

**THE EFFORTS BY THE ZAMBIA ELECTRICITY SUPPLY CORPORATION TO
REDUCE POWER OUTAGES AND THEIR IMPACT IN LUSAKA'S HIGH
DENSITY AREAS.**

**BY
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FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE
IN MASTER OF PUBLIC ADMINISTRATION (MPA).**

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DECLARATION

I Blessing Kaela Pambwe, do hereby declare that this dissertation represents my own work and has not been submitted by anyone else at the University of Zambia or at any other University for the purpose of acquiring a degree.

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CERTIFICATE OF APPROVAL

This dissertation for Blessing Kaela Pambwe has been approved as fulfilling the requirements for the award of The Masters in Public Administration of the University of Zambia.

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ABSTRACT

Energy is said to be the engine of the economy globally. This is because critical social and economic services such as health, education, transport and commerce, among others cannot be efficiently and effectively provided in the absence of reliable and affordable energy services. However, in Zambia access to electricity in urban areas stands at 67.3% while in rural areas it is at 4.4% translating into 31.4% at the national level. The few who have access to electricity are also subjected to load shedding and notorious power outages. The purpose of this research is to evaluate the effort by the Zambia Electricity Supply Corporation (ZESCO) to reduce power outages and their impacts in Lusaka's High Density Areas. The research used a mixed method approach, involving both qualitative and quantitative methods. A sample of 196 was engaged, comprising 190 respondents and six (6) key informants. A questionnaire, observation and semi-structured interviews were used to collect data. The data was analyzed using SPSS, Microsoft Excel and content analysis. The finding indicates that ZESCO was making a lot of effort to reduce power outages in Lusaka's High Density Areas. ZESCO was building more power stations in different parts of the country. These include the Kariba North power station and the Musonda falls power station among others. The company was also undertaking system re-enforcements by putting more transformers closer to the load centers. This involves identifying an area where they can put up another transformer in order to offload the existing customers to the new transformers. This eventually leads to load balancing. The study also showed that in order to ensure that the country's generation capacity matches the ever increasing load demand, ZESCO had engaged various stakeholders such as Maamba collieries, Ndola energy and Bangweulu solar company to produce power and sell to ZESCO under the Bulk power purchase Agreement. This power is then fed into the national grid for transmission to consumers. The study also demonstrated that ZESCO had made some stride to reduce dependence on hydro power sources by building a 50MW solar power plant at the Lusaka Multi Facility Economic Zone while the Japanese were putting up a 300MW solar power plant in Mpika and Copperbelt province.

In terms of the impact of the efforts by ZESCO in reducing power outages in Lusaka's high density areas, the study found that the efforts by ZESCO impacted positively on the social and economic life of the people in high density areas. Power outages which were lasting up to 16 hours had significantly reduced to less than 2 hours per day while in some areas it was almost non-existent. People were now able to use electrical equipment like radios, television, fridges and stoves. The study also demonstrated that due to the efforts by ZESCO to reduce power outages, cases of houses getting burnt due to the frequent use of candles had also reduced. In addition, reduction in power outages also contributed to reduced criminal cases such as fighting, murder, stealing and rape cases which frequently took place especially at night. The other impact of the efforts by ZESCO to reduce power outages in the two areas is that it stimulated self-employment and increased productivity of home business through higher revenues of existing businesses and the creation of new ones. Furthermore, firms could no longer incur costs of raw materials that go to waste and damage to equipment resulting from sudden power outages. In the long run the number of workers deemed redundant was reduced as firms operated at full capacity. In the education sector, reduction in power outages resulted in increased education possibilities as school going children, especially those in examination classes, were now able to study either at their homes or their nearby schools during night times while in the health sector Service delivery to the people improved as hospitals and clinics were able to continue with their operations during the night.

Key words: Effort, Impact, Power Outages and High Density Areas.

DEDICATION

This dissertation is dedicated to my parents Mr. Stanley Pambwe and Mrs. Beatrice Kunda Pambwe who have always wanted to see me progress academically and life in general.

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TABLE OF CONTENTS

DECLARATION	i
COPYRIGHT.....	ii
CERTIFICATE OF APPROVAL.....	iii
ABSTRACT.....	iv
DEDICATION.....	v
ACKNOWLEDGEMENT	vi
CHAPTER ONE.....	1
INTRODUCTION AND BACKGROUND.....	1
1.1 Introduction.....	1
1.2 Background of the study	1
1.3 Historical evolution of the power sector in Zambia.....	5
1.4 Overview of the Electricity Supply Industry of Zambia	7
1.5 Governance and administration of the energy sector in Zambia.....	8
1.6 Legal Framework	11
1.7 Other policy and regulatory frameworks	12
1.8 impact of power outages on high density areas	14
1.9 Statement of the problem	17
1.9.1 Research objectives.....	18
1.9.2 General objective	18
1.9.3 Specific objectives	18
1.9.4 Research questions.....	18
1.9.5 Rationale of the study	18
1.9.6 Conceptual definitions	19
1.9.7 Conceptual framework.....	21
1.9.8 Structure of the dissertation	22

CHAPTER TWO.....	23
LITERATURE REVIEW	24
2.1 Introduction.....	24
2.2. Literature on Issues relating to effort.....	24
2.2.1 Literature on Zambia.....	24
2.2.2 Literature on Africa.....	28
2.2.3 Literature on developing countries outside Africa.....	32
2.2.4 Literature on developed countries	34
CHAPTER THREE.....	36
RESEARCH METHODOLOGY	36
3.1 Introduction.....	36
3.2 Type of research.....	36
3.3 Scope of the research	37
3.4 Research design	38
3.5 Sources of data.....	39
3.6 Sample size	39
3.7 Sampling methods.....	39
3.8 Methods of data collection.....	41
3.9 Reliability of data.....	41
3.9.1 Validity of data	42
3.9.2 Methods of data analysis.....	42
3.9.3 Research ethics.....	43
3.9.4 Limitation of the Research.....	43
CHAPTER FOUR	45
PRESENTATION OF FINDINGS.....	45
4.0 Introduction.....	45

4.1 Background characteristics of informants/respondents	45
4.2 Social-economic status of the respondents	49
4.3 Summary of findings on the background information of heads of households.....	50
4.4 Efforts by Zesco to reduce power outages in Lusaka’s high density areas.....	51
4.5 Effort by engaging various stake holders.....	55
4.6 Efforts to reduce dependence on hydro power sources.....	57
4.7 Steps to diversify energy generation by investing in alternative sources	58
4.8 ZESCO’S development plans in the generation, transmission and distribution subsectors.....	58
4.9 Transmission development plan.....	60
4.10 Distribution development plans	61
Figure 4.10.5. Awareness about ZESCO’S efforts to reduce power outages in Lusaka’s high density areas	62
4.11 Conclusion	67
CHAPTER FIVE.....	69
IMPACT OF THE EFFORTS BY ZESCO TO REDUCE POWER OUTAGES IN LUSAKA’S HIGH DENSITY AREAS	70
6.0 Introduction.....	70
6.1 Impact of the efforts by ZESCO to reduce power outages on the social and economic life of the people of Kanyama and Mtendere high density areas.	70
6.2 Impact of the efforts by ZESCO to reduce power outages on the education sector in Kanyama and Mtendere high density areas	74
6.3 Impact of the effort by ZESCO to reduce power outages on health sector in Kanyama and Mtendere high density areas	75
6.4 Conclusion	75
CHAPTER SIX.....	77
CONCLUSION AND RECOMMENDATIONS.....	77
7.0 Introduction.....	77

7.1 Conclusions..... 77

7.2 Recommendations..... 79

REFERENCES 81

APPENDEIX: 1..... 88

APPENDIX: 2..... 92

LIST OF TABLES

Table 4.1.1: Gender and number of respondents.....	46
Table 4.1.2: Shows the Age Distribution of Respondents.....	47
Table 4.2.3: Indicates respondent's employment status.....	49
Table 4.2.4: shows respondents' monthly income.....	50
Table 4.10.5: Respondents views on whether there were any sub-station and transformer installed or upgraded by ZESCO to reduce power outage in the area.....	64
Table 4.10.6. Respondents' views on whether they were receiving notices from ZESCO about load shading.....	65

LIST OF FIGURES

Conceptual framework.....	21
3.3.1 Map of Lusaka district.....	37
Figure 4.1.1: Gender and Number of respondents.....	46
Figure 4.1.2: Shows the Age Distribution of Respondents.....	47
Figure 4.1.3: Shows the Marital Status of the Respondents.....	48
Figure 4.1.4: Indicates the Education Background of the Respondents.....	49
Figure 4.10.5 Awareness about ZESCO’S efforts to reduce power outages in Lusaka’s high density areas.....	62
Figure 4.10.6. Indicating ZESCO’s response to customer complaints	63
Figure 4.10.7. Indicates the methods of notifying residents about load shading by ZESCO.....	66

LIST OF ABRIVIATIONS

BSA- Bulk Supply Agreement
CAG- Cluster Advisory Groups
CAPC- Central Africa Power Corporation
CEC- Copperbelt Energy Corporation
CPC- Copperbelt Power Company
CSO- Central Statistical Office
DRC- Democratic Republic of Congo
ERB- Energy Regulation Board
IDC- Industrial Development Corporation
IPPs- Independent Power Producers
LPG- Liquid Petroleum Gas
MEWD- Ministry of Energy and Water Development
MMD- Movement for Multi-Party Democracy
NEP- National Energy Policy
NHCC- National Heritage and Conservation Commission
OPPI- Office for Promotion of Private Investment
UNCTAD- United Nations Conference on Trade and Development
VFEB- Victoria Falls Electricity Board
ZABS- Zambia Bureau of Standards
ZCC- Zambia Competition Commission
ZIC- Zambia Investment Center
ZDA- Zambia Development Agency
ZEGC- Zambia Electricity Grid Code
ZESCO- Zambia Electricity Supply Corporation
ZIPAR- Zambia Institute of Policy Analysis and Research
ZRA- Zambia Revenue Authority

CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 Introduction

This dissertation evaluates the efforts by the Zambia Electricity Supply Corporation to reduce power outages and their impacts on Lusaka's high Density Areas. The chapter presents the background of the research, statement of the problem, research objectives, rationale of the research and the conceptual framework. The chapter ends with the structure of the dissertation.

1.2 Background of the study

Energy can be defined as the ability to do work (Cayne, Halsey and Shores, 1970). It is said to be the engine of the economy globally. This is because of the important role that it plays in the economic and social development of the country. For instance, energy plays a very important role in the development and diversification of the economy by facilitating economic activities in all sectors of the economy. For this reason, an increasing supply of reliable energy, matched with the demands of industry in order to sustain economic growth, raise the people's living standards, and poverty reduction is, therefore, critical to any country in the world (Republic of Zambia, 2017). However, according to Amad (2017:27), "about 1.4 billion people, about a quarter of the world population, have no access to electricity." This means that the problem of electricity supply and access is a worldwide problem which requires urgent attention and concerted efforts of different stakeholders.

In Africa, particularly Sub-Sahara Africa, the situation is even worse. According to Avila, Carvillo, Shaw and Kamen (2017) Sub-Sahara Africa is the most deficient region in the world in electricity supply, with more than 600 million people lacking access to electricity, and several million people are connected to an unreliable grid that does not meet their daily energy service needs. Furthermore, Eberhard, Roseness, Shkaratan and Vennemo (2011) argue that less than 30% of the population in Sub-Sahara Africa has access to electricity, compared with about 65 percent in South Asia and more than 90 percent in East Asia. This means that a greater number of the African population in the Sub-Sahara region are still in energy poverty. Access to reliable electricity undoubtedly improves the livelihood of people through lighting their households, powering their appliances, providing additional hours of

study and work. Women and children in urban and rural areas are able to save their time through the usage of electricity for heating and cooking, rather than fetching and using firewood. At macro level, electricity boosts the economic activities and improves the productive efficiency of firms operating in the country (Abotsi, 2016).

Zambia, like many other countries in Sub-Sahara Africa, has a variety of energy resources, particularly woodlands and forests, coal and renewable sources of energy such as hydropower. Despite the availability of a wide variety of energy resources, electricity, being the second most important energy source after wood fuel, only contributes about 10% to the national energy supply (National Energy Policy, 2008). Furthermore, Zambia's electricity supply is dominated by hydro power and accounts for more than 80 percent of the total installed capacity. Interestingly, "Zambia's hydro resource potential is estimated at over 6000MW and the installed capacity is over 2,700MW, of which small and medium sized power generation accounts for less than 2%, despite Zambia being rich in renewable energy resources such as biomass, solar, wind and geo-thermal." (Republic of Zambia, 2017:3). These statistics imply that Zambia has about 3300MW of untapped hydro-potential.

