way and seven focus group discussions were done.

4.6 Data collection methods and field work

The study used the interview and questionnaire technique and focus group discussions to collect data. Semi-structured questionnaires were used. This technique allowed the researcher to get as many views as possible on the phenomenon being investigated (Creswell, 2009:8). It is this kind of interaction which is the basis of the social constructivist philosophical assumption or worldview. The other advantage of the technique is the fact that it yields thick description of the phenomenon under study. Yves (in Ngwenya, 2015:40) argues that the main advantages of this technique are that “it can produce an in-depth analysis of phenomena in context, support the development of historical perspectives and guarantee high internal validity which is to say that the observed phenomena are authentic representations of reality”. This is, once more, another form of triangulation, as the questionnaires yield both quantitative and qualitative data. Percentages can be calculated from the quantitative data, which gives the results objectivity.

Interviews were conducted with respondents who were unable to complete the questionnaires on their own and a key informant who preferred an interview to a questionnaire. Questions on the questionnaires were read out to the respondents and answers were written in the appropriate blank spaces on the questionnaires. The other key informants preferred self-administered questionnaires.

Key informants were drawn from organisations in the energy and environmental sectors, both public and private. The public sector organisations included the Department of Energy, the Forestry Department, ZEMA and ZESCO while the private ones were Oryx, Afrox and Ogas. Government documents, especially those from the Ministry of Environment, Tourism and Natural Resources (METNR) provided secondary data on the phenomenon under inquiry.

Focus group discussions were held with a number of charcoal traders and users. The focus group discussions, and individual interviews, were conducted in English, Bemba and Nyanja, depending on the language the participants preferred. Information collected from personal interviews was recorded in English in the spaces provided on the questionnaire during the interviews, while focus discussions were electronically recorded and later transcribed verbatim in English for analysis.

Focus group discussions are an effective method of collecting qualitative data (Calandro, 2011:25; Barlagne, Cornet, Blazy, Diman & Ozier-Lafontaine, 2016:2). They allow for exploration of participants' in-depth nuanced opinions regarding an issue (Calandro, 2011:25; Barlagne et al, 2016:2) and they provide "a platform for interaction between the participants within a limited period of time" (Kitzinger et alin Barlagne et al, 2016:2). Further, the "type and range of data generated through the social interaction of the group are deeper and richer than those obtained from one-to-one interviews" (Rabiee, 2004:656). Therefore, the use of the focus group discussion method in the study also vouches for the quality and diversity of the data that was collected.

Face-to-face interviews and self-administered questionnaires were supplemented by data that were collected through document analysis (secondary sources). Documents

containing government policies on climate change mitigation and related documents from organisations like METMR, ZESCO, ERB and the Forestry Department were analysed.

By the nature of their authorship, these documents were considered to contain credible and reliable information. GRZ MEWD (2008) has information on the national energy policy, which includes LPG as one of the envisaged alternatives to woodfuel. GRZ MTENR (2007) and GRZ MTENR (2010) are documents produced by the Zambian government Ministry of Tourism, Environment and Natural Resources which is in charge of all matters related to climate change. The documents provided valuable information on the climate change situation in Zambia and the mitigating and adaptation measures being carried out. The Background Paper on Climate Change issues, Zambia, by Fumpa-Makano (2011) contains valuable information related to forests and climate change. The author is a renowned government consultant on climate change matters. Chinambu (2011) documents information on the petroleum industry in Zambia, which covers the status of LPG promotion in the country. The author is a UN consultant and expert in the energy sector. Vinya et al (2012), Zambian government consultants on matters of deforestation, provide valuable information on the drivers of deforestation in Zambia. They prepared the report for the Forestry Department (FD) and the Food and Agriculture Organisation (FAO) under the auspices of the national UN-REDD+ programme of the Ministry of Lands, Natural Resources and Environmental Protection (MLNREP).

4.7 Data capturing and editing

Data were captured on self-administered questionnaires, interview questionnaires and as electronic recordings on a tablet. The data collected were edited based on the research objectives and research questions. Irrelevant data, that is, data that were not related to the research objectives and questions, were edited out. Focus group discussions were transcribed into verbatim dialogues. As far as possible, the original discussions were maintained although, in some cases, certain portions, especially unintelligible ones, were omitted. These were indicated by [...]. The original language of discussions was Bemba,

mixed with English and Nyanja. The transcripts were translated into English.

4.8 Data analysis

The collected data were analysed in a way that made them address the objectives of the study and answer the research questions. The data were, therefore, grouped according to the following categories under which the questions were classified:

(1) Perceptions on the dangers of charcoal production and use; (2) Perceptions on the various alternatives to charcoal; (3) Knowledge of LPG as a domestic energy source; (4) The possibility of introducing LPG as an alternative domestic energy source; (5) Challenges that may impede the introduction of LPG as an alternative domestic energy source in Zambia; and (6) How the challenges may be addressed. The questions in the questionnaires were tailored to the six categories. Emerging themes, which helped answer the research questions, were identified under each category. This is in line with qualitative content analysis, which is an inductive strategy of data analysis. Bryman (in Kohlbacher, 2006:12) argues that qualitative content analysis “comprises a searching-out of underlying themes in the materials being analysed”. Titscher et al (in Kohlbacher, 2006:14) further explain that “the core and central tool of any content analysis is its system of categories: every unit of analysis must be coded, that is to say, one or more categories. Categories are understood as more or less operational definitions of variables”. This conforms to the way the study operationalised the six categories into variables (refer to section 3.4 “Conceptualisation and definition of key variables of the study” above).

The central characteristic of qualitative content analysis is that of categories. Hsieh & Shannon (2005:1278) define qualitative content analysis as “a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns”. Bryman (in Kohlbacher, 2006: 2) defines qualitative content analysis as

an approach to documents that emphasizes the role of the investigator in the construction of the meaning of and in texts. There is an emphasis on allowing

categories to emerge out of data and recognizing the significance for understanding the meaning of the context in which an item being analysed (and the categories derived from it) appeared.

Patton (in Zhang & Wildemuth, (undated:1) defines qualitative content analysis as “any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings”.

Content analysis, as a method, has a number of approaches. This study adopted thematic content analysis which is defined by Ryan & Bernard (in Braun & Clarke, 2006:5) as a “process performed within major analytic tradition (such as grounded theory)”. Braun & Clarke (2006:7) define it as “a method for identifying, analysing, and reporting patterns (themes) within data. It minimally organizes and describes your dataset in (rich) detail”. Brytzis (in Braun & Clarke, 2006:7) adds that the method goes further in that it often “interprets various aspects of the research topic”.

The validity and trustworthiness of a data analysis method lies in its transferability and dependability. The fact that qualitative content analysis involves individual steps of interpretation, which are determined in advance, makes it a stronger interpretive method than any other such method (Mayring, 2014:53). Mayring (2014:53) further argues that this aspect of qualitative content analysis makes it “comprehensible to others and intersubjectively testable; therefore, it can also be transferred to other subjects, is available for use by others and can be regarded as a scientific method”. Kohlbacher (2006:14) indicates that the strength of the method resides in the fact that “it is strictly controlled methodologically and that the material is analysed step-by-step”. The steps followed in the qualitative content analysis process basically involve, in broad terms, (1) summary; (2) explication; and (3) structuring (Mayring in Kohlbacher, 2006:14). At the summary stage, the material is reduced to manageable chunks but still reflects the original material. The explication stage involves explaining, classifying or categorising, and coding the material whereas the structuring stage involves the filtering out of a certain structure from the material. It is at this stage that units of analysis are defined, results are processed and themes are established.

Focus group data were analysed using framework analysis, which is another form of thematic content analysis (Gale et al, 2013:2). Framework analysis is an effective way of analysing thematically textual data generated either from interview or focus group discussions (Gale et al, 2013:2; Rabiee, 2004:657). The method allows the researcher to become immersed in the data as he would need to listen and re-listen to the audio recordings in order to compile the transcripts (Gale et al, 2013:4). The method also allows for thick description as it involves summarising data which “is kept within the wider context of each case” (Gale et al, 2013:5). Further, the method provides a clear audit trail from original raw data to final emerging themes (Gale et al, 2013:6;) as it is “systematic, sequential, verifiable and continuous” by way of the steps followed during data analysis (Rabiee, 2004:657).

As per the framework analysis method, focus group discussion data were analysed through the following steps (Gale et al, 2013:4-5; Rabiee, 2004:657): First, the discussions were transcribed verbatim. Second, the researcher familiarised himself with the data by re-listening to the audio recordings and re-reading the discussions. Third, the researcher coded the transcripts. This involved making brief notes describing what he interpreted in the text as being of some significance. This allowed the researcher to classify data so that it could be compared with other data sets. Fourth, the researcher developed a working analytical framework based on the few transcripts that had been coded. This involved grouping together the codes used so as to reduce them to common codes. Fifth, the researcher applied the working analytical framework “by indexing (re-arranging) subsequent transcripts using the existing categories and codes (Gale et al, 2013:5). Sixth, the researcher charted (summarised) data into the framework matrix using a spreadsheet. This involved summarising the data from each transcript by category. Seventh, the researcher interpreted the data. This involved identifying emerging themes from the data.

The results of the study are presented in Chapters 5 and 6 and discussed in Chapter 7 according to the themes which emerged from the data analysis. The themes have been classified under the six categories mentioned above, which were developed a priori at

questionnaire designing stage.

Triangulation was done at this stage. Triangulation refers to the use of various methods, a wide range of informants, documents and sites in order to increase the validity of the results of a study (Shenton, 2004:65). (This strategy is discussed in detail under the next section). Basic quantitative data were generated from the categories as part of the operationalisation of the variables. Perception and knowledge of certain aspects of the phenomenon were quantified in terms of percentages to achieve some objective measurement of the variables. As has already been pointed out, triangulation in this regard gave a balanced analysis of the data to strengthen its validity and rigour.

Qualitative content analysis is a form of triangulation as it is a combination of analysis tools from both quantitative and qualitative research. Like general research, qualitative content analysis was developed from quantitative content analysis (Mayring, 2014:9). Mayring (2014:9) further explains that

qualitative content analysis involves conceptualising the process of assigning categories to text passages as a qualitative act, following content-analytical rules (springing from quantitative content analysis). In this respect qualitative content analysis is a mixed methods approach: assignment of categories to text as qualitative step, working through many text passages and analysis of frequencies of categories as quantitative.

4.9 Reliability and validity/credibility and trustworthiness

Strictly speaking, reliability and validity are associated with quantitative research (Noble & Smith, 2015:34; Anderson, 2010:2). Noble & Smith (2015:34) indicate that debate is ongoing as to whether reliability, validity and generalisability are appropriate to evaluate qualitative research. These terms, in the broadest context, do actually apply to qualitative research

with validity referring to the integrity and application of the methods undertaken and the precision in which the findings accurately reflect the data, while reliability describes the consistency within the employed analytical procedures (Noble &

Smith,2015:1; cf. Anderson, 2010:34).

However, Noble & Smith (2015:34) are quick to indicate that, since quantitative and qualitative research differ in terms of philosophical positions and purpose, alternative frameworks for establishing rigour are necessary. Shenton (2004:64) presents Guba's four criteria for ascertaining trustworthiness in qualitative research with their quantitative research equivalents as follows: (1) credibility (internal validity); (2) transferability (external validity); (3) dependability (reliability); and (4) confirmability (objectivity). Shenton (2004:64) discusses a number of strategies under each criterion which can be used to ensure trustworthiness in qualitative research. However, a detailed discussion of each strategy is beyond the scope of this research report. Therefore, only the strategies which the study employed will be briefly discussed.

The study used triangulation and thick description in order to ensure trustworthiness. According to Shenton (2004:65), triangulation is one of the strategies under Guba's first criterion, "credibility" and involves the use of different methods, a wide range of informants, documents and sites. This is corroborated by Henry (2015:2), who explains that triangulation deepens understanding through the collection of data from various sources on the same topic to create a stronger account of the research. Triangulation also allows for various methods to complement each other. "Different methods have different strengths and weaknesses. If they *converge* (agree) then we can be reasonably confident that we are getting the true picture" (Gillham in Kohlbacher, 2006:23). Jick (in Kohlbacher, 2006:23) supports this assertion when he says "effectiveness of triangulation rests on the premise that the weaknesses in each single method will be compensated by the other". Jick (in Kohlbacher, 2006:23) further argues that triangulation "can potentially generate what anthropologists call 'holistic work' or 'thick description'". Henry explains that triangulation may involve multiple methods, analyses or theories. The study, therefore, ensured trustworthiness through the use of individual interviews; focus group discussions; self-administered questionnaires; secondary data from different documents on the phenomenon under study by and about the relevant organisations; and a wide range of informants from the various research areas (sites)

already mentioned under section 3.2, *Research design and methodology*.

On the other hand, thick description involves detailed explication of everything done related to the study. Therefore, apart from triangulation as seen above, thick description requires the researcher to provide a deeply detailed account of the research in order to ascertain the possible application of the findings to other times, places, people as well as contexts (Henry, 2015:2; Shenton, 2004:69). In this way, thick description promotes transferability. Henry (2015:2) further explains that thick description also involves an audit trail, “which calls for the recording of all the steps taken from beginning to end, and includes decisions made during the entire process of the research”. In this study, thick description was achieved through collecting detailed information on questionnaires and through the recording of focus group discussions. The questionnaires and focus group discussions used semi-structured questions which allowed for detailed but relevant information from the participants. This detailed information helped in carrying out valid analysis of the collected data and arriving at reliable and valid results.

From the foregoing, it can be seen that triangulation and thick description, which actually complement each other, are comprehensive enough to address all the issues related to credibility and transferability. They also promote dependability and confirmability in as far as there are similarities in these strategies. Lincoln & Guba (in Shenton, 2004:71) explain that there are close ties between credibility and dependability and that demonstration of the former goes some distance in ensuring the latter. Shenton (2004:72) also argues that triangulation plays a major role in confirmability of the data.

4.10 Ethical considerations

During the study, research ethics were ensured in a number of ways. Firstly, permission was sought from the participants both orally and in writing, before any interview was conducted or questionnaires were administered. Secondly, identities of the participants were protected and confidentiality of the results was ensured as participants were told not to indicate their names on the questionnaires. Thirdly, both voluntary and informed consent were obtained from the participants. McCauley (in Collodel et al, 2012:87-88)

makes a distinction between voluntary consent and informed consent. Voluntary consent involves making the would-be participants aware that they are participating in the study voluntarily and that they are free to withdraw at any time during the study. Informed consent requires the researcher to provide clear and accurate information, which should include the aims of the research, methods to be employed and the expected results. The researcher provided this information to the participants both verbally and by indicating this at the beginning of the questionnaire and in the letter of introduction.

The researcher did not anticipate the study to pose any physical risks to the participants as it did not involve any experiments or related activities. However, it could have some psychological effects on them. Psychological or mental harm could come about in a number of ways. These could include asking probing questions that could reveal embarrassing information (Babbie,2010:479) or make them face aspects of themselves that could be embarrassing (Babbie,2010:480). The researcher, therefore, guarded against this by being sensitive in the manner questions were asked.

The researcher believed that, by observing research ethics in the way delineated above, he would be able to get valid results. McCauley (in Collodel et al, 2012:83) confirms this when he says that ethics of social research are “about creating mutually respectful, win-win relationships in which participants are pleased to respond candidly, valid results are obtained, and the community considers the conclusions constructive”.

Ethical clearance was given by UNISA.

4.11 Shortcomings and limitations

While the researcher managed to visit most of the areas he had planned to visit, he was unable to visit one area on the outskirts of Chongwe, a district about 50km east of Lusaka City along Great East Road. This is the area where most of the charcoal consumed in Lusaka City is produced. The fact that data collection was done during the rainy season made access to the charcoal production areas impossible as the roads to these places had become impassable. Only four-wheel drive trucks manage to reach these places during the rainy season. Therefore, data were not collected from this group

of people. The other factor was time constraint. Since the study had to be completed during a stipulated time frame, the researcher could not wait for these places to dry up in order to visit them.

4.12 Conclusion

This chapter has given the reader some insight on the research area, methods of data collection and analysis and how these methods were linked to the research objectives and questions in order to produce reliable and valid results and observations. The chapter also gives the reader some insights on the efforts made by the study to try and answer the research questions and fulfil the research objectives as accurately as possible.

CHAPTER 5

RESULTS PRESENTATION: DANGERS OF CHARCOAL PRODUCTION AND USE, ALTERNATIVES TO CHARCOAL, AND LPG AS A DOMESTIC ENERGY SOURCE

5.1 Introduction

The purpose of this study was to explore the possibility of introducing liquefied petroleum gas (LPG) as an alternative domestic energy source to charcoal in Zambia, as a climate change mitigation measure. The first four chapters introduced the problem of charcoal related deforestation in the country, reviewed the literature related to the problem and described the methodological design of the study. This chapter and the one that follows present the results from the questionnaires distributed and the personal interview and focus group discussions conducted during field work.

The results from all these instruments are presented together as all of them were expected to yield similar results. This demonstrates how effectively the study made use of triangulation. As has already been seen, triangulation is a way of ensuring the trustworthiness of the data collected as it allows different methods to converge (Gillham in Kohlbacher, 2006:23; Jick in Kohlbacher, 2006:23). Triangulation is also achieved through the different ways the results are presented. Although the presentation is generally in narrative form, tables, graphs and pie charts have also been used to show the results clearly. In all cases, the results are accompanied by verbatim quotations from the respondents in order to bring out the respondents' voices and achieve thick description which, like triangulation, ensures the trustworthiness of the data collected (Henry, 2015:2; Shenton, 2004:69). The two techniques complement each other as triangulation "can potentially generate ... thick description" (Jick in Kohlbacher, 2006:23). Apart from this, verbatim quotations from the respondents provide evidence (Ryan, 2006:94).

The questions in the self-administered questionnaires, personal interview questionnaires (for those participants who could not write for themselves) and focus group discussions

were classified according to the six categories already mentioned in the previous chapter which are: (1) perceptions on the dangers of charcoal production and use; (2) perceptions on the various possible alternatives to charcoal; (3) knowledge of LPG as a domestic energy source; (4) the possibility of introducing LPG as an alternative domestic energy source; (5) challenges that may impede the introduction of LPG as an alternative domestic energy source in Zambia; and (6) how the challenges may be addressed. As indicated earlier, the results were expected to provide answers to the research questions. The first four categories of questions were meant to provide answers to the first and main research question while the fifth and sixth category of questions were meant to provide answers to the second and third research questions, respectively. The results are, therefore, presented and discussed under the three research questions namely:

- (a) To what extent is LPG appropriate as an alternative domestic energy source to charcoal in Zambia?
- (b) What are the challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia?
- (c) What are the solutions to the challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia?

The chapter first describes the respondents' demographic characteristics and how they vouch for the validity and trustworthiness of the data collected. Secondly, it gives a brief explanation of how the methods described in Chapter 4 were applied during the process of data analysis. Next, it presents the results based on categories 1 to 3. It closes with a conclusion.

5.2 Demographic characteristics of respondents

The respondents included charcoal users, charcoal traders and key informants from the energy and environmental protection sectors. This section discusses respondents in terms of their relevance to the study and to providing credible answers to the research

questions. This is important “in order to understand the nature of the findings” of the study (Morton 2006 in Khumalo, 2013:98). Khumalo (2013:98) further justifies the importance of sample profiling by arguing that it gives credibility to the data that the study collects and that it qualifies a study as a scientific effort. He further argues that sample profiling distinguishes research findings as scholarly work from common talk or fiction.