However, according to the Central Statistical Office (2015) living conditions monitoring survey report, rural access to electricity stands at 4.4% compared with 67.3 percent in urban areas. The national access to electricity stands at about 31 percent. The rural urban divide in terms of access to electricity is therefore wide. The low access to electricity in Zambia is generally attributed to the growth in population and industrial activities that have not been matched with the rate of electricity connection. The few who have access to electricity are also subjected to load shedding and notorious power outages. For instance, in July, 2015, 2018 and 2019 Zambia experienced daily 8-hour power cuts exacerbated by low water levels at the main reservoir for hydroelectric generation (Owen, 2016; cossen and waitz, 2016).

Malama et' al (2015) adds that the electricity deficit that Zambia is experiencing is as a result of the positive economic growth which leads to an increase in demand for mining and other economic activities in the country. The increase in demand forced the Zambia Electricity Supply Corporation (ZESCO), the national power utility company with the legal mandate of generation, transmission, distribution and supply of electrical power to residential, commercial and industrial consumers, to embark on widespread power rationing or load shedding. Load shedding is an organized form of electricity outages. However, the load shedding of Zambia in particular the high density areas does not seem to be organized as

power is switched off by ZESCO without strictly following the laid down time table. The high density areas are the most hit by load shedding which from the power utility company's perspective is seen to be the temporal solution to their inability to meet the growing demand. This, undoubtedly, had serious impact to the different sectors of the economy, particularly the Zambian households in high density areas, the small and medium enterprises who could not afford to use other alternative sources of energy. It also made it very difficult for consumers to plan their activities. Wamuwi et'al (2019) revealed that load shedding had far reaching social and economic effects on the lives of the poor urban residents, and small scale business enterprise (SMEs) that routinely depend on access to stable electricity. They further add that the load shedding phenomenon has gotten worse and has become a major political issue, reflecting the hardships for households and business men.

The Zambia Electricity Supply Company (ZESCO), a parastatal company under the company Act, previously known as the Zambia Electricity Supply Corporation, was established in 1970 after an Act of parliament which was passed in 1969. It controls the majority of generation and distribution capacity in the country (Owen, 2016). It is through this company that the state supplies electricity to the Zambian people and the industries. However, due to the economic down turn of the 1980s which resulted in copper prices plummeting on the international market, the state could not manage to provide the various services, including supplying electricity in an efficient and effective manner. With the reintroduction of multi-party democracy in Zambia in 1991, a new government under the Movement for the Multi-Party Democracy (MMD) came to power. This government pursued economic reforms such as liberalization and the creation of a free market economy, moving away from the command system of economic management (Machungwa, 2005)). Among the measures taken by the MMD government was to carry out reforms in the country in order to bring about efficiency in the delivery of services. The major reforms in the energy sector in Zambia were carried out in the 1990s with the formulation of the National Energy policy (NEP) in 1994, establishment of the Energy Regulation Board (ERB), abolishment of ZESCO monopoly and allowing the participation of several private operators in the sector (Republic of Zambia, 2017). Others included the introduction of the Rural Electrification Levy, establishment of the Rural Electrification Authority (REA), attempts to unbundle and the commercialization of the Zambia Electricity Supply Company (ZESCO) (Machungwa, 2005).

The first National Energy Policy (NEP) was formulated in 1994 to promote optimal supply and utilization of energy, especially indigenous forms, for social- economic development in a

safe and healthy environment (NEP, 2008). This policy was, however, reviewed following the growing awareness about the integrated nature of energy in economic development. The changes in the energy sector, domestic economy and the international energy scenario also prompted the review of the 1994 energy policy to bring into effect the 2008 Energy Policy. There was an identified need to mainstream gender into Energy Policy as a critical tool for promoting efficient allocation of resources and also promoting equity. The 1994 Energy Policy did not include the growing awareness of the impact of HIV/AIDS which had affected all sectors, including energy. It therefore, became necessary for the policy to address issues of HIV/AIDS. Furthermore, the revision of the policy was prompted by the need to encourage the participation of more players in the development of electricity industry and government's desire to promote alternative energy sources such as biofuels and LPG.

The main objective of the 2008 Energy Policy was “to create conditions that would ensure the availability of adequate supply of energy from various sources, which are dependable, at the lowest economic, financial, social and environmental cost consistent with national development goals” (NEP, 2008:1). The specific objective of the policy with regard to the electricity sub-sector which is also related to reducing power outages was “to expand generation and transmission capacity and increase access to electricity” (NEP, 2008:1). In 2019 the 2008 National Energy policy, was reviewed and this resulted in the formulation of the 2019 National Energy Policy. Therefore, the 2019 NEP builds on previous policies of 1994 and 2008 and is anchored on the Seventh National Development Plan (7NDP) and the vision 2030. Although, the essence of the previous policies remain valid, social, political, environmental economic situation has undergone significant changes prompting the review of the 2008 National Energy Policy. The 2019 NEP policy aims at guiding the energy sector in the development of electricity generation, transmission and distribution capacity. The 2019 National Energy Policy was anticipated to (1) enhance cost effectiveness and efficiency in the supply of petroleum. (2) facilitate the development and deployment of renewable and alternative energy. (3) promote security of energy through diversification of energy sources at cost reflective levels pricing which would promote investment in the sector, consequently scaling up access to energy services in both rural and urban areas. (4) it also considers climate change mitigation and adaptation while advancing sustainability in the sector. Furthermore, the policy mainstreams gender and disability aspects aimed at increasing access to clean and efficient energy thereby reducing poverty among the vulnerable groups especially women and children (NEP, 2019).

The National Energy Policy was supported by other Acts of parliament which included the Electricity Act of 1995, amended in 2003, which permits private investment in the power sector, the Petroleum Act (1995), the Energy Regulation Act No. 16 of 1995 under which the Energy Regulation Board (ERB) had been established, the Rural Electrification Act (2003) which established the Rural Electrification Authority (REA) and the Zambia Development Agency (ZDA) Act of 2006 (Machungwa, 2005)

Although the formulation of the above highlighted reforms was a positive step in the energy sector, Smith (2015) states that load shedding became increasingly common since 2006 and got worse in 2015, 2018 and 2019. It impacted negatively, not only on the manufacturing and mining industry, but also on the quality of life of Zambians with access to grid electricity. Smith (2015) further states that in order to alleviate the situation, ZESCO entered into contracts with the Southern African Power Pools (SAPP) utility and emergency power suppliers (including Aggreko, PLC). In November, 2015, these contracts totaled 172MW delivered during different times of the day (Smith, 2015).

1.3 Historical evolution of the power sector in Zambia

Zambia's power sector can be traced as far back as 1906 when the first thermal power plant was established in Livingstone to serve a section of the town. In order to supply electricity to the lead and zinc mine in Kabwe (Broken Hill), a 2MW generator was installed at Mulungushi power station in 1925, followed by another 2MW generator in 1927 (Mihalyi, 1977). Hydro Power is said to have taken hold in 1938 when the hydroelectric power plant was installed below the third gorge of the Victoria Falls.

The 1950s and 60s saw three significant developments in the power sector. First, four power stations, with a combined capacity of 120MW, were interconnected to the grid supply on the Copper belt. Second, in 1956 hydropower began being imported, when the transmission line was laid from Katanga, the neighboring Democratic Republic of Congo (DRC), to Kitwe on the copper belt. This development resulted in the birth of the Rhodesia Congo Boarder Power Company which was entrusted with the responsibility of operating the transmission lines and distributing power to the Copper belt. This company was, in 1964, renamed the Copperbelt Power Company (CPC). The third significant development was the construction of the Kariba dam and also the Kariba south power station which was owned and operated by Central Africa Power Corporation (CAPCO). This corporation was established in 1963 and was

jointly owned by the governments of Southern and Northern Rhodesia (Zimbabwe and Zambia) (Kapika and Eberhard, 2013).

As an alternative to the Kariba scheme, the Kafue Gorge power station was constructed. When Zambia became independent in 1964, the Zambian government revived the projects with preliminary works beginning in July, 1967. It was not until 1972 that the project was commissioned with an initial capacity of 600MW (USAID, 2008). According to Mihalyi (1977) the capacity of the Kafue Gorge was later increased from 600MW to 900MW in 1972. Later, Zambia was home to the new reservoir at Itezhi tezhi (World Bank, 1985)

The Zambia electricity Supply Corporation was formed in 1969 and became effective in 1970. It was charged with the responsibility of generation, transmission and distribution of electricity throughout the country, except areas that were supplied by CAPCO. In Zambia CAPCO had two customers namely; the Central Energy Corporation supplying Lusaka and surrounding areas, and Copperbelt Power Company (CPC) which was based on the Copper belt (Kapika and Eberhard, 2013).

In July, 1970 the Central Energy Corporation that supplied small towns by diesel generating station and the Victoria Falls Electricity Board (VFEB) which owned the power station at the falls were placed under ZESCO. In addition to this in 1972, ZESCO acquired municipal operations in Livingstone and Ndola undertaken by VFEB and Ndola Council Electricity respectively. Similar operations were taken over by ZESCO on the Copper belt (World Bank, 1985). By 1985 ZESCO became the major supplier of electricity in the country, except the copper belt mines and the lead-zinc mines at Kabwe.

Another milestone in the evolution of the power sector in Zambia was the commissioning of the Kariba North bank in 1977. This power station was built from the loan acquired by the Zambian government through the Kariba North Bank Company from the World Bank (Mihalya, 1977).

In 1991 power changed hands and the Movement for Multi-Party Democracy (MMD) formed the government. No sooner did the MMD come to power than they began to introduce policy reforms which liberalized the Zambian economy and the energy sector inclusive. In the energy sector, the first National Energy policy was formulated in 1994 “to promote optimal supply and utilization, especially of indigenous forms of energy, for social and economic development in a safe and health manner” (NEP, 2008:1). Later the 1970 Electricity Act was repealed and replaced with the 1995 Electricity Act which ultimately liberalized the

electricity sub sector. This Act was amended in 2003, resulting in the formation of a key institution in the energy sector called the Energy Regulation Board. Other key institutions that were established include the Rural Electrification Authority (REA), the Office for Promotion of Private Power (OPPP) and the Zambia Development Agency (ZDA) among others. The recent development in the energy sector saw the revision of the 2008 National energy policy in 2019 which resulted into the formulation of the 2019 National Energy policy.

1.4 Overview of the Electricity Supply Industry of Zambia

The Zambia electricity supply Industry comprises generation, transmission, distribution and supply of electrical energy. It is operated as part of an interconnected power system linking South Africa, Zimbabwe and Democratic Republic of Congo (DRC) (IRENA, 2013). Before the liberalization of the electricity sector in 1995, Zambia's electricity supply industry had predominantly been a monopoly market led by a single state owned utility company-the Zambia Electricity Supply Corporation (ZESCO) Limited, which was formed in 1970, following the Zambia Electricity Supply Act of parliament (Republic of Zambia, 2019). Phiri and Ziba (2018) state that the Act amalgamated all undertakings that were previously managed by the local authorities to form the Zambia Electricity Supply Corporation Limited. This entrenched ZESCO'S monopoly.

Phiri and Ziba (2018) further argued that the Act gave market dominance to ZESCO which became the sole generator and supplier of electricity in the country. However, due to the inefficiency and ineffectiveness of most nationalized companies which were largely characterized by the application of inappropriate technology, dependence on imported raw materials, inexperienced management, resource misappropriation and a monopolistic environment, with little or no competition and innovation, the Electricity Supply Industry (ESI) was equally liberalized to attract private sector participation through the Act of parliament in 1995 (Fundanga and Mwaba, 1997). The liberalization of the sector attracted independent power producers (IPPs), especially in the generation subsector and these include Lusumfwa, Maamba and Ndola Energy whose entire capacity is off taken by ZESCO as well as those operated by mini hydro-generating stations, such as Zengamina in the North Western Province, whose off grid power system caters to more localized needs.

Another player in the ESI of Zambia is the Copperbelt Energy Corporation (CEC) which is a private company incorporated in the 1950s and is presently the largest private sector player in

the transmission sub sector. It is also licensed to generate, transmit, distribute and supply electricity which it purchases in bulk under the bulk supply Agreement (BSA) from ZESCO for onward supply to the mines. The company owns and operates a vast network of power transmission and distribution infrastructure, covering the entire Copperbelt province. Apart from supplying power to the mines, the company transports power for ZESCO and other utilities in the region using interconnection with the Democratic Republic of Congo (DRC). CEC co-owns the interconnection with SNEL, the DRCs national power utility. CEC has an embedded thermal electricity generation capacity of 80MW which is used for emergency power supply, as an added value service to its customer, and for voltage management (CEC, 2020).

1.5 Governance and administration of the energy sector in Zambia

According to the United Nations Conference on Trade and development (UNCTAD (2017) the governance structures are set of institution, policies and regulations that frame ownership structures and operations, and the rights and responsibilities of actors in the electricity sector. They are generally recognized as important determinants of sectoral performance, the quality of electricity services and private sector and finance in the sector. There are a number of institutions and laws that govern the operation of the energy sector in Zambia and described hereunder are the major ones:

The Ministry of Energy.

This Ministry was established in 2016, following the presidential directive to realign the Ministry from the Ministry of Energy and Water Development (MEWD) (Republic of Zambia, 2018). It has an advisory organ, known as Cluster Advisory Group (CAG) headed by the permanent secretary. The Ministry of Energy is responsible for the formulation and implementation of the National Energy Policy and co-ordination of stakeholders in the sector. It is also responsible for the development of the national energy strategy and plan, the monitoring and evaluation of current policies and the development of new energy programmes (Lanfranconi, 2018). In addition, the Ministry also compiles inventories of energy resources, develops a detailed pattern of distribution, consumption and pricing of energy to maintain an energy information system for planning, forecasting and policy analysis. Monitoring the implementation of the rural electrification programme is also another important function of the Ministry of Energy (Republic of Zambia, 2019).

Under the current law, the Ministry is also mandated to appraise and approve applications to increase or decrease generating capacity for all undertakings, arbitrate appeals disputing objections to license applications by ERB, oversee maintenance of undertakings, approve the construction of transmission lines and most importantly has the mandate to change the regulations governing the industry (Phiri and Ziba, 2018).

Office for Promoting Private Power Investment (OPPPI).

This is one of the five departments under the Ministry of Energy which was created in 1999 and dedicated to the promotion of private investment in the Energy sector. This department was specifically designed to streamline investment procedures and reduce the complexity and red tape associated with obtaining investment appraisals, permits and licenses in the electricity sector (IRENA, 2013). The OPPPI also promotes the development of largely untapped hydro potential and the improvement of rural electrification through the use of least cost technologies and renewable energy (Phiri and Ziba, 2019).

Zambia Development Agency (ZDA)

In 2006, the Zambia Investment Center (ZIC) was merged with Zambia Privatization Agency (ZPA), Export Board of Zambia, Small enterprise board of Zambia and Zambia processing Zones authority to form a new institution called the Zambia Development Agency (ZDA) (Republic of Zambia, 2014; Madimutsa, 2016). ZDA was operationised in 2007 and was mandated to foster economic development through the promotion and facilitation of both direct investment and trade. The agency act as a platform connecting investors with information and services supporting market entry. It is expected to be a one stop shop for all investors, including those in the energy sector (Republic of Zambia, 2019).

Zambia Bureau of Standards (ZABS)

This is a national standards body of Zambia which was established under an Act of Parliament Cap 416 of 1994. It is charged with the responsibility for the preparation of Zambian standards, quality control, quality assurance, import and export, quality inspection, certification, and removal of technical barriers to trade (Republic of Zambia, 2019; Lanfranconi, 2018).

Environmental Council of Zambia

This institution was established under the environmental protection and pollution control Act Of 1990, cap 204 of the laws of Zambia. The environmental council of Zambia works in conjunction with the Energy Regulation Board in formulating measures aimed at minimizing the impact on the environment of the production and of electricity (Lanfranconi, 2018).

Zambezi River Authority (ZRA)

The operation and maintenance of the Kariba dam complex, as well as the investigation and development of new hydro sites on the Zambezi River, is handled by the Zambezi River Authority. This institution is co-owned by Zambia and Zimbabwe. In addition to this, the authority analyses and disseminates hydrological and environmental information pertaining to the Zambezi River and Lake Kariba (Republic of Zambia, 2019).

Zambia Competition Commission (ZCC).

It was established by the competition and fair trading Act. This institution also works hand in hand with the ERB in investigating and monitoring the levels and structure of competition within the energy sector and develops appropriate rules to promote competition (USAID, 2008).

Industrial Development Corporation (IDC)

According to Phiri and Ziba (2019), the industrial Development Corporation is the most recent addition to the institutions framework which plays a twofold role as an investor in the Electricity Supply Industry (ESI) and a stakeholder in ZESCO. This institution is an investment company wholly owned by the Zambian government and was incorporated in the early 2014. The mandate of the IDC is to play a catalytic role in Zambia's industrialization through the promotion of job creation and domestic wealth formation in key sectors. Lanfranconi (2019) states that the IDC facilitates provision and raising of long term finance for industrial projects. In addition to this the IDC plays its role through evaluation, pricing and lowering the investment profile by serving as co-investor alongside private investors. (Republic of Zambia, 2019).

1.6 Legal Framework

According to the NEP (2019) the energy sector is currently governed by four major statutes namely, the Energy Regulation Act, the Electricity Act, the Petroleum Act and the Rural Electrification Act.

Energy Regulation Act

The Energy Regulation Act of 1995 Cap 436, which was amended in 2003, is responsible for the establishment of the Energy Regulation Board (ERB) as the regulator of the energy sector in Zambia. It also defines the powers and functions of ERB. By this Act the ERB is expected to perform its function in a fair, transparent, efficient and effective way to safeguard the interest of all stake holders. The Act also entrusts the ERB with the responsibility of establishing fuel prices (including electricity tariffs), establishing and monitoring application of the Zambia Grid Code, and designing standards with regard to the quality, safety and reliability of supply of energy in conjunction with the Zambia Bureau of Standards. (IRENA, 2013). In addition, the ERB also receives and investigates complaints, approves location and construction of energy infrastructure, develops guidelines and other regulatory interventions (NEP, 2019). The Energy Regulation Act was, however, amended in 2003 with the main purpose of strengthening the board in its operations (Republic of Zambia, 2019).

It is however, important to note that the legal framework does not adequately enable the effective regulation of the sector because it is unable to balance the interest of the consumers and the licensees, thereby failing to offer adequate protection to consumers. In addition, there is no provision in the legal framework for the board to create a holistic energy fund to enable it to respond to current issues (NEP, 2019). The National Energy policy document further highlights that the ERB licensing functions significantly rely on prior regulatory approvals from other statutory bodies and agencies such as Water Resource Management Authority (WARMA), National Heritage Conservation Commission (NHCC), Zambia Environmental Management Agency (ZEMA), Zambia Development Agency (ZDA), and department of land.

In 2019 the Energy Regulation Act was amended to bring into effect the Energy Regulation Act of 2019. The main objectives of this Act are to provide for licensing of enterprises in the energy sector, to continue the existence of the Energy Regulation Board and redefine its

functions and repeal and replace the Energy Regulation Act of 1995 among others (Energy Regulation Bill, 2019)

Electricity Amendment Act (2003)

The Electricity Act provides for the regulation of generation, transmission distribution and supply of electricity and to provide for matters connected with or incidental to the foregoing (NEP, 2019). This Act liberalized the electricity sector by opening up all three segments to private operators. In line with the spirit of liberalization which sought to attract more private sector participation, the Act was amended in 2003 (Republic of Zambia, 2019).

On the 27th December, 2019 the Electricity Act Number 2 of 2019 was passed to regulate the generation, transmission, distribution and supply of electricity so as to enhance the security and reliability of the supply of electricity, to provide for the sale and purchase of electricity within and outside Zambia. The act also seeks to facilitate the achievement of efficient, effective, sustainable development and operation of electricity infrastructure. It further provides for the roles and responsibilities of various participants in the electricity sector and facilitate adequate level of investment in the electricity sector (Electricity Act, No. II, 2019).

Rural Electrification Act (2003).

This Act established the Rural Electrification Authority (REA) whose primary role is to provide electricity to rural areas of Zambia. The REA, is therefore, anticipated to accelerate electricity access in rural areas which currently stands at 4.4 percent. The 2003 Act also empowered REA to manage the Rural Electrification Fund and to provide for matters connected with or incidental to the foregoing (Republic of Zambia, 2019). “The REA is responsible for the implementation of the Rural Electrification Master Plan (REMP) by facilitating the creation and monitoring of rural electrification organizations or companies” (IRENA, 2013:27).

1.7 Other policy and regulatory frameworks

The power system development master plan (PSDMP)

In an effort to effectively implement the 2008 National Energy Policy, the government of the Republic of Zambia developed the power system development master plan (Republic of Zambia, 2010). The main objective of this plan is to provide a blue print for the power system in the country up to the year 2030 (NEP, 2019). The plan highlights least cost expansion

options for generation, transmission and distribution in the country. According to the Republic of Zambia (2019) the plan has also prioritized generation projects which when developed would add a total of 4,337 Megawatts to the national grid by 2030.

Zambia Electricity Grid Code (ZEGC) SI No. 79 2013.

“The grid code establishes technical requirements for the connection and use of the electrical transmission system by parties other than the owning electricity utility in a manner that will ensure reliable, efficient, economic, secure and safe operation” (Republic of Zambia, 2019:16). The grid seeks to ensure that investments are made within the requirements of the code and provide access on agreed standard terms to all parties wishing to connect to or use the transmission system. Furthermore, it applies the principle of non-discrimination through the provision of consistent and transparent criteria and procedure. (Republic of Zambia, 2019).

Zambia distribution code (2016)

This code is designed to provide clear procedure for both planning and operational purposes to ensure efficient development, operation and maintenance of a coordinated and economic system. It also seeks to promote grid integration of renewable energy technologies. According to the Republic of Zambia (2019) “the grid code also seeks to avoid undue discrimination between distribution Network Service Providers (DNSPs) and other categories of participants” (Republic of Zambia, 2019:16).

REFIT Strategy (2017)

The REFIT strategy aims at harnessing the renewable energy sector’s potential to drive economic growth and improve the quality of life of all Zambians. In order to achieve this goal, this strategy focuses on the promotion of small and medium sized renewable energy projects of up to 20MW, quick deployment of private investment for small and medium sized renewable energy projects and ensuring cost effective tariffs through transparency and competition in the sector (Republic of Zambia, 2017). Generally, diversification of the power sector by adding a portfolio of small and medium renewable energy projects in the short term is the anticipated result of this strategy.

1.8 impact of power outages on high density areas

This section gives a general picture of how power outages affect the high density areas of Lusaka district. This is important because to evaluate the efforts put in place by ZESCO to reduce power outages and their impacts in Lusaka's high density areas, requires a basic understanding and appreciation of how these areas have been affected by power outages. Discussed hereunder are some of the impact of power outages in Lusaka's high density areas.

According to ZIPAR (2015) power outages affect the use of electrical appliances like radios, television, and fridges, as these rely on electricity in order to work. Hence not being able to use these electrical appliances is unbearable and seen as a serious effect of power outages in high density areas. Perishable food stuffs such as meat, fish and dressed chickens, among others, usually get spoiled in the fridges of many people due to prolonged power outages. Households not only face the cost of perishable foods which cannot be preserved but also lose leisure time. For instance, people are not able to listen to the news or watch their favorite television programme due to the prolonged power outages which usually last for 12 hours per day Wamuwi et'al, (2019).

Power outages are also said to contribute to the increase in crime in society. These include stealing, fighting, robbery, rape cases, murder which frequently happen in many communities experiencing prolonged outages especially at night. These crimes make people to live in fear, especially that some residents get beaten by the junky (thugs). Amad (2015) also strengthened this argument by revealing that power outages heightened criminality and insecurity among households. Many people take advantage of the blackout to do all kinds of criminal activities thereby making the residents feel insecure especially at night.

While some users turn on their backup generators during the time of power outages, others delay all electricity intensive activities until power is returned. Phiri (2017) echoed similar sentiments when he stated that very few business people resorted to using alternative energy sources, and employed measures to mitigate the effects of load shedding or power outages.

Lack of water in high density areas is connected to power outages as the water providers depend on power supply to pump water to these communities in high density areas. In addition, Wamuwi et'al (2019) noted that due to power outages which affect communities, women and other family members ferried water from other alternative sources. This adds to labor burden of women and a re-allocation of chores. It also leads to fatigue among women

and children. What this means generally is that power outages affected the social way of life of the people in the community.

Power outage also leads to the disruption of business operations and this result into loss of turn over or profits. Business entities are negatively impacted in terms of output, productivity, operation costs, revenues and business goodwill. This eventually translates into reduced revenue collection for the government. For small enterprises soft drinks and beer do not sale as much they are supposed to due to frequent power cuts. In addition, customers reduce the purchase of some products such as meat and other perishables due to frequent power outages.