5.2.1 Charcoal users and traders (Questionnaires and interviews)

Most of the participants from the nine research areas exclusively used charcoal for cooking and heating. This is because the other main source of domestic energy in the country, electricity, is too expensive for them due to their low income levels. This is in line with GRZ MEWD’s (2008:2) assertion that charcoal is mainly used by energy consumers of low income levels. This, therefore, made the participants from these areas very suitable for the study as the information they provided would be very credible in terms of policy formulation regarding the change that the study proposes.

This sub-section discusses the demographic characteristics of charcoal users and traders from whom data were collected by questionnaire and interview. Three hundred and ninety two (392) respondents were involved. The validity of the data collected from this group can be inferred from two main factors. Firstly, the majority of the respondents were females who are the actual users of charcoal (of the 392 total number of questionnaire respondents, 206 (53%) were females while 186 (47%) were males). Secondly, while the ages of both male and female respondents ranged from 19 to 60 years, the majority, 264 (67%), were between 30 and 49 years old. This age range comprised mature people who either used charcoal (especially females) or who ran homes that used charcoal (in the case of males). Therefore, the information collected from this age group was credible as the respondents drew on their experiences.

Table 5.1 below shows age and gender distribution of the questionnaire respondents in raw figures while Figures 5.2 and 5.3 show age and gender distribution, respectively, of questionnaire respondents in percentages.

Table 5.1: Age and gender distribution of questionnaire and interview respondents

Age group	Gender		Total
	Male	Female	
10-19	16	24	40
20-29	20	30	50
30-39	74	76	150
40-49	52	62	114
50-59	15	09	24
60 and above	09	05	14
Totals	186	206	392

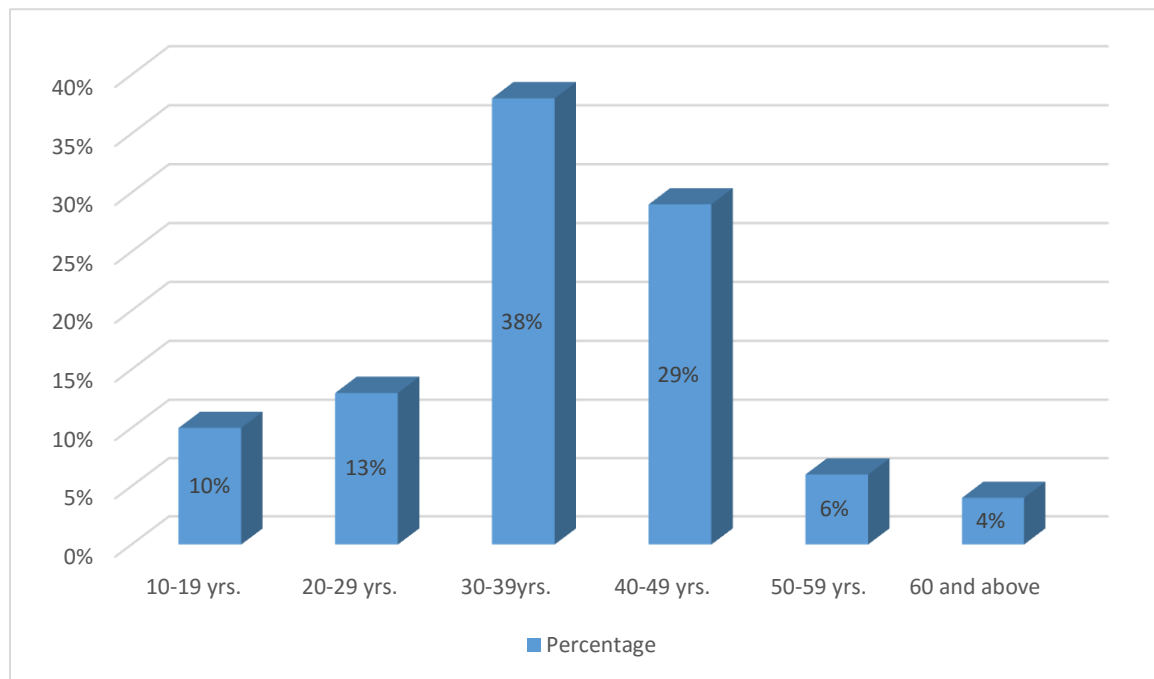


Figure 5.1: Age distribution of questionnaire and interview respondents in percentage

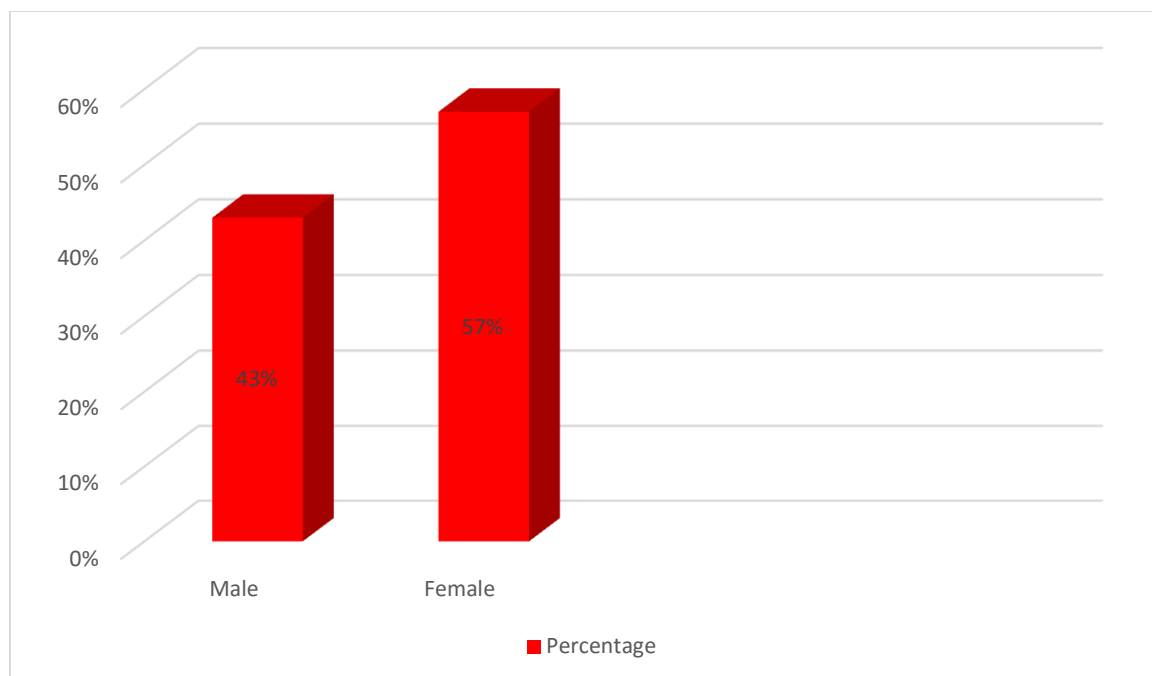


Figure 5.2: Gender distribution of questionnaire and interview respondents in percentage

That the participants were from a low income bracket can also be further confirmed by their occupations. Most of the participants were either unemployed or were engaged in informal or low paying employment. Some of the occupations indicated on the questionnaires included general worker, security guard, gardener, maid, housewife, self-employed, business woman or man (running informal small businesses, such as selling vegetables, amongst others).

This is in line with the energy poverty and energy transition (energy ladder) theories which hold that people who earn low incomes use energy sources that are at the bottom of the energy ladder such as cow dung, firewood, charcoal and related energy sources (Sovacool, 2013:1). The International Energy Agency (IEA), as cited by Savacool (2013:1), defines energy poverty as the lack of access to clean energy like electricity and the dependence on biomass sources of energy like firewood and charcoal. Similarly, the United Nations Development Programme (UNDP) defines energy poverty as the “... inability to cook with modern cooking fuels ...” (Sovacool, 2013:1). The Asian Development Bank (ADB) gives a much broader definition of energy poverty as “the

absence of sufficient choice in accessing adequate, affordable, reliable, high-quality, safe and environmentally benign energy services to support economic and human development (Sovacool, 2013:1).The theories also hold that, as people’s incomes improve, they graduate from a lower energy source to a higher one on the energy ladder. Therefore, if someone was using firewood, for example, they are likely to switch to either charcoal or electricity if their income improved, depending on how much improvement takes place.

Table 5.2 and Figure 5.3 below show the occupation distribution of the respondents both in raw figures and percentages. The occupations have been reduced to the following main categories: Formal, informal and unemployed. Most of the respondents fall under the last two categories, informal and unemployed, which represent 303 (77%) of the respondents.

Table 5.2: Occupation distribution of questionnaire and interview respondents

Occupation	Frequency	Percentage
Formal	89	23%
Informal	148	38%
Unemployed	155	39%
Total	392	100%

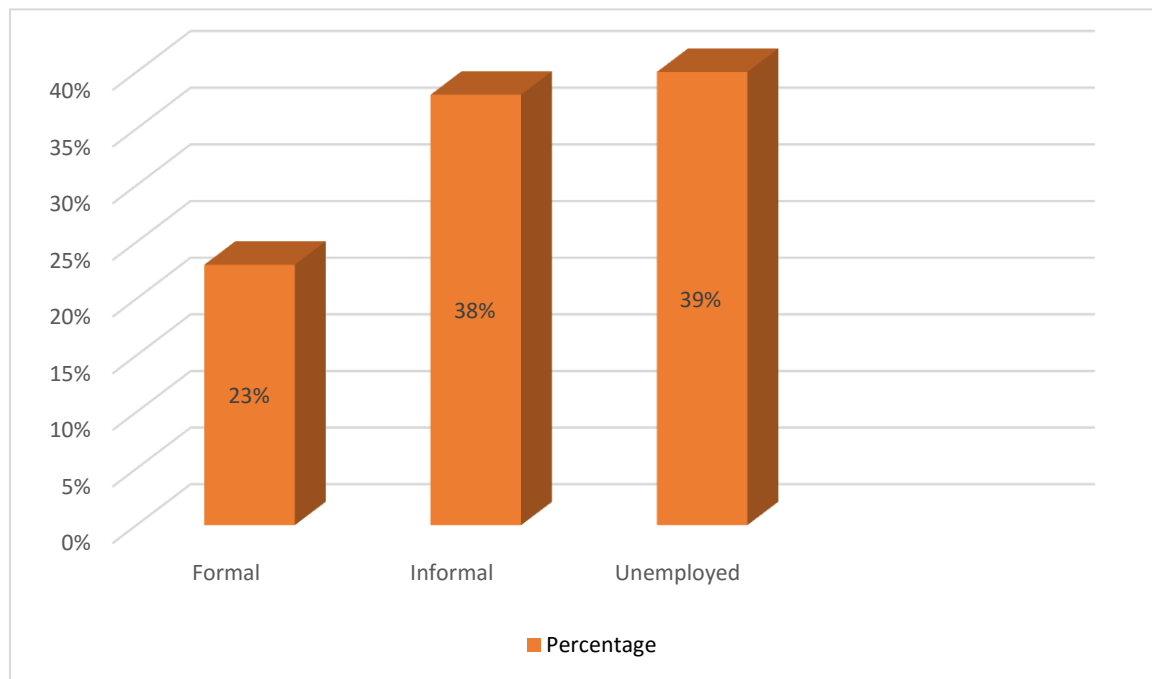


Figure 5.3: Occupation distribution of questionnaire and interview respondents in percentage

The foregoing is also in line with the theoretical framework of this study, Social Ecology, which maintains that environmental degradation is a result of poverty. Sovacool (2013:1) puts this human-environment nexus in perspective by arguing that “environmentally, energy poverty forces its victims to harvest more polluting and less energy-dense fuels such as woody biomass or charcoal often causing land degradation, deforestation, and the contamination of soil and water resources.” It is also clear from this and the information in the preceding paragraph above, that energy poverty is a development issue. Therefore, as a household’s income improves (an aspect of development), “firewood and charcoal give way to kerosene which in turn is displaced by LPG and electricity” (Reddy & Reddy, 1994:561). This is the energy transition theory that arranges the different sources of energy in such a way that the simplest, most polluting and least efficient source of domestic energy is at the lowest rung of the energy ladder. Sovacool (2013:2) explains, “[t]he ladder is often described in terms of efficiencies with the more efficient fuels or sources moving higher up. For example, kerosene is 3 to 5 times more efficient than wood for cooking, and liquefied petroleum gas is 5 to 10 times [more

efficient] than crop residues and dung”.

5.2.2 Key informants (Questionnaires)

Key informants were another category of respondents from whom data were collected by questionnaire. Sixty (60) self-administered questionnaires were administered to this category of respondents while one interview was conducted.

5.2.3 Charcoal users and traders (Focus group discussions)

To enhance the data collected through questionnaires from individual respondents, seven focus group discussions were also conducted in four of the nine research areas, involving both charcoal users and charcoal traders. This sub-section describes the demographic characteristics of this category of respondents. The size of the focus groups ranged from six to 21 respondents per group while the ages ranged from 18 to 70 years. The majority of these respondents fell in the age category between 21 and 59 years (Table 5.3 and Figure 5.4), most of whom were married with the number of children ranging from one child to ten children. Apart from their own children, a number of the respondents also looked after other dependents. Most of the charcoal-user respondents were either involved in informal employment or were unemployed. Charcoal selling was the only occupation for all the charcoal traders. Therefore, like the respondents to whom questionnaires were administered, as discussed above, this category of respondents belonged to a low income category and used charcoal exclusively to meet their cooking and heating needs. Coupled with the fact that most of them are married and have children and other dependents to look after, as indicated above, these respondents were very regular consumers of charcoal and, as such, were the appropriate people to provide the information needed for the study.

Table 5.4 and Figure 5.6 show occupation distribution of the respondents in both raw figures and percentages.

Table 5.3: Age and gender distribution of focus group discussion respondents (both users and traders)

Age group	Gender		Total
	Male	Female	
10-19	03	01	03
20-29	07	15	22
30-39	03	06	09
40-49	01	18	19
50-59	0	09	09
60 and above	0	06	06
Totals	13	55	68

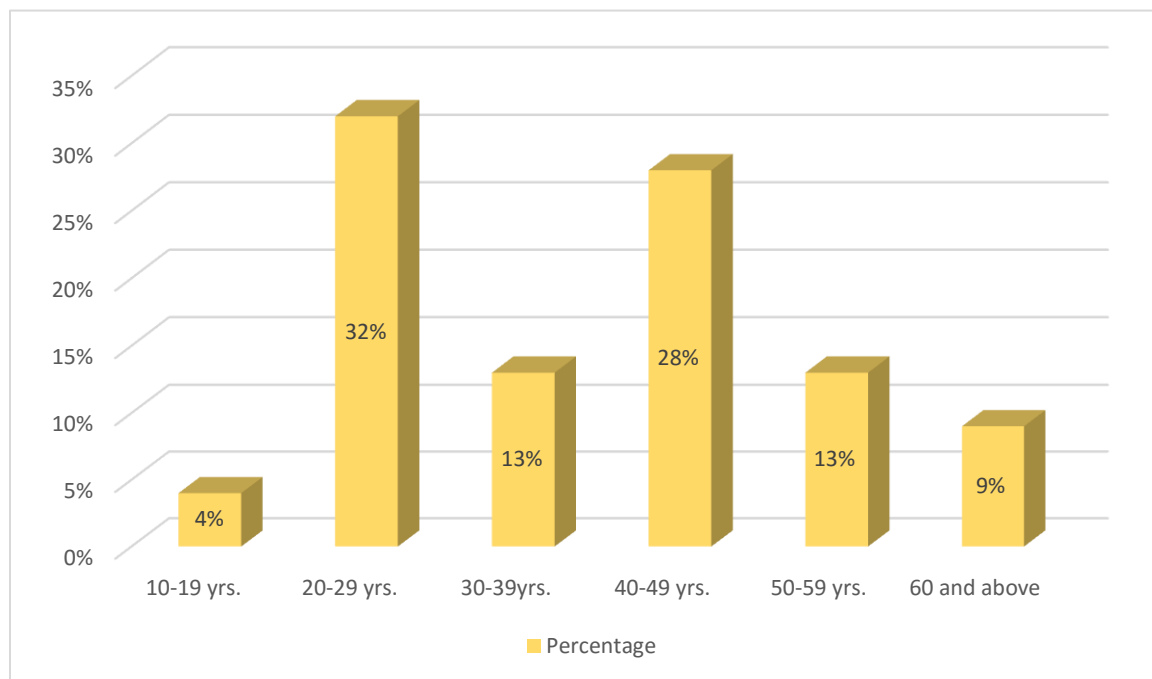


Figure 5.4: Age distribution of focus group discussion respondents (both users and traders) in percentages

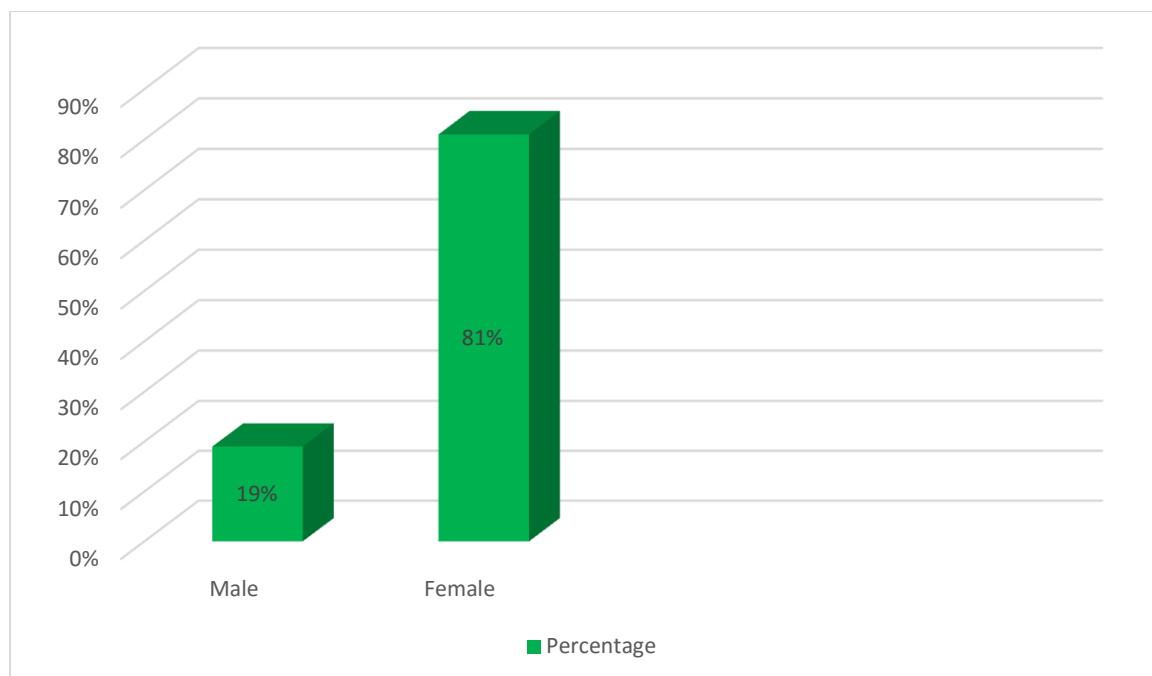


Figure 5.5: Gender distribution of focus group discussion respondents (both users and traders) in percentages

Table 5.4: Occupation distribution of focus group discussion charcoal-user respondents

Occupation	Frequency	Percentage
Formal	05	10%
Informal	13	27%
Unemployed	30	63%
Total	48	100%