Due to frequent power outages, some establishments experience idle labor while others incur over time labor costs. According to Mwila et'al (2017) the cost arising from labor was defined as the amount of money paid to a worker otherwise not working due to power outages. On the other hand, over time labor cost was defined as the amount of money paid to a worker for extra hours worked after load shedding. What this means is that power outages increase the cost of doing business as business entrepreneurs have to spend more money on labor costs as compared to the time when there are reduced power cuts. Meanwhile, some enterprises resort to closing their businesses due to lack of money to acquire alternative sources of energy. Amad et' al (2017) echoed similar sentiments when he revealed that power outages increased the cost of running generators to more than USD 0.25/kwh. Consequently, smaller enterprises are forced to close due to the cost associated with using generators or lack of money to use other alternative sources of energy such as solar.

Firms also incur the cost of raw materials that go to waste and damage to equipment resulting from sudden power outages. In the long run workers deemed redundant will be laid off if firms cannot operate at their optimum capacity. This increases the number of citizens deprived of income to acquire basic needs and increase the poverty levels in the country. Further, firms stand to lose credibility and potentially business obligations (ZIPAR, 2015).

Power outages increase the cost of living for the people as they have to buy charcoal and candles which increasingly become expensive due to their high demand. This entails that power outages affect the economy at household level because people are deprived of income as they have to channel their little resources on other items which were not planned for. In addition to this, the increasing use of charcoal as a source of energy for cooking has an environmental impact as it increases the rate of deforestation in Zambia and consequently, leads to climate change (ZIPAR, 2015).

Ayesha (2016) further argues that frequent interruption in electricity supply due to outages can have negative impacts on the extent to which individuals and businesses can utilize their resources. To those residents who are entrepreneurs, power outages result in small businesses like barbershops and salons, particularly those which cannot afford to use alternative sources of energy like solar to lose customers who are forced to travel to areas which are not affected by lack of power. These small businesses are forced to close earlier than expected. This eventually led to loss of not only profits but their only source of income.

Phiri (2017) also made similar observations when he stated that power rationing which was started by ZESCO had impacted negatively on firm's productivity and profitability. Though his focus was on large firms, it is obvious that small businesses can be adversely affected by power outages. These small businesses are unable to use alternative energy sources, and a large number of them do not employ measures in order to mitigate the effects of power outages (Phiri, 2017). Further, Davie (2013) highlights that power outages stifle income generating activities and hamper the provision of basic services such as health care and education

In terms of education, power outages affect the school going children, as they cannot manage to study, especially during the night. This too impact negatively on the performance of pupils and students in their education. The United Nations Department of Economic and Social Affairs (UNDESA, 2014) highlighted the following benefits of having reliable power supply: (1) lighting and extended hours of studying (2) facilitation of ICT in the classroom (3) enhanced staff retention and teacher training (4) better school performance based on attendance, completion rates, test scores and (5) co-benefits such as improved sanitation and health, gender empowerment, and community resilience. This means that the absence of reliable power supply impacts negatively on these gains in the education sector.

Similarly, in the health sector Power outages affect the smooth delivery of services. Access to the clinic during night time is usually a challenge especially for expectant mothers who in some cases are requested to come with their own lighting system such as candles. Further, clinics and hospitals often s rely on electricity in a number of ways. For instance, patients with chronic health conditions rely on power dependent durable equipment such as ventilators, oxygen machines, x-ray machines, scanners among others. The absence of reliable power supply in these health facilities reduce the chances of survival for such patients to a great extent. In addition, a health care facility building also relies on electricity for many

operations. These include lighting, security systems, fire alarms and environmental controls like air conditioning. In addition, with the advent of information and communication technology (ICT) in Zambia, a lot of institutions including health facilities are embracing the use of ICT. However, power outages affect the electronic health records and an array of electricity dependent durable medical equipment and devices to provide care (FEMA, 2019),

1.9 Statement of the problem

Despite Zambia having an estimated hydro potential of over 6,000MW and holds up to 40% of the water supply of the Southern African Development community (SADC), 70% of its hydro generation capacity has not yet been exploited (Malama et al, 2015; Phiri, 2017). According to the Central Statistical Office (2015), only 4.4% in rural areas have access to electricity compared with 67.3 percent in urban areas. The national access to electricity stands at about 31 percent of the population in Zambia, leaving the majority to depend on wood fuel and other traditional sources for their household energy (Republic of Zambia, 2017). The few who have access to electricity have been subjected to load shedding and notorious power outages for at least 8 hours due to the low water levels at the main reservoir for hydroelectricity (Owen, 2016; smith, 2016).

According to smith (2015) load shedding was initially imposed on households, business and industry, excluding the mines. However, in July, 2015, a decision was made to reduce power supply to the mines by 30% and since then the mining companies were asked to operate restricted power allocations, being offered additional power at higher cost, and had their compliance monitored by ZESCO (Smith, 2015).

While the challenge of load shedding is a cross cutting issue affecting almost all key sectors of the economy such as mining, agriculture, manufacturing industries and business enterprises throughout the country, it greatly affected households, especially those in the high density areas of Lusaka District. This is because it does not seem to be organized as power is switched off by the power utility company without a time table developed and communicated to stakeholders. In situations where the schedule is developed, it is not followed consistently thereby making it very difficult for consumers to plan their activities. A manifestation of this problem can also be seen in the large number of reports in the popular press of high incidence of load shedding. Organized groups in society such as the Chamber of Commerce and Industry and Industrial Association have also staged protests and complaints that load shedding has reduced the level of productivity in industries. Though attempts have been made

by ZESCO to improve its operations in the provision of electricity, it however seems that this has not been achieved particularly with regard to individual households in high density areas as they experience power cuts, sometimes without notice (Chisanga, 2016). This raises some questions about whether the measures (efforts) put in place by the power utility company (ZESCO) to reduce power outages are sufficient. This study therefore, seeks to evaluate the measures (efforts) put in place by ZESCO to reduce power outages and what their impacts are in Lusaka's high density areas.

1.9.1 Research objectives

1.9.2 General objective

To evaluate the efforts by ZESCO to reduce power outages and their impact in Lusaka's high density areas.

1.9.3 Specific objectives

1. To evaluate the efforts by ZESCO to reduce power outages in Lusaka's high density areas.
2. To interrogate the impact of the efforts by ZESCO to reduce power outages in Lusaka's high density areas.
3. To make recommendations on how the supply of electricity can be improved in high density areas of Lusaka city.

1.9.4 Research questions

1. What is ZESCO doing to reduce power outages in Lusaka's high density areas?
2. What legislation and institutional framework are in place to ensure electricity is available to consumers?
3. What is the impact of ZESCO'S efforts to reduce power outages in Lusaka's high density areas?

1.9.5 Rationale of the study

The rationale of this study is that it will provide evidence based information on the effort and impact by ZESCO in reducing power outages in Lusaka's high density areas. Energy has been chosen because of the following reasons: first, it is an important input in the production process. Secondly, it is cross cutting in nature as "critical social and economic services like

health and education, transport and commerce cannot be efficiently and effectively provided in the absence of reliable and affordable energy services” (NEP, 2008). Thirdly, energy access largely affects the ability of a country to meet its wider development objectives and fourth, Economic growth is synonymous with energy access (Kaunda, Morel and Mtawali, 2013). On the other hand, electricity has been chosen because it is the second most important energy source in Zambia after wood fuel (Republic of Zambia, 2014). Its reliable supply to the people has positive consequences on their living conditions, their health and ability to engage in productive activity which may lead to poverty reduction. Electricity, therefore, makes life worthwhile in a modern society such that its increased consumption now symbolizes high economic status of a country (Amad, 2015). More importantly, the provision of reliable electricity supply is critical to promoting industrialization and the sustainable growth of any economy (Phiri and Ziba, 2018). Among the people that will benefit from the information that will be generated by this research include the policy makers, civil society organizations, non-governmental organizations, members of the public and researchers.

The policy makers will benefit from the information that will be generated by this research in that it will be based on facts and this can be used to improve the quality of policy decisions. The civil society organizations and non-governmental organizations will use the information to influence government to come up with policies that will ensure the greatest good for the greatest number of people in the country. Additionally, they will use this information to supplement effort of the government on how to improve the supply of electricity, particularly in high density areas in Lusaka District. The members of the public will find this information educative, as it will highlight on the efforts and the impact of ZESCO’s measures intended to better their livelihood through reliable supply of electricity. The researchers, on the other hand, will find the information generated by this study educative in order to identify areas on which future research should focus to contribute to the body of existing knowledge.

1.9.6 Conceptual definitions

In this proposed study, the concepts and terminologies that appeared frequently are the following: effort, impact, Electricity generation, Electricity Transmission, power outages and high density areas. The meanings of these concepts in the context of this study is as follows:

Effort: effort can be defined as the amount of physical or mental energy that is needed to do something (Hornby, 2010). Effort also refers to an attempt to do something, especially when

it is difficult to do. In the context of this study, these attempts refer to the measures, actions and programmes that are undertaken to make the implementation of the policy, programme or project possible. Particular attention would be on what has been done and is being done by ZESCO to deal with the problem of power deficit which consequently leads to power outages in Lusaka's high density areas.

Impact: refers to the results, change, or effect caused by either internal or external forces on something (Hornby, 2010). In this study impact refer to the results that are produced due to the actions undertaken to achieve some stated goals.

Electricity generation: The meaning of Electricity generation as used in this study refers to the production of electricity using different technologies such as coal, solar, biomass and wind and especially hydro.

Electricity transmission: In this study Electricity transmission refers to the process by which large amounts of electricity produced are transported over long distances for eventual use by customers.

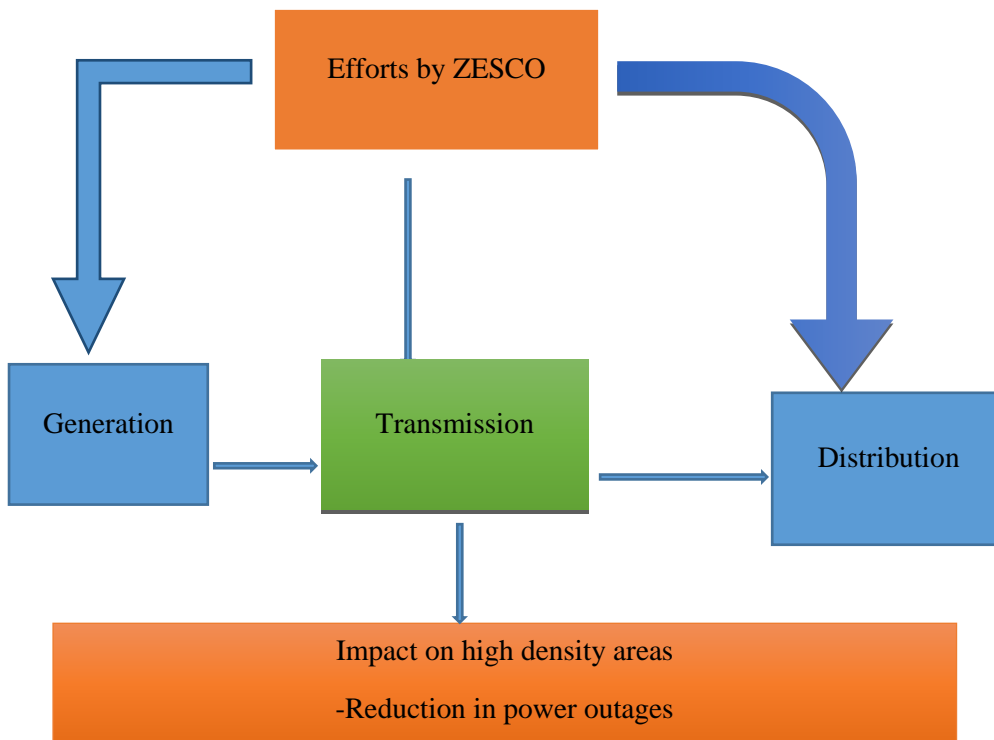
Electricity: electricity can be defined as a form of energy used in the application of heat, light and power. According to Kaunda, Morel and Mtawali (2013:6) "electricity is the flow of electrical energy through conductive material.". In the context of this study electricity refers to the electrical power produced by hydro.

High density area: In the context of this study, high density areas refer to legally and recognized planned areas with a lot of people residing in them. The residents living in these areas often lack adequate and affordable basic services such as water supply, solid waste collection and sewerage services, as well as other services such as street lighting and roads (Renaud, 1981).

Power outages: In this study Power outages refers to the state of complete absence of electricity at the consumer's end. These power outages come in many different forms but they can generally be categorized into either planned or unplanned (Amad, 2015). Sudden equipment failure, unanticipated faults and burnouts for example, are unplanned and result in continuous blackout, lasting many hours and sometimes days. In contrast, according to Gertler, Lee and Mobarak, (2017) load shedding incidents, are planned and occur somewhat predictably, with power being available a few hours each day. Planned outages also differ in terms of whether they are communicated to consumers in advance.

1.9.7 Conceptual framework

Figure.1



Source: Author

The conceptual framework is based on the process of electricity delivery. Electricity delivery to the consumers involve three stages: Generation, transmission and distribution. The Zambia Electricity Supply Corporation (ZESCO) is the power utility company that is charged with the responsibility of Generating, transmitting and distributing power in Zambia (Owen, 2016). To deal with power outages the power utility company puts up various measures such as building of more power stations in order increase the generation of power using different technologies such as coal, solar, biomass, wind and especially hydro among others. Stake holders such as independent power producers are also engaged to produce power which is sold to ZESCO in bulk under the Bulk Purchase Agreement.

After electricity is generated by ZESCO it is transmitted over long distances using transmission lines. These lines are constructed between transmission substations located at the electric generating stations. Transmission lines may be supported overhead on towers or may be underground. They are operated at high voltages and usually send out large amount of electric power and extend over considerable distances. When electricity comes out of the generating station, the transmission substation located there step up (increase) the voltage

while within the operating area, transmission substations reduce (step down) the transmitted voltage. This power is then carried through lines to distribution systems located in the local service territory (Phiri and Ziba, 2018). The distribution system connects the transmission system to the customers for domestic or industrial usage. All these are part of the effort on the part of the power utility company to ensure that load shedding or power cuts experienced by high density areas is reduced to the minimum. The impact of these efforts which is reduced load shedding or power cuts are felt by the consumers in their various localities such as high density areas.

1.9.8 Structure of the dissertation

This dissertation is divided into seven chapters. Chapter one is the background of the study. It presents the introduction of the research, historic evolution of the power sector in Zambia, overview of the Electricity Supply Industry of Zambia, governance and administration of the energy sector in Zambia, statement of the problem, the general and specific objectives, the research questions, the significance of the study and conceptual framework. Chapter two is the literature review and it presents literature on the concepts of effort by the power utility companies and energy institutions to reduce power outages. The literature reviewed was from Zambia, Africa, developing countries outside Africa and developed countries. Chapter three presents the methodology that was used in this research. In particular, the chapter presents the type of research, location of the research, research design, sources of data, sample size, sampling methods, methods of data collection, reliability of data, validity of data, methods of data analysis, research ethics applied and limitation of the research. Chapter four investigates the effort by ZESCO to reduce power outages in high density areas. The content of this chapter includes specific effort to reduce power outages, efforts by engaging various stake holder to reduce power outages, efforts to reduce dependence on hydro power sources, steps taken to diversify energy generation by investing in alternative sources of energy, ZESCO'S development plans in the segment of generation, transmission and distribution, awareness of resident about what ZESCO is doing to reduce power outages, ZESCO'S response to customer complaints, substations or transformers installed by ZESCO and the methods used by ZESCO to notify residents about the impending power outages. Chapter five interrogates the impact of the efforts by ZESCO to reduce power outages in Lusaka's high density areas. It specifically looks at the impact of the efforts by ZESCO to reduce power outages on the social and economic life of the people of Kanyama and Mtendere areas. It also analyses the impact of the efforts by ZESCO to reduce power outages on the education and health sector

in both Kanyama and Mtendere high density areas. The sixth Chapter gives the conclusion and recommendation. This chapter gives the overall conclusion and makes policy recommendations and areas in which future research should be focused.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The purpose of this section is to review literature on the concepts of issues relating to effort of measures taken by power utilities and energy institutions to reduce power outages and their impact on beneficiaries. It will begin by reviewing literature on Zambia, selected African countries, developing countries and the developed countries. After this a conclusion will be made to derive some important lessons learnt from the literature.

2.2. Literature on Issues relating to effort

2.2.1 Literature on Zambia

Mukumba and Mukuka (2016) carried out a study titled *the energy crisis and its impact on the economy*, the purpose of the paper was to provide a brief analysis of the current energy situation in Zambia, and sought to address the information asymmetry that exist between the public and the government on the causes of the energy crisis, its impact on the economy, and the measures that the government is currently taking to alleviate the situation. The study concluded that future efforts need to focus on growing and diversifying generation capacity to keep pace with Zambia's economic growth. A solution to the crisis requires both steps to mitigate immediate effects and longer term policies to tackle the fundamental vulnerability of the country's power sector. It also concluded that the success of both sets of actions fundamentally hinge on implementing a tariff strategy that seeks to both incentivize investment as well as maintain access and affordability of electricity to consumers. This is essential to limit pressures on public finances, attract greater public investment in the sector so that the 6,000 MW unexploited hydro power potential can be exploited by giving them more incentives to invest in the sector. Equally importantly, the government has to ensure that all measures taken to alleviate the energy crises translate into accessible and available electricity for consumers. In the long term, alleviating the power crisis will require continuously growing capacity, diversifying energy generation and better management of water resources and providing incentives to encourage Independent Power Producers. The government should also seek to unbundle, however, implementing these measures may necessitate fundamental restructuring of the sector aimed at improving planning, procurement, financial sustainability and encouraging participation by the private sector.

Lastly, there is also need to increase accountability for spending, budgeting implementation and performance. Doing so will result in ensuring that the measures that are being taken to address the current energy crisis result in tangible results for both the ordinary citizens in Zambia as well as the industries which serves as the backbone of the Zambian economy.

This study by Mukumba and Mukuka (2016) is relevant to this research in that it teaches us among others the following things: (1) growing the energy generation capacity (2) water management and (3) diversifying of the generation capacity are some of the key measures that would help to alleviate the energy crisis in Zambia and ensure sustainable growth of the economy. However, for this to be effective, it requires a proper tariff strategy that is more cost reflective in order to attract private sector investment such as Independent Power Producers (IPPs) who would supplement the public power utility company's efforts to increase power generation to deal with the power crisis that Zambia is currently facing. In addition, the study emphasised that accessibility and availability of electricity for citizens are the intended outcome of the measures being taken by government. The study also demonstrates that unbundling the power utility company through administrative reform strategy such as restructuring aimed at improving planning, procurement and financial sustainability is an important measure which if implemented would help deal with the power crisis in Zambia. Further, we learn from this study that for tangible results to be felt by both the ordinary citizens and industries, accountability for spending, budget implementation and performance are very key. The major weakness of this paper by Mukumba and Mukuka (2016) is that it only concentrated on the causes of the energy crisis and its impact on the economy. The impact of the efforts by ZESCO on the beneficiaries were not highlighted by this study and this is the gap that will be filled by this study.

Machungwa (2005) *presented a paper entitled parliamentary reform on energy legislation and sustainable development in Zambia*. This paper was presented in cape town, South Africa and it focused on Zambia, s experience with power sector reform particularly, electricity. This paper concluded that the need and importance of energy sector reform in Zambia and indeed most developing countries in Africa was not debatable. Though several positive outcomes had been observed, there were so many serious problems that needed to be tackled. It further concluded that it was possible to re-orient the process to take into account factors that needed addressing to ensure energy sector reform benefit the developing country, its people and the investors. For that to happen, all key stakeholders including the international financing institution, private sector companies and government would have to cooperatively

renegotiate equal and fair terms. This would entail establishing, in the initial stages, forums for discussions where all could present their needs and problems, with the joint aim of designing a cooperative strategy on how to address sustainable development objectives that benefit all stakeholders.

This paper by Machungwa is relevant in that it recognizes the important role that policy reforms play in improving the electricity sector in Zambia, especially in dealing with the challenge of power outages. In addition, the paper highlighted that policy reforms should benefit developing countries, its people and the investors. The paper also recognized the need for interaction of different stake holders such as government, international financing institutions and the private sector in order to address the problem of energy and also maximize the benefits for all of them. However, the major weakness of Machungwa's (2005) paper is that it was done two decades ago. A lot of changes have taken place in the energy sector particularly, electricity. This study will therefore, fill this gap by highlighting on the efforts by ZESCO to reduce power outages and their impact in Lusaka's high density areas.

Phiri and Ziba (2018) in their working paper titled *Investment Challenges in Zambia's Electricity Supply Industry*, highlighted the barriers to entry in the Electricity Supply Industry (ESI) and the factors limiting competition. Drawing on secondary sources, the study found that at the very start, limited access to finance for energy projects potentially prevents the commencement of energy projects. Exacerbating the entry barriers are the below cost electricity tariffs, the monopoly power held by ZESCO and its vertical integration and an inadequate regulatory framework to promote competition and prevent undue political interference. They further stated that these finding justify the unbundling of ZESCO and the provision of legal reforms that support policy consistency, multi-year tariff adjustments and open and non-discriminatory access to the transmission and distribution grid.

This study by Phiri and Ziba (2018) teaches us that there are several factors that hinder the private sector's effort to participate in the ESI in Zambia in order contribute to the reduction of power outages. These include lack of access to finance, monopoly of the electricity sector by ZESCO, below cost reflective tariffs, inadequate regulatory framework among others. What this means is that if mechanisms are devised for the private sector to access finances, it would allow for energy projects to start and complete on time. This however, needs to be accompanied with Policy reforms to promote competition and prevent political interference. In addition, the monopoly of Zambia's electricity sector by ZESCO, particularly in electricity

transmission and distribution hinders the entry of private sector players who may bring about competition which is very important in bringing about efficiency and effectiveness in the sector. The implementation of the electricity cost reflective tariff is also key if the sector is to attract investors. Lastly, the study is relevant because the highlighted barriers to entry in the Electricity Supply Industry were used by this researcher to seek for answers from the relevant officials on what they are doing to ensure these barriers to entry in the ESI were addressed. However, the limitation of this study is that it relied upon secondary data only. This research however, will in addition to secondary data, collect primary data in order to get first-hand information from the key informants on the efforts by ZESCO to reduce power outages and their impacts in Lusaka's high density areas.

In their study *entitled review of renewable energy technologies in Zambian households: Capacities and barriers affecting successful deployment*, Mudenda, Makashini, Malama and Abanda (2018) reviewed the requisite capacities for households for the adoption of renewable energy services and expounded on some of the barriers hampering the widespread deployment of renewable energy among households. Desk research approach was used to analyze the capacities which should be possessed by Zambian households and possible barriers constraining the widespread deployment of renewable energy technologies. The findings revealed that there was a need for broader, multidimensional understanding of access to renewable energy in order for deployment to be effective. The requisite capacities for the acquisition of renewable energy by households include access, range of energy service levels, dependability and quality, affordability and usability. Barriers to successful adoption of clean energy technologies include underserved populations, policy inadequacies, an underexploited renewable energy sector and a heavy reliance on a service-challenged hydropower utility. Since most of the aforementioned challenges were institutional in nature, the paper concluded with recommendation of a baseline assessment to understand knowledge, perception, attitudes and drivers for renewable energy technology adoption among households.

This study by Mudenda et al (2017) is relevant to this research as it emphasized the need to have a broader and multidimensional understanding of access to renewable energy in order for deployment to be effective. This is very key because the adoption of renewable energy technologies can be constrained by several factors ranging from the lack of understanding on how to access and deploy this form of energy. The study is also relevant as it highlighted on some of the requisite capacities that households should have for the acquisition of renewable energy. These include access, which is the households' ability to acquire cleaner energy

carrier. The user should also have a wide range of renewable energy technologies available for use in a given locality. Availability mode ought to have a certain level of reliability in order to guarantee sustainable use from the households' point of view. Others include affordability and usability.

On the other hand, we also learn from this study that the adoption of renewable technologies is faced with several barriers such as underserved population, inadequate policies, unexploited renewable energy sector and heavy reliance on hydro power at the expense of other forms of renewable energy. These barriers were useful to this researcher in developing the data collection instrument that was asking appropriate questions into the efforts that ZESCO was making to reduce power outages and their impact in Lusaka's high density areas. The limitation of the research however, is that it did not reveal the sample size of the study and relied mostly on secondary data. To make this study reliable both primary and secondary data would be collected and the sample size would be revealed.