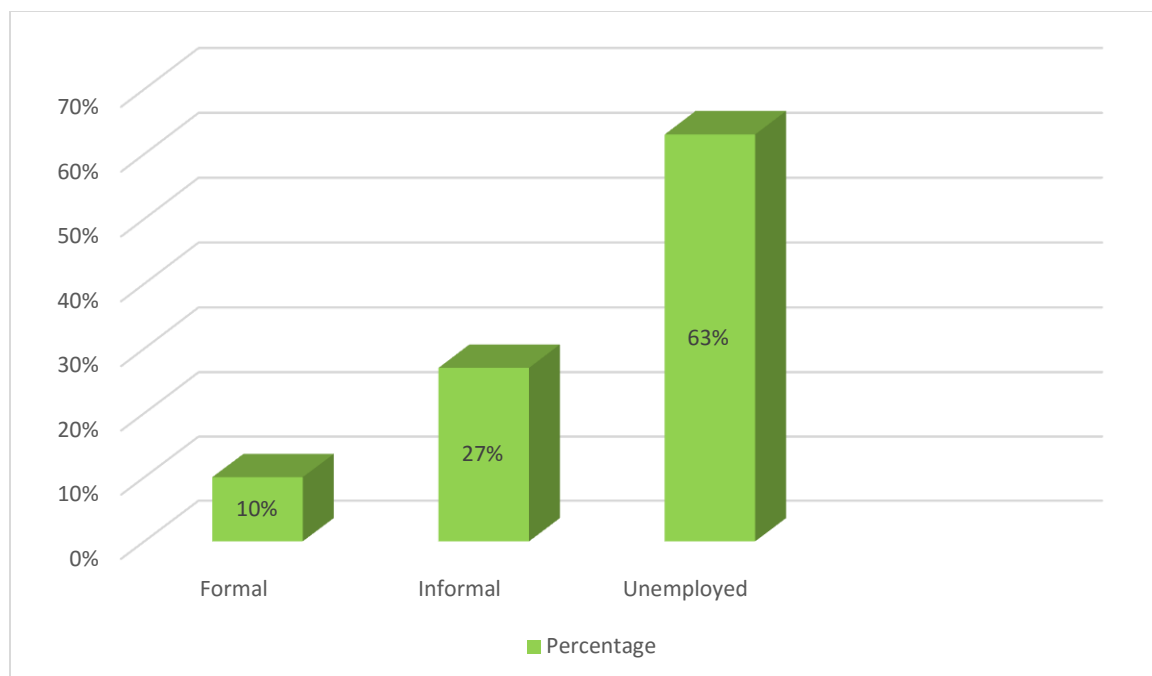


Figure 5.6: Occupation distribution of focus group discussion charcoal-user respondents in percentage

Figures 5.7 to 5.12 show some of the focus group discussions that took place during the study. The respondents were purposively selected to include women mainly. Women are the people who mainly use charcoal as they are the one who are in charge of cooking in homes. This bias towards women ensured that the data that were collected were authentic and reliable. The age of the women respondents was also important. The age of the majority of women respondents ranged from 20-49 years. This is the age group that is actively engaged in cooking in various homes. The kind of occupation one is engaged in determines the kind of domestic energy one will use. Most of the focus group respondents were either in informal employment or unemployed. Therefore, they used charcoal exclusively to meet their cooking needs as it is the cheapest source of domestic energy.



Figure 5.7: A focus group discussion with charcoal traders at a Mtendere charcoal market



Figure 5.8: Some focus group discussion charcoal-trader participants at another Mtendere charcoal market completing consent forms



Figure 5.9: A focus group discussion with PHI maids and gardeners from Mtendere and neighbouring townships (charcoal users)



Figure 5.10 (a): A focus group discussion with charcoal users from Kaunda Square (members of the Catholic Nazareth lay group)



Figure 5.10 (b): A focus group discussion with charcoal users from Kaunda Square (members of the Catholic Nazareth lay group)



Figure 5.11: A focus group discussion with charcoal users from Mandevu

5.3 Methodological approach application to data analysis process

As described in Chapter 4, questionnaire data and focus group discussion data were analysed using the qualitative thematic content and framework analysis methods, respectively. Data were coded, grouped into similar categories and later reduced to themes. Focus group data were transcribed verbatim, coded, categorised and reduced to themes. The results in the section that follows are, therefore, presented according to the research questions, using question categories which were developed a priori as questionnaire sections and the emerging themes that were developed inductively.

5.4 Results presentation

This section presents fieldwork results on the basis of completed self-administered questionnaires, individual interviews and focus group discussions conducted during fieldwork. The section first presents summaries of fieldwork results based on the six categories discussed above, under each research question. The first four categories fall under research question (a) while the fifth and sixth categories fall under research questions (b) and (c) respectively.

5.4.1 Research question (a): To what extent is LPG appropriate as an alternative domestic energy source to charcoal in Zambia?

The appropriateness of LPG as an alternative domestic energy source to charcoal in Zambia was found to be possible (Table 5.5). On average, 68% respondents were aware of the dangers of charcoal production and use. The respondents' perception on the various possible alternatives to charcoal available in the country recorded a high average of 73%. Although only an average of 13% of the respondents were aware of LPG as a domestic source of energy, an average of 64% of the respondents thought LPG would be an appropriate alternative domestic energy source to charcoal in Zambia (Table 5.5).

Table 5.5: Summary of findings on the appropriateness of LPG as an alternative domestic energy source to charcoal in Zambia

Serial No.	Category	Purpose	Emerging themes	Results summary
1	Perceptions on the dangers of charcoal production and use	To establish how many, in terms of percentage, charcoal users and traders are aware of the dangers of charcoal production and use and how charcoal production and use can be linked to climate change.	<p><i>Aware</i></p> <ul style="list-style-type: none"> • Environmental degradation <p><i>Not aware</i></p> <ul style="list-style-type: none"> • Trees used to produce charcoal which is a very cheap source of domestic energy • Charcoal used since time immemorial • Zambia is a poor country and people heavily depend on charcoal for cooking • People use charcoal when there is no electricity (load shedding) 	On average, 68% of the participants are aware of the dangers of charcoal production and use to personal health and the environment.
2	Perceptions on various possible alternatives to charcoal	<p>(a) To establish how many, in terms of percentage, charcoal users and charcoal traders are aware of the various possible alternatives to charcoal.</p> <p>(b) To establish the possible alternatives to charcoal</p>	<p><i>Possible to replace charcoal:</i></p> <ul style="list-style-type: none"> • Non usage of charcoal in some other countries • Availability of other sources of domestic energy other than charcoal • Government intervention <p><i>Not possible to replace charcoal:</i></p> <ul style="list-style-type: none"> • No other cheaper source for poor people • Charcoal used since time immemorial • Charcoal is source of income for some poor people 	<p>(a) On average, 73% of the participants are aware of various alternatives to charcoal</p> <p>(b) Possible alternatives to charcoal</p> <ul style="list-style-type: none"> • LPG • Solar • Electricity • Coal • Kerosene • biogas
3	Knowledge of LPG as a domestic energy source	To establish how many, in terms of percentage, charcoal users and charcoal traders know that LPG is a domestic energy source.	<ul style="list-style-type: none"> • Lack of knowledge about LPG • High cost of LPG • Non availability of LPG in most parts of the country • The danger of LPG 	On average, 13% of the participants are aware of LPG as a domestic source of energy
4	Possibility of introducing LPG	(a) To establish how many, in terms of percentage,	<i>Possible if:</i>	(a) On average, 64% of the

	<p>as an alternative domestic energy source to charcoal in Zambia.</p>	<p>participants/key informants, think introducing LPG as an alternative domestic energy source to charcoal in Zambia is possible.</p> <p>(b) To establish what measures government organisations in the energy and environmental protection sectors are taking regarding the introduction of LPG as an alternative domestic energy source to charcoal in Zambia.</p>	<ul style="list-style-type: none"> • Reduction of LPG prices • Government intervened • Sensitisation • Gradual introduction • Stakeholders engagement • Availability of LPG • Banning of charcoal <p><i>Not possible because:</i></p> <ul style="list-style-type: none"> • LPG is not as cheap as charcoal • Charcoal has been used since time immemorial • Rural areas heavily depend on charcoal; no other alternatives • Zambia is a poor country • LPG not readily available in most places in Zambia 	<p>participants think it is possible to introduce LPG as an alternative domestic energy source to charcoal in Zambia.</p> <p><i>(b) (1) Dept. of Energy:</i></p> <p>LPG enshrined in the National Energy Policy of 2008 as one of the alternative energy sources to charcoal;</p> <p>pilot projects conducted in peri-urban areas of Mtendere and Kalingalinga on the promotion of LPG usage; dissemination of information to demystify LPG</p> <p><i>(2) ZESCO:</i> Sponsoring of adverts on LPG usage; organised stakeholder meeting on LPG Promotion;</p> <p><i>(3) ZEMA:</i> Providing mitigation and adaptation programmes to climate change – LPG could be part of the process in the development of the options.</p>
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Category 1: Perceptions on the dangers of charcoal production and use

The purpose of the questions under this category was to establish how many, in terms of percentage, charcoal users and traders were aware of the dangers of charcoal production and use and how charcoal production and use could be linked to climate change. On average, 68% of the participants were aware of the dangers of charcoal production and use to personal health and the environment (Figure 5.13). The major theme that emerged from the responses was environmental degradation with the

following sub-themes: climate change, deforestation and air pollution.

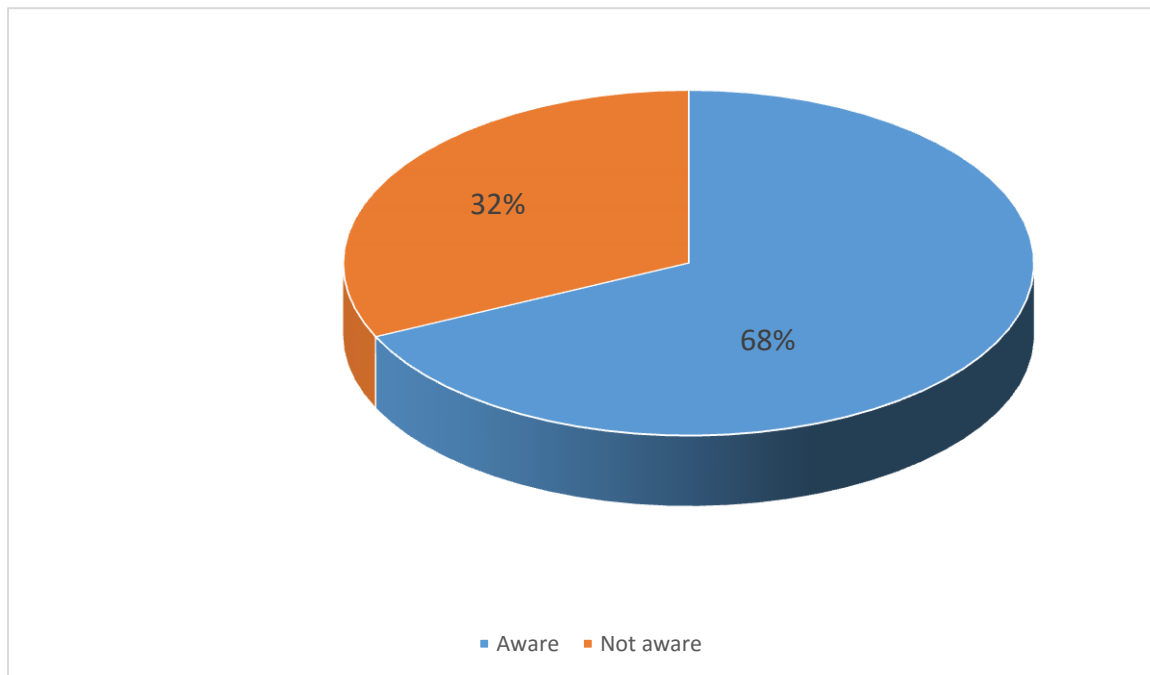


Figure 5.12: Category 1- Perception levels on the dangers of charcoal production and use

Theme: Environmental degradation

(a)Cutting down of trees for charcoal production

When respondents were asked whether cutting down trees for charcoal production was good, the majority indicated that it was not good. They said cutting down trees degraded the environment and brought about climate change. The answers provided by some questionnaire respondents included, inter alia, soil erosion, changing rain pattern, global warming, deforestation and air pollution as “...trees bring fresh air as they are shaking. Now if we cut them down there will be too much heat” one of the focus group discussants indicated, referring to global warming. “ ... When many trees have been cut down, the land becomes bare, it also contributes ... even the way it is raining ... then there is soil erosion. The soil is swept and that destroys nature” another focus group discussant from a different focus group pointed out, referring to soil erosion, changing rainfall patterns and deforestation.

Figure 5.13 below shows the kind of trees that are cut down for charcoal production. The trees are live and form very healthy forests that help sequester carbon from the atmosphere as well as prevent soil erosion and general environmental degradation and ultimately mitigate climate change.



Figure 5.13: Live trees that are cut down for charcoal production

(b)Effects of charcoal production and use on health and the environment

The majority of the respondents answered in the affirmative regarding whether charcoal production and use had health and environmental effects. Regarding health effects, they mentioned problems like causing headaches, making people faint, causing coughing and resulting in death if a person inhaled charcoal fumes in an enclosed place. "... If you use charcoal in the house, especially if the house is painted with oil paint, it intoxicates. I was once intoxicated and I almost died. This is a disadvantage of using charcoal," one focus group respondent said. Another respondent confirmed this, "If it is done inside the house there is a problem. Charcoal produces carbon monoxide. People can faint ... And if the

house has been painted ...”Others indicated that charcoal dust could cause tuberculosis: “We who sell charcoal, as we are packing and that air goes into the chest, most people develop TB...” one respondent pointed out. “The problem that charcoal gives us ... the chest gets damaged. It causes coughing, TB, due to the dust that is breathed in ...” another discussant from a different focus group confirmed.

The environmental effects mentioned by the respondents included air pollution, deforestation and changing rainfall patterns. “It brings about pollution,” one questionnaire respondent pointed out. “Personally, it has been my worry... the government is not strict where cutting trees is concerned. There are no restrictions ... these people who cut trees ... it is a crime ... they destroy nature,” a focus group respondent from one focus group indicated suggesting deforestation. “Trees ... according to what they teach ... If they become less, they bring about climate ... so rain, it does not rain in the same way it rains where there are many trees ...” another focus group respondent indicated referring to changing rainfall patterns. This was supported by another focus group discussant who said, “Sometimes it just thunders and no rain. Sometimes you see a black cloud and you think it would rain but nothing. It is the cutting of trees for charcoal that is causing all this. Rainfall in Zambia is no longer normal. We should stop cutting down trees so that it can start raining normally.”

Figure 5.14 shows the deforestation and general degradation caused by charcoal production. Cutting down trees does not only degrade the “physical” environment, but also the atmosphere as when trees are cut down, they release the carbon that they absorbed and stored when they were live trees. Carbon is a GHG and it contributes to climate change when it is released into the atmosphere.



Figure 5.14: Environmental degradation resulting from charcoal production

Figure 5.15 below shows other effects of charcoal production on the “physical” environment and the atmosphere. The area around the kiln is left bare and thus exposed to soil erosion. Secondly, the fumes released into the atmosphere during the charcoal production processes contribute to global warming and climate change.



Figure 5.15: Charcoal being produced in earth mound kiln

Figures 5.16 (a) and 5.16 (b) show how the logs chopped from the live cut down trees are arranged in readiness to be covered with earth to make a kiln. Fully grown live trees are cut down for the purpose, leaving the environment bare. The environment is exposed to weather elements like wind, floods and heat resulting in general degradation of the area. Indigenous trees that are cut down for charcoal production take many years to be fully grown. Therefore, the affected area will take a long time to become a forest it once was.



Figure 5.16(a): Tree logs before they are covered with earth to make a kiln



Figure 5.16 (b): Tree logs before they are covered with earth to make a kiln

Figure 5.17 shows bags of charcoal, the end product of the charcoal production process. Charcoal is put on a brazier and lit to cook a meal, heat water and warming a house. During the cold season, people also sit around a brazier to warm themselves. Burning charcoal produces carbon monoxide which can be fatal if used in an enclosed place, especially if people are sleeping in such a place. Apart from this health hazard, the fumes that charcoal releases into the atmosphere cause global warming and climate change.



Figure 5.17: Bags of charcoal displayed for sale

(c)Changes noticed in the climate in recent years

The majority of the respondents indicated that they had noticed some changes in the climate in recent years which they could attribute to the effects of charcoal production and use. The two major changes that were mentioned by the majority of the respondents were changes in the rainfall pattern and global warming. “Rain patterns have changed,” a questionnaire respondent observed. Other observations made regarding the changing of rainfall patterns included the late onset of rain, inadequate rainfall and erratic rain patterns. “This time around rain starts late because, in the past, it used to start around October. But nowadays it starts around December. For example, last year it started in January ... which never happened in the past,” a focus group respondent indicated. “The

way it used to rain when we were growing up is different from the way it is raining nowadays. It has changed ... It used to rain a lot, especially this month (February). ... But nowadays, it rains like it is about to depart. It is erratic. It is just raining at a specific place where rain clouds have formed ... where clouds have formed it rains very quickly and stops," another focus group discussant concurred.

Responses given by questionnaire respondents that pointed to global warming included phrases like "warm winters", "too much heat" and "shorter winters". A focus group discussant linked global warming to deforestation and charcoal production. She said, "I would like to talk about heat. Nowadays it is hotter than it used to be. This can be attributed to the fact that there are fewer trees to bring fresh air. Trees have become fewer due to charcoal burning. So, as a result, it is very hot, there is no fresh air as we are cutting down trees for charcoal."

(d)The link between charcoal production and use and changes in the climate

When the respondents were asked whether charcoal production and use were some of the causes of the changes in the climate, the majority answered in the affirmative. They indicated that there was a link between trees and rainfall, and that cutting down trees caused deforestation which affected rainfall negatively. "Cutting down trees causes deforestation," one questionnaire respondent wrote. "Trees produce fresh air," wrote another. "Rain comes through trees," was the response from another participant.

Some respondents also indicated that fumes produced during charcoal production and use disturbed climatic conditions. They also associated cutting down of trees with global warming. "... When the smoke goes there into the atmosphere, it usually disturbs the atmospheric conditions ... when charcoal is being produced, smoke goes into the atmosphere," a focus group respondent from one group pointed out. "... It would be good to stop using charcoal ... there are many problems and it has become very hot," a focus group respondent from a different group indicated. A focus group discussant observed that winters have become warmer than they used to be in the past. "Nowadays June is not that cold," she argued.

Category 2: Perceptions on various possible alternatives to charcoal

The group of questions asked under this category were meant to establish how many, in terms of percentage, charcoal users and charcoal traders thought it was possible to change from charcoal to another source of domestic energy and if they were aware of the various possible alternatives to charcoal. When asked whether it was possible to change from charcoal to another source of domestic energy in Zambia, the majority indicated it was. On average, 73%, of the participants indicated it was possible to do so (Table 4.18). The themes that emerged from their responses were: (1) Non usage of charcoal in some other countries; (2) Availability of sources of domestic energy other than charcoal in the country; and (3) Government intervention. The possible alternatives to charcoal that were identified were: (1) LPG; (2) solar; (3) electricity; (4) coal; (5) kerosene; and (6) biogas.