2.2.2 Literature on Africa

Eberhard, Gratwick, Morella and Antmann (2016) carried out a study titled *independent power projects in sub-Saharan Africa: Lessons from five key countries*. The objective of the study was to evaluate the experience of independent power producers (IPPs) and to identify lessons that can help African countries acquire more and better private investment. At the core of this analysis was a reflection on whether IPPs have benefited sub-Saharan Africa and how such transactions might be improved. The analysis was based primarily on in-depth case studies carried out in five countries; Kenya, Nigeria, South Africa, Tanzania and Uganda that have the most extensive experience with IPPs. The study concluded that investment in Africa's power sector IPPs was growing, but not so fast enough. The region does not have sufficient power. All sources of investment need to be encouraged. For IPPs to flourish, the countries of sub-Saharan Africa need dynamic, least-cost planning, linked to the timely initiation of competitive procurement of new generation capacity. This must be accompanied by building an effective regulatory capacity that encourages the distribution utilities that purchase power to improve their performance and prospects for financial sustainability and to widen access to electricity. Such efforts promise social and economic development across the region.

The relevance of this study by Eberhard et al (2016) is that it recognizes the fact that sub-Saharan Africa does not have adequate power and therefore, needs to encourage a wide

variety of investments. One such investment is by attracting the independent power producers (IPPs) to invest in alternative sources of energy. These IPPs are very important in that they supplement government effort in the production of power in the country which is necessary to deal with the power outages and deficit. However, for these IPPs to work, they require sound planning which means countries must be able to project future electricity demand correctly, decide on the best supply or demand management option, as well as anticipate how long it would take to procure, finance and build the required generation.

Further, it emphasized on building an effective regulatory capacity in order to improve performance of the electricity sector. The regulator must be independent and endowed with competent and sufficient human resource whose quality of regulation should not be compromised. This study by Eberhard et al (2016) also gives an insight into the efforts that government should make to improve electricity in the country. However, the impact of these efforts were not highlighted. The study can be criticized for being too broad as it involved five countries. This study will narrow itself to one country (Zambia) where the impact of the efforts by ZESCO to reduce power outages in high density areas will be highlighted.

Kumi (2017) carried out a study titled, *Electricity situation in Ghana: Challenges and Opportunities*. The study concluded that Ghana has been committed to providing universal access to electricity by the year 2020. This has been seen through the establishment of the National Electrification Scheme, in which programmes such as the SHEP has extended electricity to about 82.5 percent of the population of Ghana as of the end of 2016. This pace of electrification, however, cannot guarantee the country universal access to electricity by the year 2020 unless the average electrification rate is increased from 2.6 percent to 4.4 percent. The study further concluded that the electricity sector in Ghana had been plagued with severe power supply challenges, characterized persistent load shedding over the last decade.

These challenges were not a result of lack of installed generation capacity since the total installed generation is far above the peak power demand for the country. The challenges can however, be attributed to unavailability of adequate generation capacity due to fuel supply challenges, inefficient distribution system leading to high distribution losses and loss of revenue resulting from non-payment of bills as well as poor tariff structure, making it difficult for electricity utility companies to recover their investment in the sector. The efforts aimed at addressing some of these challenges include the MCC Compact II which seeks to provide financing for the enhancement of the grid infrastructure to mitigate some of the

distribution losses and also provide technical as well as managerial capacity to the country's distribution companies. The government is also developing the other gas resource from the country's oil fields to provide stability in the supply of natural gas to the nation's thermal generation facilities. There have also been proposals to establish an LNG regasification unit to augment local gas supply.

This study by Kumi (2017) teaches us that load shedding, lack of adequate generating capacity due to fuel supply challenges, inefficient distribution system leading to high distribution loss and loss of revenue can have severe effects in the electricity supply industry of a country. In addition, the tariff system needs to be designed in such a way that it is able to help in recovering the costs expended in the generation of electricity in order to avoid running in losses. The study also highlights the importance of financing aimed at strengthening the grid infrastructure in order to avoid some of the distribution losses. The role of capacity building of those in charge of running distribution companies is also something worth noting from this study. The major weakness of this study however, is that first it did not reveal the methodology that was used to collect data and also the sample size. Secondly, the impact of the efforts being undertaken in Ghana were not highlighted and this is the gap that will be filled by this study.

Another study was carried out by Morlot, parks, Ogunleye and Anyeni (2019) titled *Achieving a clean energy access in sub-Saharan Africa*. The study took an in-depth look at the challenges and opportunities to provide clean energy access in sub Saharan Africa. The revelations of this study were that packages of policies were needed to promote clean energy access, including electricity for productive uses, full of technical solutions, notable off grid and mini grid renewable, energy efficiency, as well as clean cooking. Innovative financing and improved private sector governance are essential ingredients to make markets work. Delivering on this golden opportunity for development requires not just more money but policy attention and massive political effort from both domestic and international actors.

The study by Morlot et al (2019) is relevant as it shows that successful tackling of energy access needs to be part of an essential package of policies promoting both access and clean energy solutions (renewable, energy efficiency and clean cooking), innovative financing as well as improved public sector financing. Furthermore, the political effort from both the government and international actors is very important in the attainment of clean energy access. This is because without commitment from government and stakeholders, in including

energy access and its financing in the development agenda, no positive results can be scored. The limitation of this research however, is that it mainly focused on Nigeria, a large country with over 200,000,000 people, governed by the federal system and therefore its findings cannot be generalized to other countries such as Zambia, a small country with about 18,000,000 people governed by a unitary system. The study also did not highlight on the impact of the various efforts to reduce power outages in Nigeria.

Insights can also be drawn from the study by Eberhard, Dyson, Olao and Godinho (2019) *entitled revisiting reforms in the power sector in Africa*. The study reviewed African experience in power sector reforms, to offer learning and inputs for designing policies, programs and regulatory frameworks to adapt to this new era. The research relied on local answers and perspectives gathered through 30 extensive questionnaires from utility professionals in Association of Power Utilities of Africa (APUAs) experts. The study revealed that power utilities in Africa still largely retain the traditional integrated monopoly utility structure, although many have included independent power producers (IPP). Only 12 out of 43 countries included in the study had partially or completely unbundled the sector. It also revealed that 33 out of 42 countries in the study have established an electricity regulator. They further stated that electricity access remains a sticky challenge for most African countries; especially in sub-Saharan Africa where 645 million people still lack an electricity connection. Mini grids and off grid electricity supply models, especially those that harness small modular renewable generation technologies are increasingly attractive and cost competitive for remote communities since half of the respondents (in all sub-Saharan Africa) reported the existence of a mini grid industry in the country. *Ongoing* effort for regional electricity interconnection remains an important tool for supporting optimal system performance.

This study teaches us that some African countries that have an integrated monopoly utility structure need to restructure and unbundle the electricity sector. The generation, transmission and distribution of electricity should not be monopolized but instead other private players should be allowed to participate in this process in order to bring about efficiency and effectiveness in the electricity sector. Where electricity connection is concerned, a lot of effort is needed to ensure the majority of the people have access to electricity. However, despite the highlighted shortcoming, the study is also relevant in that it shows some of the efforts that African countries particularly, in sub-Saharan Africa, are making in order to increase access to electricity. The limitation of this study however, is that it did not bring out the

impact of the efforts being made by these African countries. Further the study was too broad as it investigated a lot of countries. This study will however, be an in-depth study of one country (Zambia).

2.2.3 Literature on developing countries outside Africa

A study was conducted by Shaalan (2017) titled, *investigating practical measures to reduce power outages and energy curtailments*. It explored from the consumer's perspective the adverse effects of the energy curtailment that reflects enormous damages (tangible and intangible) to residential sector in the city of Riyadh, the capital of the kingdom of Saudi Arabia. It proposed, analyzed and employed energy conservation and cost savings. The study results showed that some customers will suffer enormous tangible and intangible losses should these outages occur at different times, seasons, and for prolonged durations. In order to reduce these power outages and hence mitigate their adverse effects and consequences, the study proposes proper practical measures and solutions without compromising the consumers' needs, satisfaction and convenience.

This study by Shaalan (2017) reveals that power curtailment have serious effects on the consumers. It also highlights the fact that system planners should incorporate consumers' costs in their planning process regarding energy conservation, tariff structure and reliability cost trade off assessment. The major drawback of this study however, is that it did not clearly highlight the practical measures and solutions that power utility companies should implement in order to reduce the adverse effects of power curtailments in Riyadh. This study will however, highlight on the efforts by the power utility company (ZESCO) to reduce power outages and their impact on high density areas of Lusaka.

In the report entitled *the least developed countries report 2017*, the United Nations Conference on Trade and Development (UNCTAD) (2017) focused on energy transformation for LDCs. The findings of the report were that energy for all in LDCs requires more than access to energy for basic household needs. It requires that access to energy in LDCs also serves productive capacities directly, by powering the structural transformation of LDC economies and the development of more productive, modern activities and sectors with adequate and reliable energy supplies. Structural transformation, in turn, has a role of increasing energy access, by generating sufficient additional demand for electricity for productive uses to make viable the infrastructure investments required for universal access more broadly. Yet strengthening this energy transformation nexus remains a massive

challenge, given that installed generating capacity per person in LDCs is barely one twelfth of that even in other developing countries, and one fiftieth of that in developed countries.

From this report by the UNCTAD (2017) we learn that energy for all in LDCs should not just be limited to access to energy for basic households needs but rather should include serving the productive capacities by powering the transformation of LDC economies and the development of more productive, modern activities and sectors with adequate and reliable energy services. This is very critical, as the powering of productive activities like manufacturing industries, mining and agriculture sectors of the economy with adequate and reliable power will enhance productivity in these sectors. This would contribute to the people's wellbeing through job creation and the production of quality goods and services. It will also contribute to the country's Gross Domestic Product (GDP). Further, the report also shows that there is a nexus between access to electricity and structural transformation. Access to electricity is essential to structural transformation. Equally important is structural transformation to electricity access. This is because productive use of electricity provides both the means by which access is able to transform the economy and, economic transformation has a role of increasing energy access, by generating sufficient additional demand for electricity for productive uses. However, the report also shows that a lot of effort needs to be put in, especially in the generation of electricity in developing countries. This report by UNCTAD can however, be criticized for being too qualitative. Secondly, the fact that it was a report means that it took a retrospective approach in its analysis which does not identify dysfunctional elements on the spur of the moment and therefore, can permit mistakes to continue for some time, a process that can be very costly to the country.

In another study Scott and Seth (2013) investigated on the political *economy of electricity distribution in developing countries*. The paper revealed that the private good nature of electricity allows for the delivery of the service to specific consumers. However, this requires effective enforcement, which is absent when overall governance and accountability mechanisms are weak. The separation of electricity generation from transmission and distribution under power sector reform measures in many countries can give rise to separated decision making and policy incoherence. The high demand for electricity owes to the value citizens place on the service, including its externalities. This can give electricity political salience, reflected in the promises and actions of politicians seeking broad electoral support or the support of particular groups. Electricity supply and pricing appear to have greater traction for politicians than increasing levels of access to electricity, probably because those

with political influence already have access to the grid. The common governance constraints found in other services can also be seen in the governance of electricity in distribution, the focus of this paper. With regard to challenges, the study revealed that electricity theft and poor financial performance of distributors are problems where monitoring and oversight by distribution companies and regulators are weak. When accountability mechanisms between politicians and citizen (electricity consumers) and between politicians and electricity providers are not strong, particular interest groups can be given preference in receiving electricity and favorable tariffs or subsidies.

The lessons learnt from this study are that since electricity has some characteristics of private good, good governance and accountability mechanism should be strengthened to avoid a situation where only some people, particularly those with money benefit more than those who do not have. In cases where the generation, distribution and transmission of electricity are separated due to power sector reforms, measures should be put in place to ensure that there is harmonious decision making and policy coherence. The other lesson learnt is that politics can have a lot of influence in the distribution of electricity, probably because politicians are mostly concerned with the support from people. Therefore, to avoid a situation where some people are given preference in receiving electricity and tariffs or subsidies, accountability mechanisms between the politician and citizen (electricity consumers) and between politicians and electricity providers should be strengthened. In most cases the concentration by politicians is on the prices of electricity, rather than access to electricity probably because the politicians themselves already have access to grid electricity. Furthermore, electricity distributors should have the financial muscle and strengthen their monitoring and oversight roles to avoid theft. This study by Scott and Seth (2018) can however, be criticized for concentrating on electricity distribution only. It therefore ignored other aspects like generation, transmission and supply which are part of the electricity supply chain. This study will attempt to fill this gap by evaluating ZESCO'S effort to reduce power outages through generating and transmission of adequate electricity and their impact on Lusaka's high density areas.