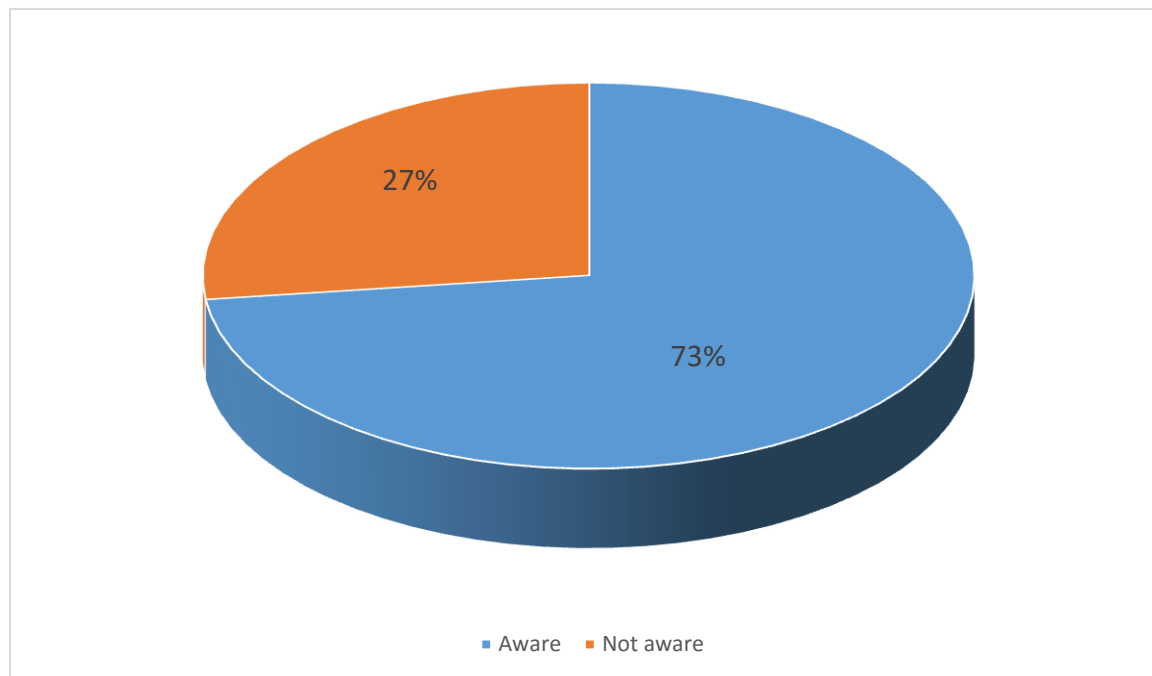


Figure 5.18: Category 2 – Perception levels on various possible alternatives to charcoal

Figure 5.19 shows the traditional charcoal cook-stove also known as brazier. The stove has a number of problems. Firstly, it is energy inefficient. That is, charcoal burns too quickly resulting in the loss of much heat and high consumption of charcoal. This means

that much charcoal is needed to cook a meal and this results in the cutting down of many trees to satisfy the cooking needs of the people. This translates into great loss of forests, soil erosion, deforestation, desertification, and other related environmental problems. Secondly, the fumes that are produced during cooking are not only harmful to the health of the people who use the stove, but also to the environment. The fumes, which are a form of GHG, get into the atmosphere and contribute to global warming and climate change.

Figure 5.20 shows the proposed LPG stove. In contrast to the brazier, the stove cooks very efficiently and it is very clean. The flame that is produced by LPG cooks much faster than charcoal and does not produce smoke or harmful fumes. LPG is not considered as a GHG by the Intergovernmental Panel on Climate Change (IPCC), therefore, it is very safe to the environment and personal health. Zambia produces LPG at Indeni Refinery.



Figure 5.19: The energy inefficient traditional charcoal cook-stove (Brazier)



Figure 5.20: A clean and energy-efficient two-plate LPG stove

Figure 5.21 shows one of the LPG outlets in Lusaka City. Since electricity load-shedding, which reached its peak in 2015, started, some Zambians have started using LPG to supplement electricity. ZESCO has also been running advertisements on television to encourage people to use LPG in order save electricity so as to lessen load-shedding. It is not uncommon nowadays to find a number of filling stations selling LPG apart from outlets that exclusively sell the commodity. The development is a very good indicator of the possibility of introducing LPG as an alternative source of domestic energy to charcoal in the country.



Figure 5.21: LPG cylinders displayed for sale at one of Lusaka City’s filling stations

Theme 1: Non-usage of charcoal in some other countries

Some respondents who indicated that it was possible to change from charcoal to some other source of energy justified their answers by pointing out that there were countries where charcoal was not used as a domestic source of energy. If these countries could do without charcoal, it was also possible for Zambia to do so. They further justified their answers by indicating that some of these countries were no better than Zambia economically. “In other countries they don’t use charcoal; they use coal instead of charcoal,” one focus group respondent pointed out. “When we (go) to other countries they don’t use charcoal,” another focus group respondent from a different group confirmed. “It is because when we go to other countries they don’t use charcoal, so it is possible even in Zambia,” a focus group discussant from yet another group observed.

Theme 2: Availability of sources of domestic energy other than charcoal in the country

The other reason most respondents gave for the possibility of introducing alternative sources of domestic energy to charcoal in Zambia was the fact that there were many other sources of domestic energy in the country. The respondents cited the following sources of energy: LPG, solar, electricity, coal, kerosene and biogas. Some specimen responses from questionnaire respondents were: “We can try using paraffin and gas stove.”; “Solar energy can be a possible replacement. It is free and we have plenty of it.” Focus group discussants also gave the following similar responses: “We can use gas stoves.”; “We could also use solar stoves.”

Theme 3: Government intervention

Some respondents thought an alternative to charcoal in the country was possible if the government intervened. They believed in the ability of government not only to intervene, but to engage other stakeholders to make the switch to another source of domestic energy possible. Responding to the question, one focus group respondent said, “It is possible if government and other stakeholders come together and make a common goal.” “It is just to introduce various organisations. These organisations should go around like ZESCO does. They should go house to house and people would know that to do this and this is dangerous,” a focus group respondent from a different group pointed out. “When government takes action, by introducing the new methods of energy resource,” a questionnaire respondent wrote.

Category 3: Knowledge of LPG as a domestic energy source

The third category of questions was meant to establish how much knowledge the respondents had of LPG as an alternative domestic energy source. The majority of the respondents were not aware of LPG as a domestic energy source. On average, only 13% of the participants were aware of LPG as an energy source (Figure 4.22). The following were the major themes that emerged from the responses: (1) Lack of knowledge about LPG; (2) High cost of LPG; (3) Non-availability of LPG in most parts of the country; and (4) The danger of LPG.

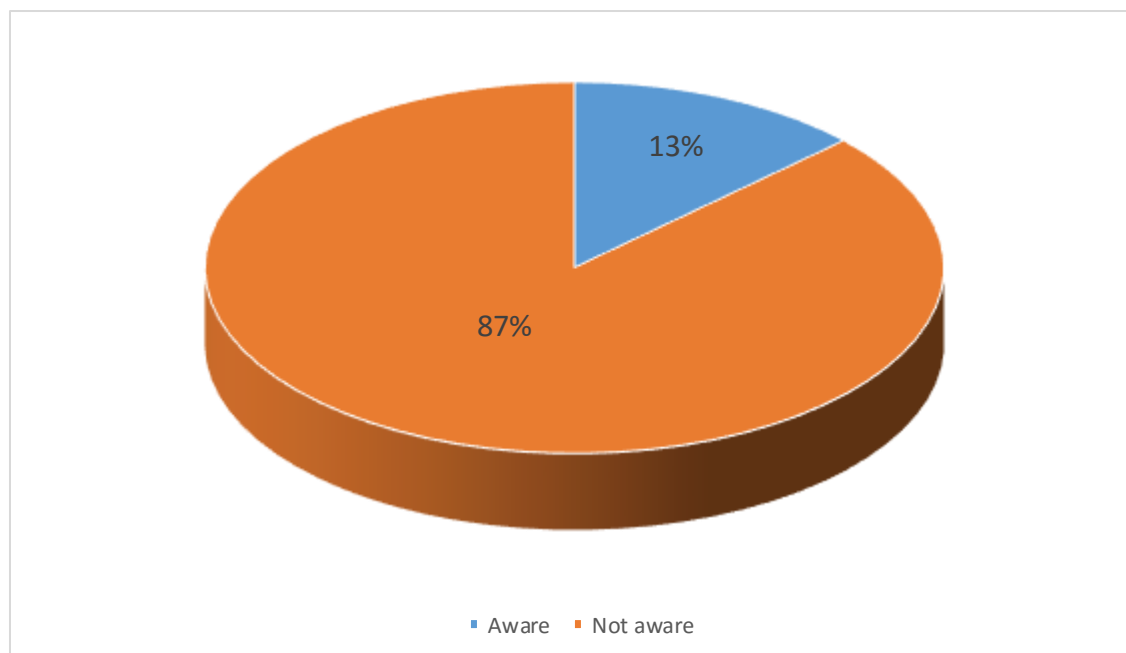


Figure 5.22: Category 3 – Knowledge levels of LPG as a domestic energy source

Theme 1: Lack of knowledge about LPG

A number of respondents expressed ignorance about LPG being a domestic source of energy. They indicated that they did not know anything about LPG because it was not commonly used in the country. Some of the responses questionnaire respondents gave were: “Not yet in Zambia is not known.”; “I don’t know”; “We are not been sensitised for LPG so we don’t know it.”; “Is not known.”; “We have never seen it before.”; “Because I have no knowledge about it.”; “No idea.”; “not yet in Zambia it is not common.”

Focus group discussion respondents also gave similar answers. “We may not have answers regarding gas because we have never used it. So we would not know its benefits, whether it is good or not. Unless you tell us about the benefits of gas so that we learn and we know the benefits of gas ... so teach us about the benefits of gas,” one respondent explained. “I have never used gas,” another respondent admitted.

Theme 2: High cost of LPG

A small number of respondents expressed knowledge of LPG as a domestic energy source. However, they indicated that LPG was out of their reach because it was very expensive. These respondents also attributed the lack of general use of LPG in the country to this factor. Some of the responses they gave were: "... because we cannot afford it."; "It's expensive."; "Because gas stoves are expensive."; "Cos they are not common and they are too expensive."

Theme 3: Non availability of LPG in most parts of the country

The few respondents who knew about LPG also indicated that its usage was not wide because it was not readily available in most parts of the country. They gave answers like: "Because have not accessed it yet."; "Cos they are not common"; "It is not easily accessible."

Theme 4: The danger of LPG

The small group that knew about LPG also attributed the lack of usage of LPG in the country to the fact that it was dangerous. They indicated that even people who could afford to buy LPG did not use it because it was generally believed that it was very dangerous. "It is dangerous. It can explode," one focus group respondent pointed out. "By telling them how dangerous it is ... because there are people who can afford but they just think it is dangerous. They don't know much," another respondent explained. "Education would be needed. Gas is dangerous," yet another one warned.

Questionnaire respondents shared the same views. "Highly dangerous to human health because its (sic) carbonated," one respondent wrote. "Because it is harmful if not handled well," another one observed. "I think its (sic) not safe because I don't know much about it," another one pointed out.

5.5 Conclusion

This chapter has presented results based on Categories 1 to 3. The results show that the participants know the dangers of charcoal production and use and the various alternatives to charcoal in the country. Although the participants' knowledge of LPG as a domestic energy source is not that sound, the fact that they are aware of the dangers of charcoal and the various alternatives to it, gives hope that convincing them to switch to LPG would be easy.

CHAPTER 6

RESULTS PRESENTATION: POSSIBILITY OF INTRODUCING LPG AS AN ALTERNATIVE DOMESTIC ENERGY SOURCE IN ZAMBIA, CHALLENGES AND SOLUTIONS

6.1 Introduction

This chapter presents the rest of the results of the study. The results are based on categories 4 to 6. It specifically presents answers regarding the possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia, the challenges that are likely to be encountered and the possible solutions to these challenges.

Category 4: Possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia

This section presents fieldwork results based on the fourth category. The questions under this category were meant to provide answers to the first and key research question, that is, the possibility, or otherwise, of introducing LPG as an alternative domestic energy source in Zambia. The questions were intended to establish two things: firstly, how many, in terms of percentage, participants thought that the introduction of LPG as an alternative domestic energy source to charcoal in Zambia was possible. Secondly, the measures that the government organisations in the energy and environmental protection sectors were taking regarding the introduction of LPG as an alternative domestic energy source to charcoal in Zambia.

On average, 64% of all participants, users, traders and key informants, indicated that it was possible to introduce LPG as an alternative domestic energy source to charcoal in Zambia (Figure 6.1). However, they mentioned a number of things that needed to be done to make the change possible. Their responses have been reduced to the following themes: (1) Reduction of LPG prices; (2) Government intervention; (3) Sensitisation; (4) Gradual introduction of LPG; (5) Stakeholder engagement; (6) Availability of LPG; (7) Banning of charcoal; and (8) Alternative livelihoods for charcoal producers and traders.

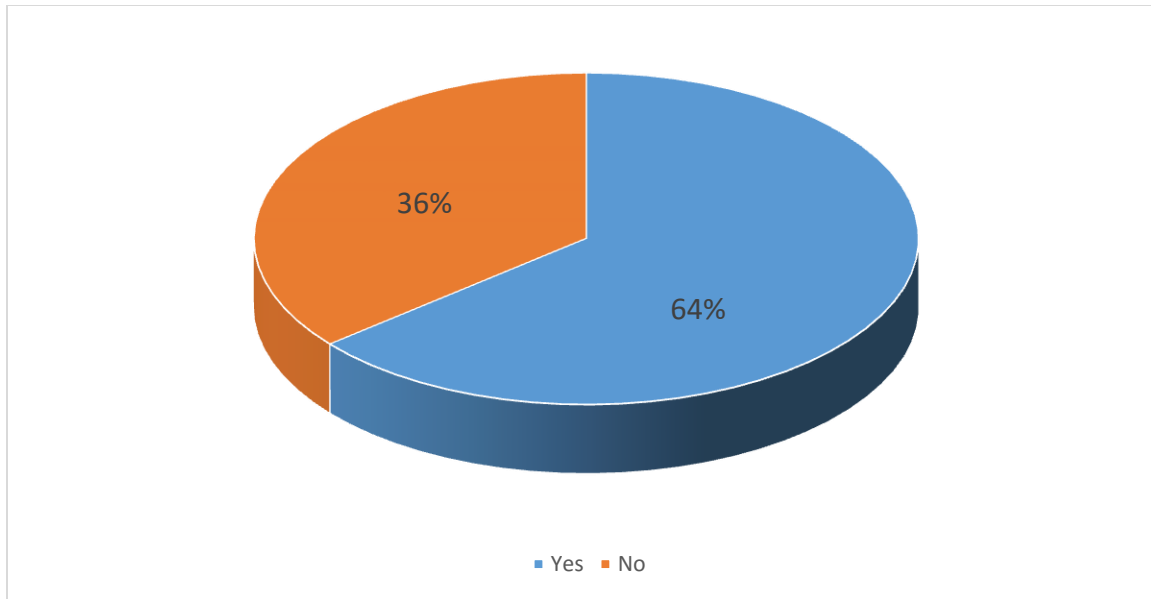


Figure 6.1: Category 4: Possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia

The study also revealed that government organisations in the energy and environmental protection sectors were taking some measures regarding the introduction of LPG as an alternative domestic energy source to charcoal in the country. The organisations, some officials of which participated in the study as key informants, included the Department of Energy, ZESCO, ZEMA and FD.

The themes and organisations mentioned above are now presented.

Theme 1: Reduction of LPG prices

One of the things respondents suggested should be done in order to make the proposed change possible was the reduction of LPG prices. The respondents believed that many people were not using LPG at the domestic level because it was too expensive. They compared the price of charcoal to that of LPG, and they indicated that the price of the former was far less than that of the latter. They also pointed out that charcoal was affordable even to the poorest of the poor in the country because it could be sold in small portions costing as little as K1.00 or K2.00.

Responding to the question whether it was possible to introduce LPG in Zambia, one of

the focus group discussants replied, “Yes, now the price, it should be in such a way that even we (poor people) can afford ... you see, we can buy charcoal even at K1.00. So even them should come up with a good price that everyone can afford to buy gas ...” A respondent from another focus group gave a similar answer, “... many people cannot afford to buy gas. Some people are used to buying charcoal that is sold in small portions. Some just buy charcoal for K2.00 and it meets their cooking needs, now gas ... you can't buy for K2.00.” Some respondents indicated that prices of LPG could come down if the government partnered with other organisations to find ways of reducing the prices. “I think government should partner with other organisations so that the price of gas can be reduced so that everybody can afford to buy gas,” one focus group respondent observed. Others thought LPG prices would naturally drop if the government made LPG readily available country wide. “...The other thing the government can do is to make gas available in the country. This would make the price of gas to go down so that each and every one can afford to buy gas,” a focus group respondent pointed out.

Questionnaire respondents gave similar answers. Some respondents gave the following answers: “If people are given a cheaper price.”; “By the government to import more gas and by reducing prices.”; “To reduce the prices for everyone to afford and buy gas (sic) stoves and to import more gas.”

Theme 2: Government intervention

The majority of the respondents indicated that the government was the key agent of change in as far as the proposed change was concerned. Therefore, they believed if the government took the lead and played a major role, the proposed change was possible. Other suggestions that should be driven by the government to make the proposed change possible were: reduction of prices; sensitisation; gradual introduction; stakeholder engagement; making LPG available; banning charcoal; and provision of alternative livelihoods for charcoal producers and traders. The participants indicated that the government could effectively achieve all this by engaging other stakeholders; introducing subsidies on the price of LPG and accessories; providing guidance and formulating appropriate policies; sensitising people and promoting LPG in various ways.

Responding to the central research question, one questionnaire respondent indicated, “It is possible if the government was to come in and introduce it to all citizens.” Focus group discussants also gave responses like: “It is to introduce subsidies. ... People should be paying at least 50% of the actual price of gas ...”; “... if the government can make those who sell gas stoves to reduce the prices so that everyone would be able to buy that thing (a gas stove), then there would be no problem at all.”; “But before it decides, it should talk to the councils and the Forestry Department. If it talks to the Forestry Department, the Forestry Department will ban charcoal. It means that we also will have no source of charcoal. So then the government can give us a plan that, since charcoal is banned, you should now use gas and there is nothing we can do since there will be no option”; “The government sees all these things but it seems to be reluctant to take action or to guide people on what should be done. Why has the government not taken action regarding charcoal?”

Theme 3: Sensitisation

The respondents also indicated that since LPG is not commonly used in the country, there was a need to sensitise people in terms of it being an alternative source of domestic energy, its safe usage and that it is better than charcoal. The respondents believed that this was one of the ways to change people’s mind-sets and making them embrace the proposed change. They indicated under “Government intervention” that sensitisation should be spearheaded by the government through engagement of other stakeholders. “What people need is a sensitisation to the general public in how to use gas as a source of energy,” one respondent said about LPG as an alternative source of domestic energy. On safe handling of LPG, one questionnaire respondent said, “There should be people to teach everyone how to handle gas... people can get used if the government came in and employed people to sensitise everyone on the dangers of gas...”. “If more sensitisation Zambia wide was to be done, yes it can work out,” another questionnaire respondent said about general sensitisation.