2.2.4 Literature on developed countries

In their working paper entitled *electricity connections and firm performance in 183 countries*, Geginat and Ramalho (2019) presented on the procedure, time and cost that a small or medium size business with a moderate electricity need has to invest to obtain a new

electricity connection. Data for this study was collected from distribution utilities and independent professionals such as electricians, electrical engineers and construction companies comprising 600 respondents from the 183 countries. The study found significant variation in the time and cost to obtain such an electricity connection across countries. In low income countries, for instance, it takes on average twice as long as in high income countries to connect a new customer to electricity, while the cost associated with a comparable connection is 70 times higher. The study finds that the poor performance of distribution utilities in low income countries cannot only be explained by differences in income levels. The overall level of bureaucracy appears to be another important factor. The study also found the data to be correlated with existing measure of effectiveness of the electricity sector, suggesting that the hurdles related to an electricity connection mirror the problem in the sector, such as the quality of electricity supply and the incidence of bribe payments. Finally, the study found that electricity connection affects firm performance. Simpler and less costly electricity connection processes are associated with better firm performance, in particular industries with high electricity needs, such as manufacturing motor vehicle.

The study by Geginat and Ramalho (2019) is relevant in that it shows the hurdles that electricity consumers, particularly the small and medium business, undergo in order to get connected to electricity. These include the longer time taken to get connected to electricity and also high cost of electricity connection in low income countries, as compared to high income countries. Bureaucracy is also cited as one of the major hurdles affecting the speedy electricity connection. What this means is that if the number of people accessing electricity is to increase, governments in low income countries must work at improving the procedure to electricity connection and make it more affordable. The study also revealed that the problem of inefficiency due to strict bureaucratic procedure can affect the power sector as customers resort to bribe payment. It further established that if the process to electricity connection is less costly, it can impact positively on the performance of firms. This is because manufacturing firms can produce goods at a cheaper cost and more efficiently. The limitation of this study, however, is that it did not highlight the efforts by countries to deal with the identified challenges.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section presents the methodology used in the study. According to Igwenagu (2016) research methodology is a set of systematic techniques used in research. This simply means it is a guide to research and how it is conducted. Research methodology is specifically made up of the following elements: Type of research, scope of research, research design, sources of data, sample size, sampling methods, methods of data collection, reliability of data, validity of data, methods of data analysis, research ethics and limitations of the research (Kothari, 2004).

3.2 Type of research

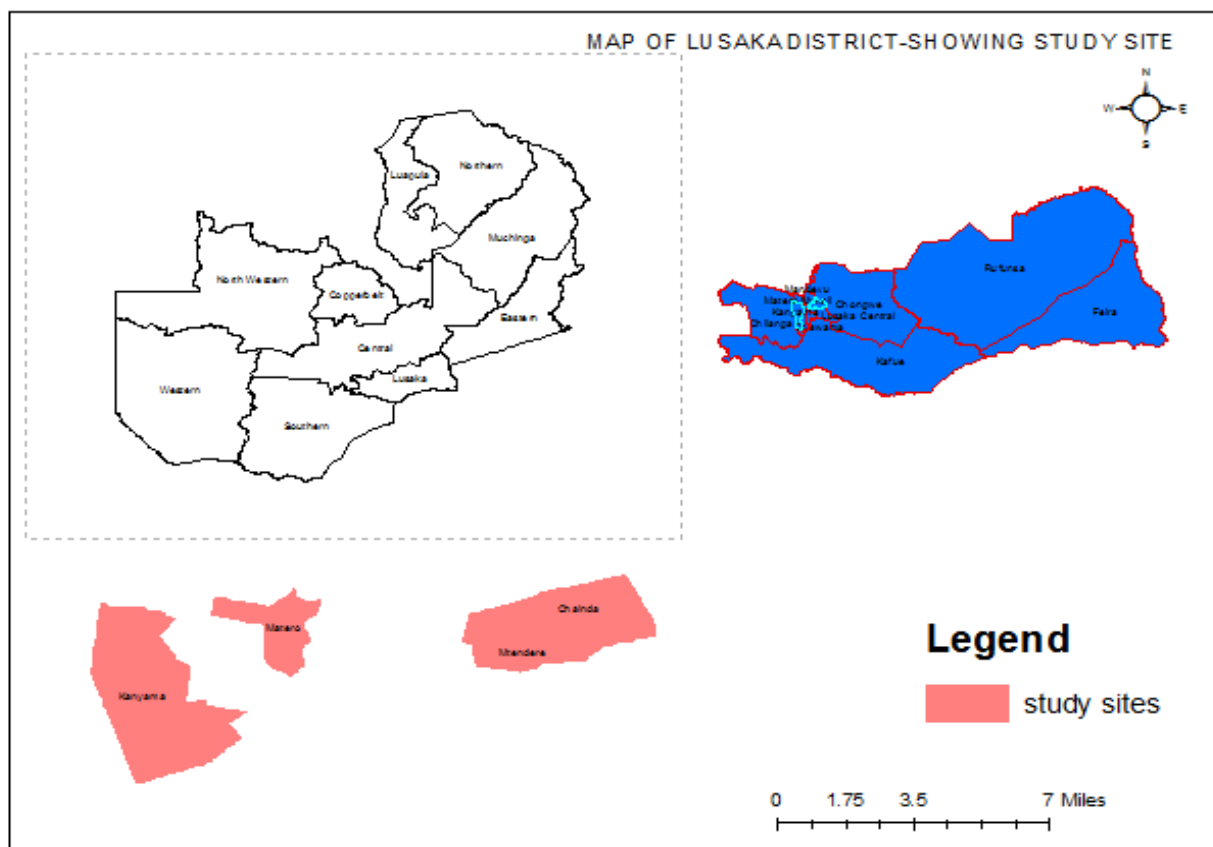
The type of research that was used in this study was categorized into three perspectives: The first perspective is categorization based on purpose. In this case evaluative research was adopted. The purpose of an evaluative research is to measure the performance of a policy or programme. It involves determining whether an intervention has produced the intended results. An evaluative research helps to gain insights about a programme and its operations. It also helps to improve practice, to modify or adapt practice to enhance the success of activities. This research therefore, assessed the impacts of the efforts by ZESCO to reduce power outages in high density areas of Lusaka. This involved carrying out a comparative analysis before and after the efforts were implemented by ZESCO.

The second perspective was categorization based on the number of cases to be investigated. In this regard, the research was a case study of Lusaka's Kanyama and Mtendere high density areas. This is because these areas are characterized by large population residing in them. The residents living in these areas often lack adequate and affordable basic services such as water supply including electricity supply (Renaud, 1981). A case study was chosen because of the following reasons: first, it intensively investigated one or a small set of cases focusing on many details within each case and the context. Second, a case study effectively depicts highly complex multiple factors, events or situation and traces processes overtime and space. Thirdly, a researcher is able to adjust measures of abstract concepts to dependable, life experience and concrete standards. Fourth, case studies have the ability to elaborate on an entire situation or process holistically and permit incorporation of multiple perspectives or

viewpoints (Norman, 2003). Further, (Bhatacherjee, 2012:93) postulates that in a case study “Multiple methods of data collection, such as interview, observation, pre-recorded documents, secondary data may be employed and inferences about the phenomenon of interest tend to be rich, detailed and contextualized.” The third perspective was categorization based on the time-frame within which the research was conducted. In this regard, the research was a one–time research. A one–time research is a research which is conducted at a single point in time (Norman, 2003). The point time that this research was conducted in was between 5th January 2020 and 28th February, 2020. A one–time research was selected because it was less costly.

3.3 Scope of the research

3.3.1 Map of Lusaka district.



SOURCE: Author

This research was conducted within the confines of Lusaka district which is found in Lusaka province. This is mainly because of a number of reasons. First Lusaka is a capital city of Zambia and is the seat of government and home to all foreign missions in the country (Chama

et al, 2007). This means that it is the host to most government ministries and key institutions such as the Ministry of Energy and ZESCO. The Ministry of Energy was chosen because it is responsible for the formulation and implementation of the energy policy and coordination of all strategic planning and operation of the energy sectors which have a bearing on the competition for energy provision. ZESCO, on the other hand, is the electricity provider currently responsible for the generation, transmission, distribution and supply of electricity in Zambia (Phiri and Ziba, 2018). These institutions were therefore very useful in providing valuable information needed for this study. The Second reason for choosing Lusaka district was that it has a lot of high density areas, among them are Kanyama and Mtendere. Kanyama and Mtendere were chosen purposively because these two areas had the highest population in Lusaka district comprising 169,253 and 106, 128 people respectively according to the 2010 national census (CSO, 2012). The third reason for conducting this study in Lusaka district is that Lusaka district has a bigger population compared to other districts in Zambia. For instance, according to the central statistical office, (2012) the population of Lusaka district in 2010 was 1,747,152. It was, however, projected to rise to 2,731,696 in the year 2020 (CSO, 2013). This huge population, therefore, puts a lot of pressure on service provision such as electricity supply, education, health, water, solid waste collection among others. The city of Lusaka is 1280 meters above sea level and covers an area of 375 square kilometers of mostly flat relief. Due to its central location and capital city status, Lusaka is easily accessible from all parts of the country. Consequently, it accounts for 32 percent of the total urban population in the country (Chama et al, 2007)

3.4 Research design

A research design can be defined as a comprehensive plan for data collection in an empirical research project (Bhattacharjee, 2012). It shows the procedure that was adopted by the researcher to answer questions vividly, objectively, accurately and economically. A mixed method design was used in this study. A mixed method design focuses on collecting both quantitative and qualitative data (Creswell, 2009). Quantitative data is data that can be quantified or expressed in terms of numbers (Turner, 2006). In this case the concentration was on collecting data that would be generated into graphs, charts and tables. On the other hand, qualitative data can be defined as empirical information about the world, not in form of numbers which most of the times (but not always) means words (Punch, 2005). It focuses on collecting in-depth information about an issue under investigation, which in this case is the

efforts by ZESCO to reduce power outages and their impact in Lusaka's high density areas. A mixed method design was chosen because the weaknesses of one design are compensated by the other. This is because both quantitative and qualitative data generate unique insights into phenomenoe that are not available in either type of data alone (Creswell, 2009).

3.5 Sources of data

The researcher collected data from two sources. These are primary and secondary data. Primary data involves relying on data that has not been collected or analyzed by other researchers. In this research, primary data included both quantitative and qualitative data (Norman, 2003). Primary data was collected by interviewing key informants who included officials from the Zambia Electricity Supply Corporation (ZESCO). Primary data was also collected through observation and questionnaires from heads of households from Kanyama and Mtendere areas. On the other hand, secondary data entails relying on data that has been collected and analyzed by others. This included text books, journal articles, working papers, seminar papers, dissertations and theses among others. These were accessed from the library, internet, individuals and organizations (Greener, 2008).

3.6 Sample size

The sample size in this research was made up of 196 respondents because this is the number judged to be adequate by the researcher. Of this number, 6 were key ZESCO employees while the remaining 190 were head of households from Kanyama and Mtendere high density areas. The sample of 190 households was divided as follows: 100 households in Kanyama high density area and 90 households in Mtendere high density area. More houses were sampled from Kanyama than Mtendere because Kanyama had the highest population in Lusaka district as evidenced by the 2010 national census (CSO, 2012). On the other hand, ZESCO was selected because it plays an important role in the energy sector in Zambia. For instance, ZESCO is charged with the responsibility of generation, transmission and distribution of electricity. Therefore, the officials from this institution are pundits who possess the relevant knowledge and expertise necessary for this proposed study.

3.7 Sampling methods

According to Bhattacharjee, (2012:69) "sampling is the statistical process of selecting a subset (called a sample) of a population of interest for the purpose of making observations

and statistical inferences about that population.” This research used both probability and non-probability sampling. For key informants, non-probability sampling method, particularly purposive or judgmental sampling was used. Judgmental sampling, was used because it allowed the researcher to use his own judgment to select a sample which he thought would provide the required information (Alvi, 2016). Judgmental sampling was also used to select Kanyama and Mtendere areas.

This study also employed the multi – stage sampling method to generate a sample from the two high density areas. This sampling method was adopted because it works well for studies that cover a wider geographical area where a complete list of members of the population is not available. The first stage involved purposively selecting Kanyama and Mtendere areas from which samples were drawn using stratified sampling method. Stratified sampling involves dividing the population into several strata that are usually more homogeneous than the total population and more reliable and give detailed information (Kothari, 2004). In each stratum, simple random sampling method, in particular the lottery technique, was used to select two residential areas. All the names of residential areas were written down on pieces of paper, put in the box which was shuffled and then the samples were picked. The lottery technique gives equal chances to residential areas to be in the sample and hence, research results can be generalized.