Theme 4: Gradual introduction of LPG

The respondents indicated that another way of making the introduction of LPG as an alternative energy source to charcoal possible was to introduce it gradually. This should go hand-in-hand with sensitisation in order for people to learn about LPG and appreciate its usefulness. “ I agree that we can stop using charcoal and start using something else....However, complete (sudden) ban of charcoal would not be good, we should just lessen using it. ... change should be implemented gradually. Even those of us who may not afford now, we will afford in the future. Charcoal has problems: some people develop TB, ... because of this many people will agree that we stop using charcoal, but not suddenly,” one focus group discussant argued. “If that change should be made, it has to be done gradually ... first they sensitise people about changing from charcoal to gas so that people have enough time to prepare themselves and start buying the requirements slowly. Changing suddenly would be a problem,” confirmed a focus group discussant from another focus group.

Theme 5: Stakeholder engagement

Bringing on board various stakeholders, in order to make the proposed switch from charcoal to LPG possible, was another strategy suggested by the respondents. As has been pointed out above, the key player in this is the government. The other stakeholders mentioned included users, traders/producers, banks and other organisations such as private companies, among others. These organisations can assist in various ways. Banks, for instance, might help with soft loans to buy LPG accessories; companies might help their employees with salary advances to buy the initial equipment; LPG dealers might work with the government to find ways of making the price of LPG and accessories affordable for everyone. “It is simple as long as we come together,” one questionnaire respondent replied to the central research question.

Focus group discussion respondents also gave similar answers. “Companies where people work ... they would like to help their employees so that they could acquire gas stoves,” one respondent said. “There are many organisations that help people. So if organisations can come in, they can help us with money,” observed another. “There is

need for cooperation. If there is cooperation like the research you are carrying out ... it can help, you know," another one pointed out. "I think the government should partner with other organisations so that the price of gas can be reduced so that everybody can afford to buy gas," indicated yet another.

Theme 6: Availability of LPG

The other theme that emerged from the participants' responses was making LPG available. As has been noted above, LPG is not commonly used in the country, let alone as a domestic energy source. The respondents indicated that this made it too expensive to be afforded by poor people. They thought that making LPG available in all parts of the country would contribute to the lowering of the prices. Making LPG available included a good distribution system and production of LPG in large quantities. Responses reflecting these ideas included, "By distributing enough LPG."; "It can be possible if it is easily produced"; "The other thing the government can do, is to make gas available in the country, this would make the price of gas to go down so that each and every one can afford to buy gas ..."

Theme 7: Banning of charcoal

Banning charcoal is another theme that emerged from the participants' responses. Some respondents felt that banning charcoal and promoting LPG would make the proposed change effective. They indicated that the government had to take the lead by enacting laws that would criminalise the cutting down of trees and charcoal production. "The government can help by passing a law that criminalises charcoal production," observed one of the focus group respondents. "The other thing is those producing charcoal should be ordered to stop cutting trees. Then those who really want to continue should be given permits just like what ZAWA (Zambia Wildlife Authority), you know. It is not everyone who can shoot or kill animals, only those with licences. This can be done also in the case of charcoal and big fines should be imposed so that not everyone will go into that business," another focus group respondent concurred. "If the government came in, it would be good stop using charcoal," another focus group respondent indicated.

Questionnaire respondents gave similar answers: “When the government burns (bans) the use of charcoal and allow only LPG.”; “When government takes action to burn (ban) charcoal maker (maker) ...”

Theme 8: Alternative livelihoods for charcoal producers and traders

The respondents indicated that banning charcoal or reducing its usage would rob charcoal producers and traders of their livelihoods. While the respondents felt that switching to LPG was possible, they believed that charcoal producers and traders needed to be introduced to alternative livelihoods. This could be done through empowerment programmes that could provide these people with capital to start new businesses such as farming. Below are some of the answers that were provided by the respondents:

“I think the government can come up with a solution ... just like now the government is engaged in youth empowerment programmes. I think that is the solution that can help those who are selling charcoal.... Since these people are business people, apart from charcoal, may be they can start selling something else since most people would stop using charcoal there would be no business ...”.

“It should start from Parliament. They put in law that bans the cutting down of trees, they put in some laws then for those who sell charcoal, at least they empower them somewhere, somewhere ... because if they just tell them stop selling charcoal, it won't be fair...”

“So, I think the government, instead of ... the traders of charcoal ... I think they can try to ... Since there is this empowerment ... I think they should do to them ...government has many farms it is using...I think these charcoal traders they (government) can try to empower them on agriculture ...”.

“Organisations ...can also help by offering charcoal producers alternative jobs since charcoal production is their livelihood.”

The role of government organisations

Measures being taken by government organisations in the energy and environmental protection sectors regarding the introduction of LPG as an alternative domestic energy source to charcoal in Zambia:

Department of Energy

According to one of the key informants at the Department of Energy, the Department had put in place a number of measures related to the promotion of LPG in the country. She indicated that LPG had been enshrined in the National Energy Policy of 2008 as one of the alternative energy sources to charcoal. She further indicated that pilot projects regarding the promotion of LPG had been conducted in peri-urban areas of Mtendere and Kalingalinga and that dissemination of information to demystify LPG were ongoing. “We have carried out pilot projects in some peri-urban areas and the results have been good. The main challenge has been availability of LPG. There was only one source then. However, many shops are now stocking LPG,” she said.

ZESCO

The key informant at ZESCO also indicated that the electricity utility company, which was experiencing low electricity generation due to low water levels at its dams associated with climate change, was also trying to promote LPG. This was in order to relieve the company of the pressure that was being exerted on it by the high demand for electricity in the country, which the company could not currently meet. The company had, as a result, introduced load shedding in order to ration electricity. Therefore, the company had started sponsoring advertisements both on television and in print media on the promotion of LPG. The company had also started engaging other stakeholders in the energy and environmental protection sectors to find the best ways of promoting LPG. Asked what his company was doing regarding LPG promotion, the key informant indicated that his company was sponsoring “adverts on LPG usage (and bringing) together stakeholders (producers, distributors, regulators, government, users) to enhance LPG usage.”

ZEMA

The study also revealed that ZEMA was providing programmes on mitigation of and adaptation to climate change. “LPG could be part of the process in the development of the options,” he said.

6.2 Research question (b): What are the challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia?

Category 5: Challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia

This section presents fieldwork results based on the fifth category. The questions under this category were meant to provide answers to the second research question. The questions were intended to establish two things: firstly, how many, in terms of percentage, participants were aware of the possible challenges to the introduction of LPG as an alternative domestic energy source to charcoal in Zambia and, secondly, what the specific challenges are. This information would help the researcher to establish the challenges that need to be addressed by policy makers in order to make the proposed change possible.

On average, 96% of the respondents indicated that they were aware of the possible challenges (Figure 6.2). The respondents also provided an exhaustive list of the specific possible challenges which have been reduced to the following themes: (1) Lack of knowledge about LPG; (2) Non availability of LPG in most parts of the country, especially in rural areas; (3) Perceived danger of LPG; (4) High prices of LPG and accessories; (5) Changing people’s mind-sets about charcoal, which they have used since time immemorial; (6) Social inequity; and (7) Lack of government initiative.

The summary of results that the questions yielded is presented in Table 6.1 below:

Table 6.1: Summary of findings on the challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia

Serial No.	Category	Purpose	Emerging themes	Results summary
5	Challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia.	<p>(a) To establish how many, in terms of percentage, participants in general, are aware of the possible challenges that would make the proposed switch from charcoal to LPG difficult.</p> <p>(b) To establish the specific challenges that the participants think would make the proposed switch from charcoal to LPG difficult</p>	<ul style="list-style-type: none"> • Lack of knowledge about LPG • Non availability of LPG in most parts of country, especially in rural areas • Perceived danger of LPG • High prices of LPG and accessories • Changing people's mind-sets about charcoal, which has been used since time immemorial • Social inequity • Lack of government initiative 	<p>On average, 96% of the participants are aware of the challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia</p> <p>(a) All participants were able to mention some challenges</p>

All the themes, except the last three, also came up under research question (a). This confirms the richness of the data as the questions which were asked in different ways and which were expected to yield similar answers, did indeed yield similar answers. Under research question (a) the respondents were not actually asked to mention the possible challenges regarding the introduction of LPG as an alternative domestic energy source to charcoal, but these responses came from the respondents themselves as they suggested what needed to be done to make the proposed change possible. All the themes are, however, presented below to show the similarity of the responses to those given under research question (a) discussed above.

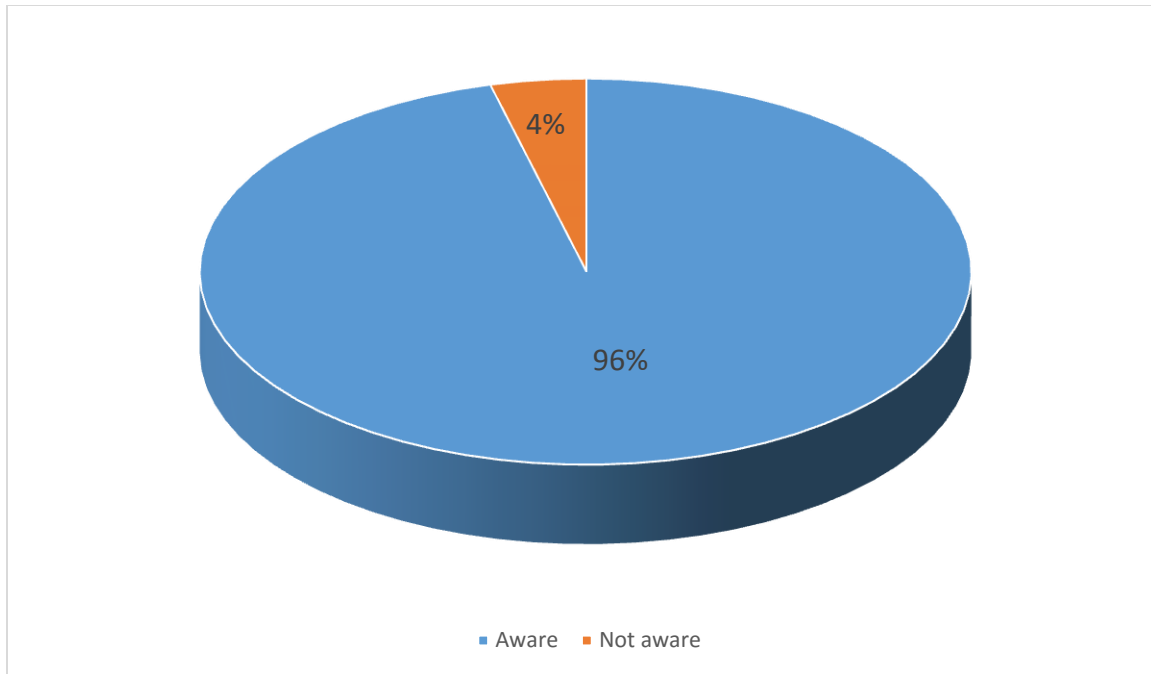


Figure 6.2: Category 5 - Perception levels on the possible challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia

Theme 1: Lack of knowledge about LPG

One of the challenges regarding switching from charcoal to LPG that the respondents pointed out was the lack of knowledge about LPG. They indicated that LPG was new to Zambia and, as such, many people did not know about it. As a result of this, people had the fear of the unknown, which included the myth that LPG was not safe to use at home. Some of the answers that questionnaire respondents gave included the following: “They (there) may be lack of knowledge, so many people may be afraid to buy it out.”; “No idea.”; “People are kind of new to that and some think its (it’s) not safe and don’t know.”; “Few people have knowledge of gas uses.”; “We don’t know what it is and how are we going to get adapted to it.”

Focus group respondents and key informants gave similar answers. “... because we are used to charcoal and we have no other means apart from charcoal,” a focus group respondent observed. “We don’t know ... we have never used it,” another one pointed out. “Lack of operation knowledge by consumers,” one key informant wrote.

Theme 2: Non availability of LPG in most parts of the country, especially in rural areas

The other possible challenge that the respondents mentioned was the non-availability of LPG in the country, especially in rural areas. Their responses that pointed to the non-availability of LPG in the country ranged from lack of places to find it and the few distributors of LPG and accessories in the country. Inconsistent production of LPG by Indeni was also cited as, perhaps, the biggest challenge in as far as the availability of the commodity was concerned. “Where to get LPG.”; “Lack of access to LPG.”; “... accessibility of the product.”; “Availability...”; “... limited number of distributors and facilities; requirements by ERB for distributing LPG; availability (Indeni not consistent with production),” were some of the responses given.

Theme 3: Perceived danger of LPG

The third challenge that the respondents mentioned was the perceived danger of LPG. Some indicated that there were, indeed, people in the country who had knowledge about LPG as a domestic source of energy and who could possibly afford it, but they believed it was too dangerous to use at home. Some specific answers that were given by the respondents in general included the following: “It would cause fire accidents.”; “Gas is dangerous.”; “People regard it as not safe and dangerous.”; “... gas is very dangerous.”; “...; safety issues....”; “... perceptions that it (LPG) is a harmful product.”

Theme 4: High prices of LPG and accessories

The fourth challenge identified by most respondents was the high prices of LPG and accessories. The price of LPG was compared to that of charcoal and they thought that of the former far exceeded that of the latter. They argued that, while charcoal could be sold in smaller portions that could cost as little as K2.00, this was not possible with LPG. “ ... many people cannot afford to buy gas. Some people are used to buying charcoal that is sold in small portions. Some just buy charcoal for K2.00 and it meets their cooking needs, now gas ... you can't buy for K2.00,” a focus group respondent argued. “We use gas at home. A 9kg cylinder costs K200.00. It does not last even a month,” another focus group respondent revealed.

The respondents indicated that considering the fact that most of the people in Zambia were poor, the switch from charcoal to LPG would only be possible if the prices of LPG could drop so that everybody could afford to buy it. “Poor people cannot afford to buy LPG,” one questionnaire respondent wrote. “Poverty levels,” another one indicated. “To get used to this LPG. How do we afford this LPG?” another one wondered. “... that would be a problem ... because most people who use charcoal may not afford to buy gas stoves,” observed one focus group discussant.

Theme 5: Changing people’s mind-set about charcoal, which they have used since time immemorial

The fifth challenge that was identified by the respondents was changing people’s mind-sets about charcoal, which they had used since time immemorial. They indicated that most people in Zambia had never used, let alone known, other domestic energy sources than charcoal. “Many people use charcoal in there (their) homes so changing can be hard,” one questionnaire respondent explained. “People in Zambia are used to use charcoal,” another responded wrote. “... having people change their mind-set from using charcoal to LPG,” yet another respondent indicated.

Focus group discussion respondents provided similar answers which included the following: “... because most people are used to charcoal.”; “... we are used to charcoal and we have no other means apart from charcoal ...”; “(We have used charcoal) ... since we were born.”

Theme 6: Social inequity

The sixth challenge that was identified by some respondents is social inequity. The respondents pointed out that Zambia is a poor country and only rich people could afford to buy LPG. This theme can be linked to the theme of LPG being too expensive to be afforded by the poor, who are the majority in the country as per the statistics given above in the Methodology chapter. The respondents, therefore, thought that people in Zambia use charcoal because it is the cheapest source of domestic energy affordable to even the poorest in the country.

“... that would be a problem ... because most people who use charcoal may not afford to buy gas stoves,” a focus group respondent from one focus group argued. “... many people cannot afford to buy gas,” a respondent from another focus group indicated. One questionnaire respondent indicated there was a need to address social inequity in the country if the proposed innovation was to succeed. He wrote, “To be equalization of a social stratar.”

Theme 7: Lack of government initiative

The seventh challenge that was identified by the respondents was lack of government initiative. The respondents believed that if the government initiated the switch from charcoal to LPG, invested in LPG or encouraged people with money to invest in it, the proposed change would be much easier. Some respondents even blamed the government for the rate of deforestation prevailing in the country because there were no consequences for people who cut down trees. “The government sees all these things (cutting trees for charcoal) but it seems to be reluctant to take action or guide people on what should be done,” a respondent from one focus group complained. Questionnaire respondents were of the same opinion. Some of their answers included: “Lack of support from the government.”; “The government will not invest in it.”

6.3 Research question (c): What are the solutions to the challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia?

Category 6: How the challenges may be addressed

This section presents fieldwork results based on the sixth category. The three questions under this category were meant to provide answers to the third and last research question. These questions were basically meant to establish three things: firstly, how many, in terms of percentage, participants were aware of the possible solutions to the challenges. Secondly, to establish what the research participants thought were some of the solutions to the challenges that might impede the proposed change. Thirdly, to establish who the research participants thought were the stakeholders who should be engaged in order to address the challenges and how these stakeholders were expected to help.

On average, 96% of participants were aware of the possible solutions to the challenges (Figure 6.3). The participants also provided an exhaustive list of solutions, which were well aligned to the challenges mentioned earlier. Further, the respondents also provided an extensive list of stakeholders that could work together to address the identified challenges. The solutions have been summarised into the following themes: (1) Sensitisation on the use and promotion of LPG; (2) Making LPG readily available throughout the country; (3) Reducing the price of LPG and accessories; (4) Empowering people to enable them to buy LPG equipment/accessories; (5) Government intervention; and (6) Banning charcoal and provision of alternative livelihoods for charcoal producers and traders. The list of stakeholders has also been reduced to the following themes: (1) Government; (2) Private sector; (3) Traditional leaders; and (4) Other countries.

The summary of the results yielded by this category is presented in Table 6.2 below:

Table 6.2: Summary of findings on solutions to the challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia

Serial No.	Category	Purpose	Emerging themes	Results summary
6	How the challenges may addressed	<p>(a) To establish how many, in terms of percentage, participants are aware of the possible solutions to the challenges.</p> <p>(b) To establish what participants think are some of the solutions to the challenges that may impede the proposed change.</p> <p>(c) To establish who the research participants think are the stakeholders who should be engaged in order to address the challenges, and how these stakeholders are expected to help.</p>	<p><i>Solutions</i></p> <ul style="list-style-type: none"> • Sensitisation on the use of LPG • Making LPG readily available throughout the country • Reducing the price of LPG and accessories • Empowering people to enable them to buy LPG equipment/accessories • Government intervention • Banning charcoal and provision of alternative livelihoods for charcoal producers/traders <p><i>Stakeholders</i></p> <ul style="list-style-type: none"> • Government • Private sector • Traditional leaders • Other countries 	On average, 96% of the participants are aware of how the identified challenges may be addressed

Solution themes

Theme 1: Sensitisation on the use and promotion of LPG

One of the solutions to the challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia that was identified by the respondents was sensitisation on the use and promotion of LPG. This solution is well aligned with the first challenge discussed above, namely, lack of knowledge of LPG in the country. The responses included sensitisation on the advantages of LPG over charcoal; education on

the importance of LPG; education on safe handling of LPG which could, at the same time, demystify the perceived danger of LPG; making it clear to both charcoal traders and users the reasons for discouraging the use of charcoal; changing people’s mind-sets regarding charcoal that they have used since time immemorial; among others. Responses related to the promotion of LPG were generally on giving out small quantities of LPG free of charge to let people get used to LPG before it could be fully introduced.

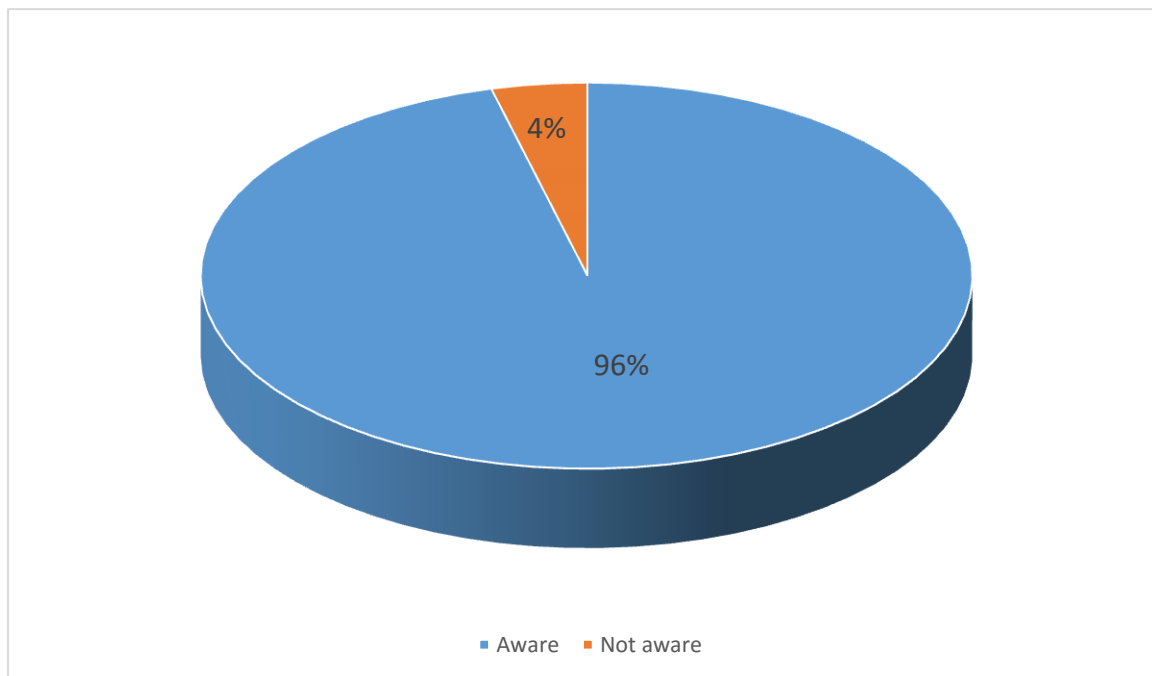


Figure 6.3: Category 6 – Perception levels on the possible solutions to challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia

In order to make people change from charcoal to LPG, they should be convinced that LPG is better than charcoal. “... if they ban charcoal, first they should tell the people who sell charcoal ... the reason why we want to ban charcoal is this and this and this ... because if you just decide ... today we have decided, even if they ban ... it will be hard ... it is just the same as these poachers ... they have banned, but they are still going on,” one focus group discussant observed. “Those challenges could be addressed by sensitizing people on the advantages of gas,” a questionnaire respondent wrote. “By

educating the people about the importance of LPG,” wrote yet another questionnaire respondent. “... the government and the social media should start alerting the community about the goodness of LPG,” concurred another questionnaire respondent.

Convincing people that LPG was safe would also be very cardinal considering that the general belief was that LPG was dangerous. “Detailed training to customers on use and dangers of LPG,” one key informant suggested. “Government incentives ... producing safety tips to users,” another key informant observed. “By telling them (people) how dangerous it is ... because there are people who can afford but they just think it is dangerous. They don’t know much,” a focus group discussant echoed the key informants’ sentiments.

Sensitisation alone may not achieve the intended results, therefore, respondents suggested that, apart from providing information on the usefulness and safe handling of LPG, promotional activities in terms of letting people “sample” LPG was very important. “They can do what they did concerning electricity. At first we had fixed rates. When they introduced prepaid meters they gave us free units in the meters to start and later we started buying on our own. It is the same with gas. When they bring to us, they should first give it to us free of charge and when it finishes, then we can start buying,” a focus group discussant suggested. “They should start by supplying it free of charge and later people can start buying it,” another focus group discussant from a different group indicated. “Can’t government provide gas free of charge at first in order to promote it?” a focus group discussant pointed out.

Theme 2: Making LPG readily available throughout the country

Making LPG readily available throughout the country was the second solution that the respondents identified. This is actually the solution to challenge number 2 discussed above, namely, non-availability of LPG in the country, especially in rural areas. The respondents indicated that LPG could be made readily available in the country by the government importing more LPG into the country; Indeni stepping up production by using the right feedstock and controlling the flaring of LPG; Indeni stopping the exporting of

LPG; the government encouraging investment in LPG by providing incentives to would-be investors, which could involve a reduction of taxes on LPG and accessories imported thereby increasing the number of producers and distributors in the country.

Some specimen answers by the respondents included the following: “By the government to import more gas.”; “... deliberate policy involving the selling of LPG.”; “Reduce some taxes for importing LPG; make LPG equipment easily accessible ...”; “... make it (LPG) readily available by opening more points of sale.”; “Government incentives; increased number of distributors ...” On the capacity of Indeni to produce enough LPG to satisfy the demand entailed by the proposed general switch from charcoal to LPG, one of the key informants at the Department of Energy said: “Indeni essentially has the capacity to produce enough LPG. Most of the LPG produced at Indeni is exported to East Africa and some of it is flared. If demand went up, Indeni would stop exporting LPG; the flaring could be controlled; and a suitable feedstock could be used to step up production.”

Theme 3: Reducing the price of LPG and accessories

The third solution to the identified challenges that the respondents mentioned was reducing the price of LPG and accessories. This is actually the solution to challenge number 3, namely, the high prices of LPG and accessories. The respondents indicated that reduction of the prices of LPG and accessories could be achieved through subsidising the prices of LPG and accessories; increasing LPG stocks in the country; reducing taxes on LPG imports; encouraging investment in LPG, among others. Some of the actual responses given by questionnaire respondents included the following: “The government to reduce the prices to make everyone to afford to buy.”; “By making LPG cheaper than charcoal ...”; “By introducing some sort of subsidies on LPG.”

Focus group respondents also gave similar responses. “I think the government should partner with other organisations so that the price of gas can be reduced so that everybody can afford to buy gas,” one focus group respondent said. “... they put in some measures; some policies, they put some policies that will help them and also help us, then when it comes to the price of gas, it also comes down,” another focus group

respondent from a different focus group indicated.

Some specimen answers from key informants are presented below:

“... reduced cost of LPG materials and accessories.”

“Reduce some taxes for importing LPG; make LPG equipment easily accessible...”

“Reduce on the cost (of) gas appliances; ... make it (LPG) readily available by opening more points of sale.”

Theme 4: Empowering people to enable them to buy LPG and accessories

The fourth solution that the respondents identified was empowering people to enable them to buy LPG and equipment/accessories. This solution resonates with the challenge of poverty or social inequity in the country. The respondents indicated that this could be achieved through the provision of loans and salary advances by financial institutions and firms where people worked, respectively; provision of free LPG and accessories initially; and deliberate policy involving the selling of LPG to enable poor people to afford to buy LPG. “It should start from parliament. They put in law that bans the cutting down of trees, they put in some laws then for those who sell charcoal, at least they empower them ...the government has to help them ... they put in some measures; some policies, they put some policies that will help them and also help us, then when it comes to the price of gas, it also comes down,” a focus group responded said regarding empowering people.

Theme 5: Government intervention

The fifth solution to the challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia that the respondents identified was government intervention. This solution relates to the challenge of the lack of government initiative that the respondents had identified earlier. The respondents felt that the government was the key player in effecting the proposed change. The government actually features in all the solutions to the challenges that the respondents identified: sensitisation; making LPG readily available; reducing the price of LPG; and the empowering of people in order to

enable them to buy LPG and accessories. Therefore, some of the responses that the respondents made under the aforementioned themes are also applicable under this theme. The other ways mentioned by the respondents in which the government could intervene included engaging other stakeholders and learning from other countries where LPG has been successfully introduced to replace charcoal.

Theme 6: Ban charcoal and provide alternative livelihoods for charcoal producers and traders

The sixth solution that the respondents identified was banning charcoal and providing alternative livelihoods for charcoal producers and traders. They also pointed out the fact that if charcoal was banned, it should be done gradually because people had used charcoal since time immemorial. Therefore, they would need time to adjust to the new domestic energy source. “The people who sell charcoal should be given alternative businesses,” one focus group respondent argued. “We could agree with the government if we were given another alternative,” responded another focus group respondent who was a charcoal trader. “Change should be there just like we change presidents. We never thought that presidents could change in this country. In the same vein, change should be implemented gradually,” another focus group respondent said about gradual introduction of LPG.

Stakeholder themes

Theme 1: Government

The respondents identified the central government as the main stakeholder in effecting the change being proposed by this study. They indicated that the central government should take the lead by engaging other stakeholders both local and foreign. The respondents identified other stakeholders that were government related including learning institutions; local councils; politicians; health institutions and government departments in the energy and environmental protection sector that have also been categorised under this theme.

Theme 2: Private sector

The respondents also identified various stakeholders from the private sector that could help in the implementation of the proposed change. These included non-governmental organisations; foreign investors; filling stations; churches; mining companies; LPG users and dealers; local communities; researchers; the media; financial institutions; and development agencies, among others. These stakeholders could help in various ways such as sensitisation, funding, investing in LPG, adopting and owning the change, and many other related issues.

Theme 3: Traditional leaders

The respondents also identified traditional leaders as very important stakeholders. These included chiefs, sub-chiefs, headmen and related leaders. These leaders preside over people who mostly live in rural areas and who constitute the poor who mostly use charcoal and who may not know anything about LPG. Therefore, these leaders would be instrumental in sensitising their subjects on the use and safe handling of LPG, as well as its advantages over charcoal.

Theme 4: Other countries

The respondents also identified other countries as important stakeholders. They mentioned donor countries and countries where LPG has been successfully introduced. Donor countries, as the name suggests, would help with various donations in form of money, equipment and ideas. Countries where LPG has been successfully introduced may help with strategies of implementing the proposed change.

6.4 Conclusion

The research findings of this chapter have confirmed the fact that it is very possible to introduce LPG as an alternative domestic energy source to charcoal in Zambia. This has been supported by the successes experienced in the countries reviewed in this study. However, while the majority of participants share this belief, they also warn that the shift may not be easy due to a number of challenges, ranging from changing the mind-sets of people who have used charcoal since time immemorial, to making the commodity

available and affordable to everyone. The participants admit that the shift will not be an easy one but they are aware of the solutions. The overriding solution is government involvement. The government has to take the lead in sensitising the people on the benefits of LPG to personal health and the environment and in protecting people from the adverse effects of climate change. The government must also engage the various stakeholders who would help to sensitise the people on the use and safe handling of LPG; bring down the cost of LPG and appliances through various forms of investments related to LPG and through increasing distribution points; provide loans and hire purchase facilities to enable people to buy the LPG equipment, amongst others.

CHAPTER 7

RESULTS DISCUSSION

7.1 Introduction

This chapter discusses and interprets the results presented in Chapters 5 and 6. The chapter analyses the themes that emerged from the data provided by the respondents regarding the possible switch from charcoal to LPG. The themes are based on the challenges that need to be addressed if the proposed switch from charcoal to LPG is to be possible. How the identified challenges can actually be addressed is also discussed. The themes are discussed and interpreted in terms of the literature reviewed and the researcher's knowledge. The discussion, like the results presentation in Chapter 4, is also done according to the three research questions and the six categories.

The study revealed that it was possible to switch from charcoal to LPG as long as the following challenges were addressed: Lack of knowledge about LPG; non-availability of LPG in most parts of the country; perceived danger of LPG; high prices of LPG and accessories; changing people's mind-sets about charcoal that they have used since time immemorial; social inequity and lack of government initiative. These challenges are analysed in detail in this section. The identified solutions to these challenges include: sensitisation on the use and safe handling of LPG; making LPG readily available throughout the country; reducing the price of LPG and accessories; government intervention; social equity; banning charcoal/gradual introduction of LPG/provision of sustainable alternative livelihoods to charcoal producers and traders; and stakeholder engagement. These solutions are also analysed in detail in this section.

7.2 Research question (a): To what extent is LPG appropriate as an alternative domestic energy source to charcoal in Zambia?

This sub-section discusses fieldwork results based on the first four categories, namely, (1) Perceptions on the dangers of charcoal production and use; (2) Perceptions on various possible alternatives to charcoal; (3) Knowledge of LPG as an alternative domestic energy source to charcoal; and (4) The possibility of introducing LPG as an

alternative domestic energy source. As indicated above, the set of questions under these categories were meant to provide answers to the first and main research question.

Category 1: Perceptions on the dangers of charcoal production and use

Theme: Environmental degradation

One major theme emerged from the group of questions asked under this category: *Environmental degradation*. The fact that the responses that participants provided could be summed up under the above theme indicates that the respondents were aware of the dangers of charcoal production and use. They were also aware of the adverse effects that this had on the environment.

This theme supports the theoretical and conceptual frameworks of the study. The theoretical framework, Social Ecology, explains the relationship between society and the environment and how social equity, or its absence, impacts negatively on the environment. Specifically, the theory of Social Ecology, posits that environmental degradation is a result of poverty. Poor people overexploit the environment because it is the only source of their livelihoods which, in most cases, are not sustainable. The conceptual framework of this study, DPSIR (Driving forces-Pressures-States-Impacts-Responses) focuses on charcoal production and use and their effects of deforestation and climate change. Poor people cannot afford cleaner sources of energy such as electricity, LPG and kerosene so they resort to charcoal which is a cheaper source of domestic energy and, in the process, they overexploit the forests and pollute the environment, which results in deforestation and climate change.

Category 2: Perceptions on various possible alternatives to charcoal

A number of themes emerged from the group of questions asked under this category. These themes were: (1) Non usage of charcoal in some other countries; (2) Availability of other sources of domestic energy than charcoal in the country; and (3) Government intervention. These themes pointed to the fact that the respondents were fully aware of the availability of domestic sources of energy other than charcoal in the country. This fulfilled the purpose of the questions asked under this category, that is, to provide

information that would help the researcher establish the amount of education that would be required to convince charcoal producers, traders and users that there were many domestic energy sources other than charcoal in the country and that switching to one of them was possible. From the above themes, it is clear that not much education would be required. This is a very important milestone towards achieving the proposed shift from charcoal to LPG.

Theme 1: Non-usage of charcoal in other countries

Under this theme, the respondents reasoned that changing from charcoal to any other domestic energy source was possible because there were other countries like Zambia where charcoal was not being used. This is a very good indicator of the possibility of introducing LPG as an alternative domestic energy source to charcoal.

This is indeed true. In countries like Botswana and South Africa, charcoal is never used as a source of domestic energy. There are no large sacks of charcoal for sale for cooking and heating. The only charcoal one can find in these countries is small packages used for braaing (barbequing) purposes. These countries mainly use LPG and electricity. In Botswana, where this researcher lived for 15 years, cooking is mainly done using LPG as electricity, which is generated from coal, is more expensive. Apart from LPG, the country also depends heavily on solar energy for lighting (especially in rural areas) and heating of water in geysers for bathing.

Theme 2: Availability of other sources of domestic energy in the country

Under this theme, the respondents reasoned that there were other sources of domestic energy in the country that included LPG, solar, electricity, coal, kerosene and biogas. This indicates that convincing people to switch to LPG would not be very difficult.

The country is indeed endowed with many other sources of domestic energy than charcoal. LPG and Kerosene are produced at Indeni Oil Refinery but it needs revamping to increase production. This is discussed below under Category 6.

Zambia also has enough solar energy to satisfy the domestic energy needs of the

country. There is a need to harness this energy effectively so that it could be used by domestic households for lighting and heating. The government could help households to acquire the solar equipment. The former Movement for Multiparty Democracy (MMD) government had embarked on a project like this. The current government could re-visit this project and empower as many citizens as possible.

Zambia is endowed with many rivers, waterfalls and lakes. Therefore, electricity generation should be possible. If these resources were effectively used, Zambia could export electricity to the whole of southern Africa and beyond. This would bring the price of electricity down in the country so that even the poorest of the poor could afford electricity. The Rural Electrification Authority (REA) has made an effort to electrify rural areas. Nowadays, it is not uncommon to find electrified grass thatched huts in rural villages. From 2006 to 2017, REA electrified 7,377 households in rural areas around the country (Musonda, 2017:12). However, these efforts are being frustrated by inadequate power generation, which has resulted in unprecedented electricity load-shedding in the country.

Zambia has also large deposits of coal particularly in Maamba in the southern part of the country. While this researcher does not support the use of coal as a source of domestic energy due to its polluting nature, it can be used to generate electricity to mitigate the electricity deficit that the country is currently experiencing.

Botswana depends heavily on thermal power for its national electricity needs. Zambia has an advantage over Botswana as it can use both hydro and thermal power to generate its electricity. Therefore, generating power using coal would go a long way in supplementing hydro-generated electricity in the country. This would bring the price of electricity low enough to give the poor access to cheap electricity and provide surplus electricity to be exported to other countries.

Maamba Collieries has started producing thermal electricity. It is envisaged that this would alleviate the electricity deficit and ease the problem of load shedding in the country. Whether this will have an effect on the problem and on the price of electricity is

still unknown. The government should encourage investments of this nature in all parts of the country where there are coal deposits.

The country has been grappling with huge quantities of refuse. Local councils have no capacity to collect the refuse that is generated on a daily basis in large towns like Lusaka City. This has been exacerbated by unprecedented street vending in these towns as a result of the high rate of unemployment prevailing in the country, especially of the youth. The unemployment situation can be traced back to the IMF Structural Adjustment Programme (SAP) which was imposed on the country in the 1980s (Kaunda, 2011:2; Shitima, 2005:1). During this time, all government firms, including the mines, were privatised which resulted in huge job losses. Most of the people who had lost employment in the mines and other firms that depended on the mines flocked to Lusaka City in search of employment.

Biogas production presents a solution to the prevailing refuse situation in the country. The government could encourage investment in biogas production which would not only solve the waste problem, but also provide clean alternative domestic energy and employment to the Zambian citizenry.

Theme 3: Government intervention

Government intervention was another solution the respondents suggested would make the shift from charcoal to another domestic energy source possible. They indicated that, to achieve this, the government should drive the process.

This information is in line with the conceptual framework of the study and the strategies used in other countries where LPG has been successfully introduced. According to the conceptual framework, DPSIR, governments should respond (R) to the various forms of environmental degradation in order to mitigate the impacts and reverse the situation. In this case, the government is expected to respond to the high rates of deforestation in the country and its effects of climate change and related impacts (I) through promotion of LPG and prioritising activities related to the introduction of LPG. How government intervention contributed to the success of LPG introduction in the countries under review

is discussed in detail under Category 6 below.

Category 3: Knowledge of LPG as a domestic energy source

The questions asked under this category were meant to help the researcher establish the amount of sensitisation that would be required to persuade charcoal users, producers and traders to switch to LPG. Only an average of 13% of all the respondents knew about LPG, let alone used it, which means that sensitisation and persuasion to accept the proposed change has still to be achieved. Although only a negligible number of people know about LPG, the majority are aware of the dangers of charcoal use and, as such, given an enabling environment, they could switch to LPG.

The themes that emerged from the questions asked under the category under discussion were: (1) Lack of knowledge about LPG; (2) High cost of LPG; (3) Non-availability of LPG in most parts of the country; and (4) The danger of LPG.

Theme 1: Lack of knowledge about LPG

The respondents attributed the non-usage of LPG in the country to lack of knowledge about LPG by the majority of people. They also indicated that even the few people that knew that LPG could be used as a domestic source of energy did not really know much about it. They further indicated that there was a myth that LPG was very dangerous, which belief exacerbated the problem. Lack of knowledge about LPG was also one of the barriers to LPG usage in some of the other countries reviewed in this study (Hood, 2010:6 (Sudan); Chilemba, 2005:72-79; Falzon et al, 2013:3 (Mozambique)).

Theme 2: High cost of LPG

The other reason the respondents gave for the non-usage of LPG in the country was the high cost of LPG and accessories. They indicated that Zambia was a poor country and, therefore, most people could not afford LPG. This information is corroborated by the reviewed studies carried out in other countries (Acharibasam & Apatinga, 2014:4 (Ghana)); Hood, 2010:10 (Sudan)). In these countries, the high cost of LPG was one of the barriers to wide usage of LPG.

Theme 3: Non-availability of LPG in most parts of the country

Another factor that the respondents indicated contributed to the paucity of usage of LPG in the country was the unavailability of LPG in most parts of the country. They indicated that LPG was only available in urban areas. This meant that those who could afford LPG but lived in rural areas had no access to it. This situation is similar to those in other countries that have been reviewed. In Sudan, LPG usage was only concentrated in the central region of the country (Hood, 2010:6; Buchanan-Smith et al, 2009:4). Studies carried out on LPG usage in Mozambique revealed that LPG use was mainly focused at the top of the income pyramid (Falzon et al, 2013:3; Chilemba, 2005:6).

Theme 4: The danger of LPG

The other factor that the respondents attributed to the poor usage of LPG in the country was the perceived danger of LPG. This can be attributed to the lack of knowledge or information about LPG. Such myths may surround a phenomenon that is not well understood. Any source of energy is potentially dangerous if not properly handled. There have also been accidents, as pointed out by one of the focus group discussion respondents, resulting from charcoal and candle use. There have also been accidents involving other sources of energy like petrol and electricity in the country but these incidents do not make people abandon these forms of energy. The accidents simply teach people to handle these forms of energy more carefully.

In the countries under review, lack of information and cultural issues have been cited, for instance, by Hood (2010:6) and Buchanan-Smith et al (2009:6), as some of the factors that contributed to the limited usage of LPG in Sudan. As a result, Hood (2010:7) recommends, inter alia, public awareness and consumer education programmes on the benefits of LPG and safety precautions of LPG use. Chilemba (2005:72-75) and Falzon et al (2013:13) also recommend awareness and education programmes, and public information campaigns, respectively, to make people in Mozambique understand the safe use of LPG.

Category 4: The possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia

This category was intended to yield responses that would give a clear answer to the first and key research question: the possibility, or otherwise, of introducing LPG as an alternative domestic energy source to charcoal in Zambia.

To begin with, an average of 64% of the respondents gave a categorical “yes” to the research question. This means that the majority of the respondents thought introducing LPG as an alternative domestic energy source to charcoal in Zambia was possible as long as the challenges or barriers to this proposed innovation were addressed. Secondly, the respondents also made suggestions about what needed to be done to ensure the proposed change was possible. The following themes emerged under this category: (1) Reduction of LPG prices; (2) Government intervention; (3) Sensitisation; (4) Gradual introduction of LPG; (5) Stakeholder engagement; (6) Availability of LPG; (7) Banning of charcoal; and (8) Alternative livelihoods for charcoal producers and traders.

Since these themes relate to the solutions to the challenges to LPG introduction, and are either the same or similar to the solutions the respondents gave under Category 6, they are discussed under Category 6 below. The last two categories discuss the challenges and solutions that were identified by the respondents.

7.3 Research question (b): What are the challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia?

Category 5: Challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia

This category was intended to provide answers to the second research question. The respondents were able to provide a list of challenges that could impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia. Therefore, the second research question was well answered. The challenges identified by the respondents are summarised as follows: (1) Lack of knowledge about LPG; (2) Non

availability of LPG in most parts of the country, especially in rural areas; (3) Perceived danger of LPG; (4) High prices of LPG and accessories; (5) Changing people's mind-sets about charcoal that they have used since time immemorial; (6) Social inequity; and (7) Lack of government initiative.

Theme 1: Lack of knowledge about LPG

This theme also emerged under Category 3, *Knowledge of LPG as a domestic source of domestic energy*, and has been adequately discussed above. Therefore, there is no need to discuss it here again. However, it is worth noting that this recurrence of similar information under different categories and questions reflects thick description. It is an important indicator of the richness of the data collected. It indicates the dependability and confirmability of the results (Shenton, 2004:72) and provides an audit trail (Henry, 2015:2) of the data collected.

Theme 2: Non availability of LPG in most parts of the country, especially in rural areas

This theme also emerged under Category 3, *Knowledge of LPG as an alternative source of domestic energy* and has already been discussed. However, it is perhaps, important to reiterate that this finding is in tandem with the findings of the reviewed studies on the issue.

Theme 3: Perceived danger of LPG

This theme was also given under Category 3, *Knowledge of LPG as an alternative source of domestic energy*, as one of the reasons why many people might not want to use LPG as a source of domestic energy. This was also the case in the countries under review. This belief was attributed to lack of public awareness on the benefits and safe handling of LPG.

Theme 4: High prices of LPG and accessories

This theme also emerged under Category 3, *Knowledge of LPG as an alternative source of domestic energy*, and has been adequately discussed. The summary of the discussion above is that the poverty situation in the country was one of the factors that contributed to low usage of LPG. This is confirmed by the fact that more than 60% of the Zambian population is poor (CSO, 2013:4; Sishekanu, 2013:2). The situation is the same in the other countries under review. Although LPG was successfully introduced in these countries, LPG usage is concentrated in urban areas where people can afford it (Hood, 2010:7; Buchanan-Smith et al, 2009:6; Falzo et al, 2013:3; Chilemba, 2005:6).

Theme 5: Changing people's mind-sets about charcoal, which they have used since time immemorial

The respondents indicated that changing people's mind-sets about charcoal that they had used since time immemorial as one of the challenges regarding the proposed switch to LPG. This is probably the most difficult challenge to address as people usually resist change from something they are used to. Some participants could not imagine life without charcoal – how could they, for example, roast a cob of maize or cassava without charcoal, they wondered. This relates to the belief of some participants that food cooked on charcoal tastes better than food cooked with LPG. This cultural factor, coupled with high poverty levels in the countries where charcoal is used, has made some studies on charcoal use conclude that banning charcoal completely is unlikely but minimising its usage is possible. This has been referred to by some scholars as “the charcoal trap” (Kutsch, Merbold, Ziegler, Mukelebai, Muchinda Kollo & Schole, 2011:1). This is highly debatable, but it is out of the scope of this study, so it will not be pursued further.

This challenge is not peculiar to Zambia. The research that has been reviewed in this study also reveals that this was the situation in other countries. In Mozambique, Chilemba (2005:72-79) discovered that the cultural habit of using charcoal was one of the barriers that needed to be overcome in order to increase LPG usage in the country. A related barrier that he identified was the wide availability of biomass fuels, that is, fuelwood and charcoal. Falzon et al (2013:3) reached a similar conclusion. They indicated

that there was a strong preference for consumers to use charcoal. In Sudan, Hood (2010:7) also showed that among the barriers to the wide usage of LPG in the country were social and cultural issues.

Theme 6: Social inequity

Respondents also cited social inequity as being one of the challenges preventing the shift from charcoal to LPG. This is perhaps the overriding and overarching challenge. It is at the root of environmental degradation and the major reason why poor people use inefficient polluting sources of domestic energy, including charcoal. This is in line with the theoretical framework of this study, Social Ecology, which posits that people devastate the environment because of poverty that has been created by social strata or classes in society. This can also be linked to energy poverty and energy transition theories discussed elsewhere in this report.

Social inequity is implied in the barriers to LPG usage cited by the research that has been reviewed in this study. Hood (2010:6) identifies the relatively large initial investment needed to acquire LPG appliances (cylinders and stoves), the high price of LPG compared to wood-fuel prices in parts of the country and social issues as some of the barriers to LPG usage in Sudan. In Mozambique, Chilemba (2005: 72-79) identifies the relatively high cost of LPG and equipment as one of the barriers. Similarly, Falzon et al (2013:3) identify financial constraints on the part of consumers as one of the barriers to LPG usage in Mozambique.

The theoretical framework of this study and scholars who have carried out research on charcoal use attribute the use of charcoal to poverty (Nawa, 2011:2; Mwitwa, Vinya, Kasumu, Syampungai, Monde & Kasubika, 2012: 4). They argue that, as long as poverty is not eradicated, banning charcoal and changing to better sources of domestic energy, which are naturally more expensive, will be very difficult, hence the term “the charcoal trap” referred to above.

Theme 7: Lack of government initiative

The respondents also identified lack of government initiative to solve the problem of deforestation as one of the challenges. The respondents felt that the government was not doing enough to curb the deforestation situation. They also felt that the government was not doing enough to promote an alternative source of domestic energy to charcoal in the country. They indicated that the government does not protect forests with the vigour that it protects wild animals. Also implied in the lack of government initiative theme is the lack of engagement with other stakeholders to find a solution to deforestation and to introduce other sources of domestic energy. The kind of initiative being referred to here is like the one taken by ZESCO, which involved bringing different stakeholders together to seek ways of promoting LPG usage.

The studies that have been reviewed in this report show that governments lack initiative to engage other stakeholders in promoting LPG usage. In Ghana, the shortages that developed after the general switch from charcoal to LPG were partially attributed to the failure on the part of the government to engage the private sector (Boni-Bediako & Dankwa, 2013).

7.4 Research question (c): What are the solutions to the challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia?

Category 6: How the challenges may be addressed

This category was intended to provide answers to the third and last research question. The respondents were able to provide a list of solutions to the identified challenges that could impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia. They were also able to provide a list of stakeholders that could come together to carry out the activities implied by the identified solutions. Therefore, the third research question was well answered.

The major challenges that were identified under Categories 1 to 4 were as follows: (1) Lack of knowledge about LPG; (2) Non-availability of LPG in most parts of the country, especially in rural areas; (3) Perceived danger of LPG; (4) High prices of LPG and

accessories; (5) Changing people's mind-sets about charcoal that they have used since time immemorial; (6) Social inequity; and (7) Lack of government initiative.

The respondents were able to provide corresponding solutions to these challenges. The themes on the solutions to the challenges, which emerged under this category and categories 1-4 were as follows: (1) Sensitisation on the use and safe handling of LPG; (2) Making LPG readily available throughout the country; (3) Reducing the price of LPG and accessories; (4) Government intervention; (5) Social equity; (6) Banning charcoal/Gradual introduction of LPG/Provision of sustainable alternative livelihoods to charcoal producers and traders; and (7) Stakeholder engagement. Some of the challenges have been discussed under related solutions. For example, instead of discussing the solution to the challenge of LPG being perceived as dangerous under this theme, it has been discussed under sensitisation which is a broad theme. Likewise, instead of discussing the solution to the challenge of *Lack of government initiative* under this theme, it has been discussed under *Government intervention*. In the same vein, *Changing people's mind-sets about charcoal which they have used since time immemorial* has been discussed under *Gradual introduction of LPG*.

Theme 1: Sensitisation on the use and safe handling of LPG

Sensitisation on the use and safe handling of LPG was the solution that the respondents provided for the challenges of the lack of knowledge and the perceived danger of LPG. This could be done in a variety of ways, most of which were suggested by the respondents themselves. For example, stakeholder engagement could be implemented to address these two challenges. The respondents identified a comprehensive list of stakeholders which was reduced to the following: government; private sector; traditional leaders; and other countries. To sensitise people on LPG, these stakeholders could carry out activities which could include public talks; radio, TV and print media programmes; posters in public places; amongst others.

The study revealed that some sensitisation activities are actually going on in the country. ZESCO and the Department of Energy are carrying out sensitisation in various ways

(see below) that should be intensified once the official introduction of LPG is launched.

Sensitisation played a major role in the promotion of LPG in the countries that have been reviewed in this study. In Sudan, promotional activities included reducing the price of LPG by 50% and exempting LPG appliances from import duty tax (Hood, 2010:6; Buchanan-Smith et al, 2009:6). These strategies were so effective that LPG usage increased (Hood, 2010:6) while the firewood and charcoal trade, on the other hand, steadily declined (Buchanan-Smith et al, 2009:6). To increase usage of LPG, which was concentrated in the central region of the country, the studies by Hood (2010) and Buchanan-Smith et al (2009) recommend that public awareness and consumer education on the benefits of LPG and safety precautions of LPG use be conducted. They also recommend that the government put in place policies and initiatives to promote LPG market development. They suggest that these include strategies for full application of subsidies and national price stabilisation (Hood, 2010:6; Buchanan-Smith et al, (2009:6).

In Mozambique, a study by Chilemba (2005) recommends the following sensitisation and promotional activities in order to overcome some barriers to LPG usage: awareness and education programmes; promotional programmes; payment terms and micro-credit facilities; instalment payments; subsidies; and the introduction of smaller LPG canisters. The study by Falzon et al (2013) also makes similar recommendations. It recommends that public information campaigns and market awareness activities be carried out; government support for LPG supply businesses and investment in LPG; and government support of private sector or microfinance initiatives (Falzon et al, 2013:3).

In Niger, aggressive government LPG promotion campaigns, based on the government-formulated ambitious LPG promotion programme as household energy, were very successful. As a result of the campaigns, LPG usage soared to 10,000 tonnes in December 2012 from 3,000 tonnes in 2011 (SNV Niger, 2013:12).

Theme 2: Making LPG readily available throughout the country

Non-availability of LPG in most parts of the country, especially rural areas, was another challenge the respondents mentioned could impede the introduction of LPG as an

alternative domestic energy source to charcoal in Zambia. The respondents identified the solution to this challenge which is to make LPG readily available throughout the country. This would not only increase the LPG stocks in the country, but would also contribute to lowering of the price of LPG. Commodities are usually expensive if the demand for them outstrips the supply. Making LPG available throughout the country would require increased production, more distributors, wholesalers and retailers. The government would need to encourage local and foreign companies to invest in the commodity. Charcoal producers and traders would need to be empowered with both capital and skills to become retailers in the commodity.

On increased production of LPG, the study revealed that, currently, Indeni Oil Refinery does not produce enough LPG to satisfy the current demand, let alone the demand that the proposed change would entail. The ongoing electricity load-shedding in the country has forced some citizens to start using LPG during these periods. This has naturally pushed the demand for LPG up, causing shortages. Lisulo (2015:1) quoted Oryx Energies Managing Director, Dansel Sannigadu, as saying, "The company has noted a sharp rise in demand of LPG among its commercial customers owing to the current power deficit, a development which has triggered shortages of the commodity". This new demand for LPG has also raised the price of the commodity, making LPG even less accessible to poor Zambians. Therefore, if the proposed switch from charcoal to LPG is implemented, LPG would become even more expensive and less accessible rendering LPG an unsustainable alternative domestic energy source to charcoal.

However, the pessimism portrayed above is allayed by other findings of the study. Firstly, if the solutions proposed by the various participants are implemented, both cost and shortages would be automatically addressed. Secondly, Indeni Oil Refinery has the capacity to increase production and availability of LPG should the demand go up permanently. According to the Senior Energy Officer who was interviewed at the Department of Energy, most of the LPG produced at the refinery is exported to East Africa and some of it is flared. The Officer explained that this is because there is little demand for LPG in the country. Therefore, should there be constant demand for LPG in

the country, the Refinery could stop exporting LPG to other countries and control the flaring. The other measure the Refinery could take is to start using a feedstock that is more suitable to the production of LPG. Asked why these measures could not be taken when LPG shortages were triggered by electricity load shedding, the Senior Energy Officer explained that the demand was sudden and not anticipated. Therefore, if a deliberate policy on the promotion of LPG was formulated, high demand would be expected and the measures in question would be put in place to avert shortages.

This is line with what happened in Ghana when there was a general switch from charcoal to LPG. The demand for LPG went up which resulted in shortages of the commodity (Broni-Bediako & Dankwa, 2013:6; Acharibasam & Apatinga, 2014:4). However, Broni-Bediako & Dankwa (2013) blamed the shortages on bad implementation of the LPG policy by the government. The study recommended the following: firstly, government to secure the participation of the private sector so that they could invest in LPG. Secondly, government to make existing key players in the supply chain aware of their responsibilities to take the needed initiatives. In Mozambique, a study carried by Felzon et al (2013) also recommended private sector participation in LPG production and distribution. They specifically recommended the establishment of a local refinery and the development of LPG infrastructure.

The examples cited above give hope about the possibility of increasing LPG production and addressing the shortages entailed by the general switch from charcoal to LPG in Zambia. Firstly, Zambia has an existing refinery in the name of Indeni, which only needs to increase production. Secondly, the respondents of this study have identified stakeholder engagement which is probably a major solution to the various challenges or barriers to the effective introduction of LPG.

Theme 3: Reducing the price of LPG and accessories

The respondents identified high prices of LPG and accessories as another impediment to the introduction of LPG as an alternative domestic energy source to charcoal in Zambia. The respondents suggested reducing the price of LPG and accessories. This could be achieved by: making LPG readily available in all parts of the country; government intervention with lower taxes on LPG and accessories; subsidies on LPG; and accessories, among others.

These strategies were used or recommended in the countries under review. In Sudan, LPG promotional activities included lowering the LPG price by 50% and exempting LPG appliances from import duty tax (Hood, 2010:6; Buchanan-Smith et al, 2009:6). This resulted in a significant increase in LPG usage. In Mozambique, recommendations for increasing the uptake of LPG included full application of subsidies and national price stabilisation (Chilemba, 2005:72-75).

Theme 4: Government intervention

The other solution that the respondents provided was government intervention. This is an all-encompassing solution as it covers many steps that the government could take to make the proposed innovation possible. These include solutions that the respondents provided such as stakeholder engagement; encouragement of investment in LPG; subsidising LPG and accessories; and ensuring enough LPG is produced in the country.

Studies that were carried out in some countries under review attributed the problems faced during the switch from charcoal to LPG on government failure to engage other stakeholders. The study carried out in Ghana by Boni-Bediako & Dankwa (2013) recommended, among other things, that (1) government secure private sector participation; and (2) key players in the supply chain take the initiative by being made aware of their responsibilities. In Mozambique, the study by Chilemba (2005) revealed a similar situation. The study identified lack of involvement by the private sector as one of the barriers to expanding the LPG market in the research area of Pemba. The study by Felzon et al (2013) revealed a similar problem and recommended that the government

should support initiatives from the private sector or microfinance initiatives.

Government intervention in the countries under review was not only a matter of recommendation by the studies carried out in these countries, but was a result of initiative by the governments themselves. The study conducted in Ghana by Broni-Bediako & Dankwa (2013) attributes the successful introduction of LPG in that country to a number of government interventions. The government started by formulating an LPG policy which guided the process of introducing LPG in the country. Secondly, the government put subsidies on LPG and its accessories which made them affordable to most Ghanaians (cf. Acharibasam & Apatinga, 2014:4). In Sudan, the government formulated an LPG policy in order to increase the uptake of LPG among the citizens. Apart from this, LPG prices were reduced by 50% and LPG appliances were zero rated in terms of duty tax (Hood, 2010:6). In Niger, the government developed an ambitious programme to promote LPG that resulted in significant LPG usage in the country (SNV Niger, 2013:12). The respondents of this study identified all the interventions described above.

Theme 5: Social equity

Social inequity was another challenge that the respondents identified. To this challenge, the respondents provided a number of solutions, which have been summed up under social equity. Some of the activities the respondents suggested, which pointed to social equity, have been discussed under other themes and could be summed up under the theme *“Empowering poor people so that they could afford LPG”*.

The respondents suggested a number of ways in which people could be empowered to afford LPG and accessories. These included: provision of soft loans by financial institutions; provision of salary advances by employers; provision of free LPG initially to give poor people time to acquire the necessary equipment; instalment payments for LPG appliances or hire purchase; tax exemption of LPG appliances; subsidising the price of LPG and appliances; and provision of skills needed to engage in alternative livelihoods, especially by charcoal producers and traders, among others.

The strategies described above were also used in the countries under review in order to make LPG affordable across the strata of society. Most of these strategies have already been adequately discussed under other themes therefore they will not be reviewed under this theme. These include: tax exemption on LPG appliances; subsidising the prices of LPG and accessories; direct reduction of prices of LPG and accessories; introduction of small LPG canisters; payment terms and micro-credit facilities; and instalment payments, among others.

Theme 6: Gradual introduction of LPG/Banning of charcoal/Alternative livelihoods for charcoal producers and traders

Changing people's mind-sets about charcoal, which they have used since time immemorial, was another challenge identified by the respondents. To this, the respondents gave solutions which included: gradual introduction of LPG; banning charcoal; and the provision of alternative livelihoods for charcoal producers and traders.

While the respondents indicated that it was possible to switch from charcoal to LPG, they thought a sudden switch would not be appropriate. They reasoned that changing suddenly from charcoal which most of the people have used exclusively as a domestic source of energy since time immemorial would cause a lot of problems. People would need sensitisation before accepting the new energy source. Therefore, they suggested that LPG be introduced gradually which is implied in the various LPG introduction strategies provided by the respondents. Sensitisation/LPG promotion; stakeholder engagement; making LPG readily available in all parts of the country; and related strategies cannot be accomplished in a short space of time. However, it is important to set the process in motion. The actual switch from charcoal to LPG could be done gradually.

Gradual switching from charcoal to LPG is also implied in the studies under review. In Sudan, the introduction of LPG was not sudden. While the promotional activities yielded significant increases in LPG usage, as we have already seen, the decline in firewood and charcoal trade was gradual but steady (Buchanan-Smith et al, 2009:6). This is evidenced by the fact that, at first, LPG use concentrated in the central region of the

country and not countrywide (Hood, 2010:6; Buchanan-Smith et al, 2009:6). A similar situation prevailed in Mozambique where the use of LPG was focused mainly at the top of the income pyramid (Falzon et al, 2013:3; Chilemba, 2005:6). In Niger, although an aggressive campaign carried out by the government yielded impressive results (SNV Niger, 2013: 12), the achievement was not 100%. The fact that the use of LPG soared from 3,000 tonnes in 2011 to 10,000 tonnes in 2012 implies there was a steady increase in LPG usage but this figure was not the national consumption.

Apart from introducing LPG gradually, some respondents thought banning charcoal completely could solve the problem of the “charcoal mentality”. They reasoned that if charcoal was banned and LPG was promoted instead, the shift to LPG would be successful as charcoal producers, traders and users would have no alternative. The ban would cut the supply from the producers, the traders would then not be able to buy charcoal to sell and the users would not be able to purchase charcoal to use at home. For the ban to be even more successful, the respondents indicated that charcoal producers and traders should be provided with alternative livelihoods. This implies equipping them with skills to start other businesses that are sustainable and environmentally friendly. The sale of LPG at a retail level readily provides an alternative business – instead of selling charcoal, these people could be empowered with LPG kiosks.

Theme 7: Stakeholder engagement

Stakeholder engagement was identified as another solution. The stakeholders that respondents provided were reduced to the following: (1) Government; (2) Private sector; (3) Traditional leaders; and (4) Other countries.

The government

The respondents indicated that the success of the proposed change lay in the hands of the government which is the main stakeholder in the implementation of the proposed change. The capability of the government to ensure the proposed change takes place lies in three main factors. Firstly, it is the government that formulates policies that direct

the development of the country. It is also the government that enacts laws that govern the country. Secondly, the government has the authority and influence that is needed to engage other stakeholders. Thirdly, it is the government that has and is able to mobilise the resources needed to effect the proposed change.

It is encouraging to learn that the Department of Energy has been carrying out pilot studies on the promotion of the use of LPG in some townships of Lusaka. However, the Department should not work in isolation. It needs to engage with other stakeholders in order to expedite this project.

The studies under review have also attested to the importance of government involvement in making the switch from charcoal to LPG successful. In Ghana, the shortages that ensued after the general switch from charcoal to LPG, as we have seen, were attributed to government failure to implement the LPG policy and to engage with other stakeholders properly (Acharibasam & Apatinga, 2014:4). On the other hand, the success of switching from charcoal to LPG in all the countries under review was as a result of the initial LPG policies that the governments of these countries put in place, coupled with the specific strategies that they used.

The private sector

The respondents also identified the private sector as another important stakeholder in the successful implementation of the innovations being proposed by this study. The private sector's strength lies in its diverse nature. The private sector includes various powerful local and multinational companies that have the resources needed to effect the proposed change. Most firms are ready to fulfil their corporate social responsibilities. However, they may not know which projects are needed by the communities. It is, therefore, the duty of the government to engage the private sector so that they can help carry out government prioritised projects.

ZESCO, the national electricity utility company, has taken the initiative of promoting LPG in the country as an alternative energy source, not only to charcoal, but also to electricity. ZESCO, which has been experiencing inadequate power generation due to lower water

levels in the dams that is associated with climate change, has implemented unprecedented load shedding. It has taken the initiative of engaging stakeholders like the Energy Department in the Ministry of Energy and Water Development, the Energy Regulation Board (ERB), LPG dealers, Indeni Oil Refinery and other stakeholders to find the most effective ways of promoting LPG in the country to discourage over dependency on electricity. ZESCO has also been running television advertisements encouraging people to use LPG stoves to save electricity.

The studies that have been reviewed in this research have shown the importance of the private sector in ensuring that the proposed change is successful. The recommendations made by almost all the studies to make the switch from charcoal to LPG successful included the governments of these countries engaging with the private sector.

Traditional leaders

The respondents also identified traditional leaders as important stakeholders. Traditional leaders have the authority and influence to effect the changes being proposed. These leaders deal directly with their communities, most of whom live in rural areas and are poor. In Zambia, 61% of the population live in rural areas and rural poverty has been estimated at 77% (CSO, 2013:4; Sishekanu, 2013:2). Traditional leaders, therefore, have authority over more than half of the Zambian population. The fact that rural people largely depend on forests for their domestic energy and the fact that they are the majority of the Zambian population, make traditional leaders important stakeholders in the proposed innovation. Therefore, traditional leaders should be engaged to help with sensitisation campaigns on the dangers of cutting down trees; the dangers of producing and using charcoal; the adverse effects of climate change and how it impacts rural populations; the usefulness of LPG; the safe handling of LPG and many related issues. Empowerment and promotional activities could also be channelled through traditional leaders.

The involvement of traditional leaders is in line with the theoretical framework of this study, Social Ecology, at two levels. Firstly, the fact that traditional leaders have authority over rural people, who are mostly poor and are the main culprits of deforestation, make

them instrumental in the curbing of deforestation. Traditional leaders' communities fear these leaders and respect what they say. Secondly, traditional leaders would like their communities to be lifted out of poverty therefore they would welcome strategies of introducing LPG that promote social equity.

Other countries

The respondents also identified other countries as stakeholders that the government could engage to help effect the proposed changes. They mentioned donor countries and countries where LPG has been successfully introduced. This could be done through bilateral cooperation, grants and loans from donor countries. There are many donor countries in Zambia that are helping with interventions regarding climate change. The government needs to mainstream the shift from charcoal to LPG so that more attention is paid to this change. LPG has been successfully introduced in Ghana, Sudan, Mozambique and Niger which have been reviewed in this study. The government could engage these countries to learn from them how the projects were successfully carried out in their countries.

7.5 Conclusion

This study has indeed contributed to the existing knowledge on climate change mitigation, the curbing of deforestation and the promotion of clean domestic energy. Firstly, it has filled a gap by being the first study in the country that does not only link deforestation and charcoal production and use to climate change, but proposes that LPG be used as a climate change mitigation strategy. Secondly, it has extended current knowledge in the area of climate change mitigation related to clean domestic energy. It has, in particular, extended the studies that have been reviewed and reinforced their findings.

CHAPTER 8

SUMMARY, CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

This chapter presents a summary of the findings of the study according to the research questions and objectives to show the extent to which the research findings answer the questions and fulfil the objectives. This chapter also presents an interpretation of the research findings in terms of the theoretical and conceptual frameworks of the study and the studies reviewed. The chapter ends with recommendations arising from the research findings of the study.

8.2 Summary

The main purpose of the study was to find out the possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia to act as a climate change mitigation measure. The country has some of the highest rates of deforestation in the world which, among other factors, is caused by charcoal production and use. Deforestation and energy production and use, in this case, charcoal, are said to be the two main contributors to GHG emissions into the atmosphere, which are responsible for climate change. It is envisaged that the introduction of LPG would also promote the sustainable use of the Zambian forests as well as providing sustainable alternative livelihoods for poor people who depend on forests to survive and, as such, contribute to the attainment of sustainable development.

Although the study was mainly qualitative in nature, it also made use of some quantitative methods, which made the study achieve triangulation, a strategy that makes research results reliable and trustworthy. The specific methods used to collect data were questionnaire, interview, focus group discussion and document analysis. The study was conducted in nine townships of Lusaka City. The respondents included charcoal users, charcoal traders and key informants from the environmental protection and energy sectors, both government and private. The data that were collected using the questionnaire and interview methods were analysed using thematic content analysis

while data collected using the focus group discussion method were analysed using framework content analysis, which is in fact a form of thematic content analysis.

To answer the research questions, the study was expected to fulfil the following research objectives:

- (a) To explore the possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia.
- (b) To understand the challenges that may impede the introduction of LPG as an alternative energy source to charcoal in Zambia.
- (c) To recommend ways to overcome the identified challenges.

The results of the study are, therefore, summarised according to the research questions and objectives under the following topics: (1) The extent to which LPG is appropriate as an alternative domestic energy source to charcoal in Zambia; (2) Challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia (3) Solutions to the challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia.

8.2.1 The extent to which LPG is appropriate as an alternative domestic energy source to charcoal in Zambia

As has been indicated in Chapter 6, the findings indicate that the majority of the participants think it is possible to introduce LPG as an alternative domestic energy source to charcoal in Zambia. The factors that point to the possibility of introduction of LPG as an alternative domestic energy source to charcoal in Zambia include the following:

1. The majority of the participants are aware of the dangers of charcoal production and use to personal health and the environment.
2. The majority of the participants are aware of the possible challenges that may make the introduction of LPG as an alternative domestic energy source to

charcoal in Zambia difficult.

3. The majority of the participants are aware of the possible solutions to the challenges.
4. The participants are aware of the appropriate stakeholders that should be engaged to make the proposed change possible.

This possibility has been strengthened by the measures that government organisations in the energy and environmental protection sectors have started taking related to the innovation proposed by the study. Some of these measures include the following:

1. The Department of Energy has enshrined LPG in the National Energy Policy of 2008 as one of the possible alternative energy sources to charcoal.
2. The Department of Energy has also carried out pilot projects in peri-urban areas of Mtenedere and Kalingalinga on the promotion of LPG usage and the results have been positive.
3. The Department of Energy has also been disseminating information to demystify LPG and has been sensitising people on the precautions related to LPG handling as well as the benefits of LPG.
4. ZESCO has been promoting the usage of LPG through mass media advertising.
5. ZESCO has also taken the initiative of engaging other stakeholders in the energy and environmental protection sectors to discuss and propose strategies to enhance LPG usage.
6. ZEMA has been providing the government with climate change mitigation and adaptation programmes and LPG could be part of the process in the development of the options.

8.2.2 Challenges of introducing LPG as an alternative domestic energy source to charcoal in Zambia

As indicated in the preceding section, the majority of the participants are aware of the challenges that could impede the introduction of LPG as an alternative energy source to charcoal in Zambia. The participants were also able to indicate specific challenges, which were generally uniform although worded slightly differently. These challenges were categorised into the following themes: (1) Lack of knowledge about LPG; (2) Non availability of LPG in most parts of the country, especially in rural areas; (3) Perceived danger of LPG; (4) High prices of LPG and accessories; (5) Changing people's mind-sets about charcoal, which they have used since time immemorial; (6) Social inequity; and (7) Lack of government initiative.

8.2.3 Solutions to the challenges that may impede the introduction of LPG as an alternative domestic energy source to charcoal in Zambia

As in the case of challenges, the majority of the participants are aware of the possible solutions to the challenges and they were summarised into the following themes: (1) Sensitisation on the use and safe handling of LPG; (2) Making LPG readily available throughout the country; (3) Reducing the price of LPG and accessories; (4) Government intervention; (5) Social equity; (6) Banning charcoal/Gradual introduction of LPG/Provision of sustainable alternative livelihoods to charcoal producers and traders; and (7) Stakeholder engagement.

Stakeholders that may partner with the government to help with the switch from charcoal to LPG were summarised as follows: private sector, traditional leaders and other countries.

8.3 Interpretation of results in terms of the theoretical framework

The results of this research conform to the theoretical framework of the study, Social-Ecology, which posits that environmental degradation is a result of poverty or social inequality. It is poor people who use forests, in this case, unsustainably in order to meet their domestic energy and livelihood needs as they cannot afford cleaner forms of energy and are not in formal employment. The theoretical framework further holds that the

question of social inequality has to be addressed if the environment has to be saved from being exploited unsustainably. The results of the study have revealed that the reason why people use charcoal is because they cannot afford to use cleaner sources of domestic energy such as electricity and LPG. The results have also revealed that, in order for poor people to be able to afford the domestic source of energy being proposed by the study, some interventions have to be done in terms of subsidising the price of LPG, empowering poor people with soft loans and knowledge about LPG, among others. This can be interpreted as a form of solution to social inequality that would save the forests from further devastation and bring about sustainable development.

Specifically, the results also fit very well into the conceptual framework of the study, DPSIR. The *Driving* forces here are livelihood needs of charcoal producers and traders and domestic energy needs of the producers, traders and users. Due to energy poverty, and poverty in general, all these categories of people heavily depend on charcoal which is a product of deforestation. This exerts a lot of *Pressure* on the forests and *Impacts* negatively not only on the forests and the general environment but on the climate as well, resulting in climate change and its various effects. Therefore, the government should *Respond* to these problems by not only introducing LPG as an alternative domestic energy source to charcoal, but also ensuring that poor people can afford to buy it and that charcoal producers and traders are provided with sustainable alternative livelihoods. By so doing, the government would bring about social equity which is one of the pillars of sustainable development.

Therefore, by solving the social problems associated with domestic energy and livelihoods, the government would be promoting sustainable development. In this case, sustainable development at an individual level would mean affording a cleaner domestic energy source much higher on the energy ladder than charcoal and thus being lifted out of energy poverty. This would foster improvements in terms of personal health and climatic conditions. This would improve food security, infrastructure security, livelihood security and many other sectors of development.

In trying to achieve sustainable development in this way, the government should engage

various stakeholders. The main solution to the problem lies in multi-stakeholder engagement and the sustainable livelihoods approach. As has been explained earlier in this report, multi-stakeholder engagement, as the term implies, involves engaging all the stakeholders that, in this case, include the energy and environmental protection sectors, charcoal producers, traders and users, all relevant government departments and agencies, ZESCO, LPG manufacturers, wholesalers and retailers, non-governmental organisations (NGOs) and many other related stakeholders as suggested by the participants of the study. The sustainable livelihoods approach involves analysing livelihoods holistically in order to make them sustainable.

Engagement of all the stakeholders by the government would result in a number of things: sensitisation on the adverse effects of deforestation; mutual agreement on how all stakeholders would work together to curb deforestation; mutual agreement on alternative and sustainable livelihoods for people who depend on charcoal production and sale; mutual agreement on the alternative sources of domestic energy that should be used to reduce dependence on charcoal; mutual agreement on the promotion of such alternative sources of energy and how to make them accessible and affordable for everyone.

This kind of stakeholder engagement would make the affected people feel respected and own the whole process. This would result in a situation that is beneficial to all. The government would be able to achieve its goals regarding deforestation and climate change mitigation; stakeholders like charcoal producers and traders would be provided with alternative livelihoods and affordable alternative sources of energy.

To talk specifically about LPG as an alternative domestic energy source to charcoal, stakeholders like LPG manufacturers, wholesalers and retailers would have growing businesses resulting from the general switch from charcoal to LPG. Stakeholders like ZESCO would also benefit as the current pressure on the inadequate power currently being experienced in the country would reduce as most domestic consumers would switch to LPG. Ultimately, the whole country would benefit economically as the saved power could be channelled to industrial use, reducing load shedding, mitigating climate

change and resulting in normal rainfall which would support productive agriculture, reduction in floods and droughts, reduction in infrastructure destruction and many other related adverse effects of climate change. This would ultimately result in sustainable development.

8.4 Interpretation of results in terms of literature reviewed

The results of this study support the findings of the reviewed studies, which were carried out in Ghana, Niger, Sudan and Mozambique, where LPG was successfully introduced. These studies also indicate the various challenges that were faced in different countries and recommend how these challenges could be addressed. As has been demonstrated in Chapter 5, the challenges faced by the countries in which the reviewed studies were carried out, are very similar to those identified by the respondents of this study. In the same vein, the solutions or recommendations to address the identified challenges that the cited studies indicate are also similar to those identified by the respondents of this study. As has been indicated by the participants of this study, the reviewed studies also place the responsibility of successfully implementing the proposed change on the government. Involvement of the private sector has also been cited as a solution to the challenges identified. This is in line with the stakeholder engagement theme that emerged from the study findings.

In view of the foregoing, Zambia can learn from these countries' experiences. Most of these countries were prompted to introduce LPG as an alternative domestic energy source to charcoal by the discovery of oil or the presence of an oil refinery. Zambia has an oil refinery so the main factor needed for the successful implementation of the proposed innovation exists.

8.5 Contribution of the study to existing body of knowledge

The study has contributed to the existing body of knowledge related to the research topic in two major ways: firstly, by yielding similar results to the results of the studies reviewed, it has extended these studies. Secondly, the study is probably the first study in the country to explore the possibility of introducing LPG as an alternative domestic energy

source to charcoal. By so doing, it provides a possible solution to the serious problems of deforestation and climate change that threaten the developmental efforts of the country.

8.6 Conclusion

The study sought to find out the possibility of introducing LPG as an alternative domestic energy source to charcoal in Zambia as a climate change mitigation strategy. The study has revealed that the proposed change is very possible. However, there are a number of challenges that need to be addressed if this change is to be actualised. The participants are not only aware of the challenges regarding the possible introduction of LPG as an alternative domestic energy source to charcoal in Zambia, but they are also aware of the possible solutions to make the change possible. Multi-stakeholder engagement and Sustainable Livelihoods Approach (SLA) are implied in the manner the participants have proposed to address the identified challenges. The onus, therefore, remains with the government to adopt the use of LPG as an effective strategy to mitigate the effects of climate change.

8.7 Recommendations

In view of the findings of this study, the following is recommended:

- The government should take the lead in implementing the switch from charcoal to LPG being proposed by this study.
- Various stakeholders in the energy and environmental sector should be mobilised to sensitise people on LPG usage so as to address the challenges that may make the proposed change difficult and also to propose alternative sustainable livelihoods for people who are engaged in the charcoal business.
- The government should also engage other countries where LPG has been successfully introduced in order to learn about the effective ways of implementing the proposed change.
- Further research needs to be done on the sustainable livelihoods for charcoal producers and traders.

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