The second stage involved selecting households from the sampled residential areas. The sample of 190 households was divided as follows: 100 households in Kanyama high density area and 90 households in Mtendere high density area. More houses were sampled from Kanyama than Mtendere because Kanyama had the highest population in Lusaka district as evidenced by the 2010 national census (CSO, 2012). Systematic sampling method was then used to obtain the actual households. Under this type of probability sampling method, only the first unit was selected randomly and the remaining units were selected at fixed intervals. This method was adopted because it helps to cover a wider population easily. In this study, after sampling the first household using simple random sampling method, a skip interval of five was used to select the households (Kothari, 2004). The actual respondents (head of households) and the key informants were purposively selected. Creswell and Clark (2011) contend that purposive sampling method involves the identification and selection of individuals or groups of individuals that are proficient and well informed with the phenomenon of interest. Thus, on the one hand, heads of households were selected as respondents because they are the ones in charge of the house and responsibilities that come in

the day to day running of the house. In situations where the head of the household was not around, such a house was skipped. On the other hand, key informants from ZESCO were purposively selected because they possess the relevant knowledge on the subject matter under investigation. Thus, a mixture of sampling methods was used to minimize biases in the sampling process.

3.8 Methods of data collection

Data for this study was collected from the 5th January, 2020 to 28th February, 2020. Both qualitative and quantitative data was collected. Qualitative data was collected using in-depth interview with key informants and observation. The format of the interview was semi structured. Semi structured interview involves having a number of pre-determined set of questions but there is room for the interviewer to ask additional questions in order to get clarification or detailed information about the issue under investigation. This format of interview was used because it gave the researcher room to get additional information on the issue under investigation (Doyle, 2018).

Quantitative data on the other hand was collected using the questionnaire. A mixture of open ended and closed ended or partially closed ended questionnaire was used in this research. This form of questioning technique enabled the researcher to collect as much information as possible on the issue under investigation. The questionnaires were both researcher administered and self-administered. For respondents who are literate, a self-administered questionnaire was applied while for those who are illiterate, researcher administered questionnaire was applied. The above data collection methods were used to collect primary data (both qualitative and quantitative).

As for secondary data, published and unpublished materials such as books, reports, working papers, journal articles, theses and dissertations, among others, related to the subject matter were examined. This also provided an opportunity to learn what different writers had written concerning the subject under investigation.

3.9 Reliability of data

“Reliability refers to the ability of a measure to yield consistent results each time it is being used” (Monnette, 2002:12). This is conditional to the fact that the person or substance being assessed is not changing or simply put the measurement is being done under the same

conditions. This study used internal consistency measure of reliability. Internal consistency is a measure of reliability that evaluates the degree to which different test items that probe the same construct produces similar results (Bhattacharjee, 2012). The questionnaire to this study was made up of questions that were logically related and the answers to such questions were also expected to be related. This means that after the responses to the questions on the questionnaire were given, the researcher checked for similar results. In cases where the responses from both key informants and respondents were found to be contradictory to his/her responses, such data was rejected and treated as unreliable. Only responses that were not contradictory with the corresponding questions were taken to be reliable. This is the data that has been presented and analyzed in this research.

3.9.1 Validity of data

Validity refers to the extent to which a measuring instrument accurately measures the concept it is intended to measure (Meier and Brudney, 2002). This research adopted content validity to ensure validity of the data collected. Content validity is a measure of validity that requires that a measure represents all aspect of the conceptual definition of a construct (Norman, 2003). The research instruments were therefore, structured in such a way that they covered all aspects of the phenomena under investigation. In the context of this study, it means that it included questions on efforts by ZESCO to reduce power outages and also questions on the impact of the efforts by ZESCO to reduce power outages in Lusaka's high density areas.

3.9.2 Methods of data analysis

Data analysis can be defined as “the process of investigating data in order to make sense of it” (Aneshensel, 2013:4). It basically entails separating a phenomenon into its constituent elements to study its nature. This research used both qualitative and quantitative methods of data analysis. Qualitative data from key informants was analyzed using thematic analysis. Thematic analysis is the process of identifying patterns or themes within qualitative data. This method was used because it identifies the themes for example, pattern in the data that are important or interesting and use these themes to address the research (Maguire and Delahunt, 2017). It, therefore, involved grouping related elements in the same category to create themes of the data. Based on the data patterns, conclusions and recommendations were made. On the other hand, quantitative data drawn from questionnaires of heads of household was analyzed using a computer programme. In this case, statistical packages for social

sciences (SPSS-20) and Microsoft excel 2019 were used. SPSS was used because it is capable of computing many different statistical procedures with different kind of data. On the other hand, Microsoft excel was used because this is the software which the researcher is quiet familiar with (Babbie, Halley and Zaino, 2007). After collecting the completed questionnaires from respondents, the data was entered on the computer for the Statistical Package for Social Science and also Microsoft excel data base to summarize the data using frequency tables, graphs and charts. The data was then interpreted in to meaningful and useful information.

3.9.3 Research ethics

This research took ethical considerations very seriously. In doing so the researcher ensured that the following is done during the conduct of research: First, ethical clearance from the Directorate of Research and Graduate Studies at the University of Zambia was obtained. Request for permission to conduct research at the sampled institutions was done. In this case permission was got from ZESCO headquarters which later informed their Lusaka regional offices concerned to assist in providing the required data. The researcher also informed all participants about the objective of the research, sampling methods and data collection methods. Participants were allowed to ask questions about the research after which their consent was obtained. The participants were further informed that their participation was voluntary and that they had the right to withdraw their consent at any time of the research. The participants were also assured that anonymity and confidentiality would be maintained. In addition, the researcher maintained honesty and integrity in the process of data collection, analysis, interpretation and presentation.

3.9.4 Limitation of the Research

There are a number of limitations that affected the study. Below are some of them:

1. The research was self-funded and so the funds were inadequate. This made it difficult for the researcher to hire a research assistant to help with the data collection. Inadequate funding also affected the completion time of this research.
2. The study was initially intended to collect primary data by interviewing some key informants from the ministry of energy. This was, however, not possible as the researcher was not given permission by the ministry of energy. To overcome this challenge, the researcher resorted to using secondary data as another method of

collecting data. Articles and publications produced by the ministry of energy, journals, and dissertations among others were utilized to generate credible data. The study therefore, may have some element of bias.

3. This study was conducted during the rainy season and so some houses that were expected to be visited were not accessed due to flooding. For instance, only the eastern part of old Kanyama was sampled and this may affect the reliability of the data collected.
4. The research was also conducted at the time when the country was experiencing some gassing incidents and later the covid 19 pandemic. Heads of households were suspicious of strangers visiting their houses. Some of them became unwilling to take part in the research. In such a situation the researcher only administered questionnaires to heads of households who were willing to participate.
5. This study was a case study of high density areas in Lusaka district and hence its finding cannot be generalized to the entire province or country.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.0 Introduction

In the previous Chapter, the methodology that guided this study was explained. This chapter presents and discusses the findings in line with the first objective which reads: To evaluate the efforts by ZESCO to reduce power outages in Lusaka's high density areas. In order to achieve its purpose, the chapter is divided into eight (8) sections. The first section is the introduction. The second section are the characteristics of the key informants/respondents. The third section evaluates the effort by ZESCO to reduce power outages. The fourth section looks at the stake holders that ZESCO has engaged to help reduce the power outages in Lusaka's high density areas. The sixth section analyses the effort by ZESCO to reduce dependence on hydro power and also the steps taken to diversify its generation portfolio through investing in alternative sources of energy. The seventh section looks at ZESCO'S development plan which lays out the investment in the segment of generation, transmission and distribution. The final section is the conclusion of the chapter.

4.1 Background characteristics of informants/respondents

Key informants

There were six (6) key informants. Three came from Lusaka East Regional Office and the other three (3) were from Lusaka Central Regional Office. All the six key informants were men. This means it was not gender balanced, as it did not include women. However, gender has no effect on the outcome of the study.

Household heads

In total, 190 respondents came from Kanyama and Mtendere high density areas. These respondents were divided as follows: 100 from Kanyama and 90 came from Mtendere. These have been presented in terms of sex, age, marital status, education level and economic status.

Table 4.1.1 Gender of respondents

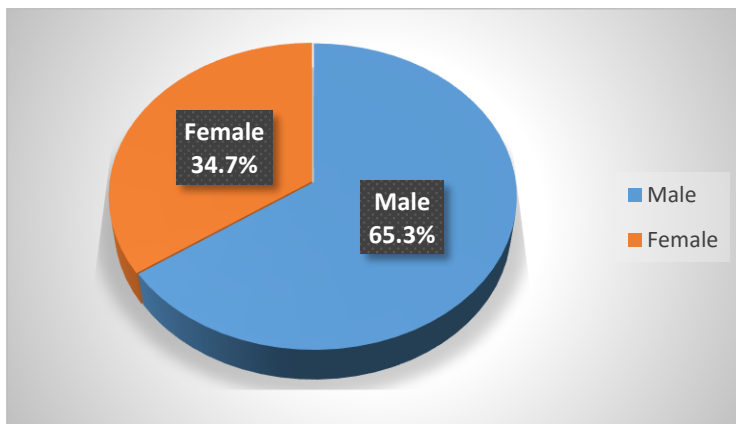
Finding

Table 4.1.1: Gender and number of respondents

Gender	Number	Cumulative percentage
Male	124	65.3%
Female	66	34.7%
Total	190	100%

Source: field data 2020

Figure 4.1.1: Gender and Number of respondents



Source: Field data (2020)

Figure 4.1.1. above shows that out of 190 respondents who participated, 124 representing 65.3% of the residents, were males, while sixty-six (66) respondents, representing 34.7 % were females.

Discussion

The gender composition shows that there were more male respondents than female respondents who took part in the study. This gender statistic does not correlate very well with the central statistical office (2010) information that there were more females than males in Lusaka district. The number of male respondents is greater because most married females who were given the questionnaires preferred their husbands to respond to the questions because of the traditional respect they accord them as heads of the households. However, gender has no effect on the outcome of the study.

Age Distribution

In terms of age distribution, majority of respondents were between the ages 46-55, representing (40%), with the least age group ranging between ages 56 and above which represented (5%). 10% of the respondents fell between the ages 18-25, while 20% were in the ages group 26-35. Only 25% of the respondents fell in the age category of 36-45. Table.2 below shows the age distribution of residents.

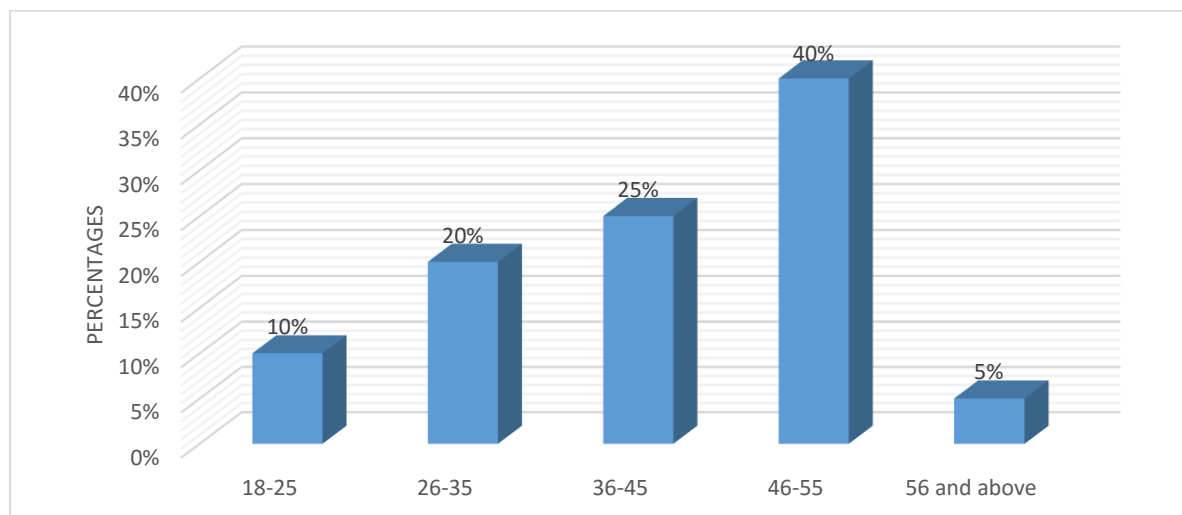
Table 4.1.2: Shows the Age Distribution of Respondents

Findings

Age group	Frequency	Percentage
18-25	19	10
26-35	38	20
36-45	47	25
46-55	76	40
56 and above	10	5
Total	190	100

Source: field data (2020)

Figure 4.1.2: Shows the Age Distribution of Respondents



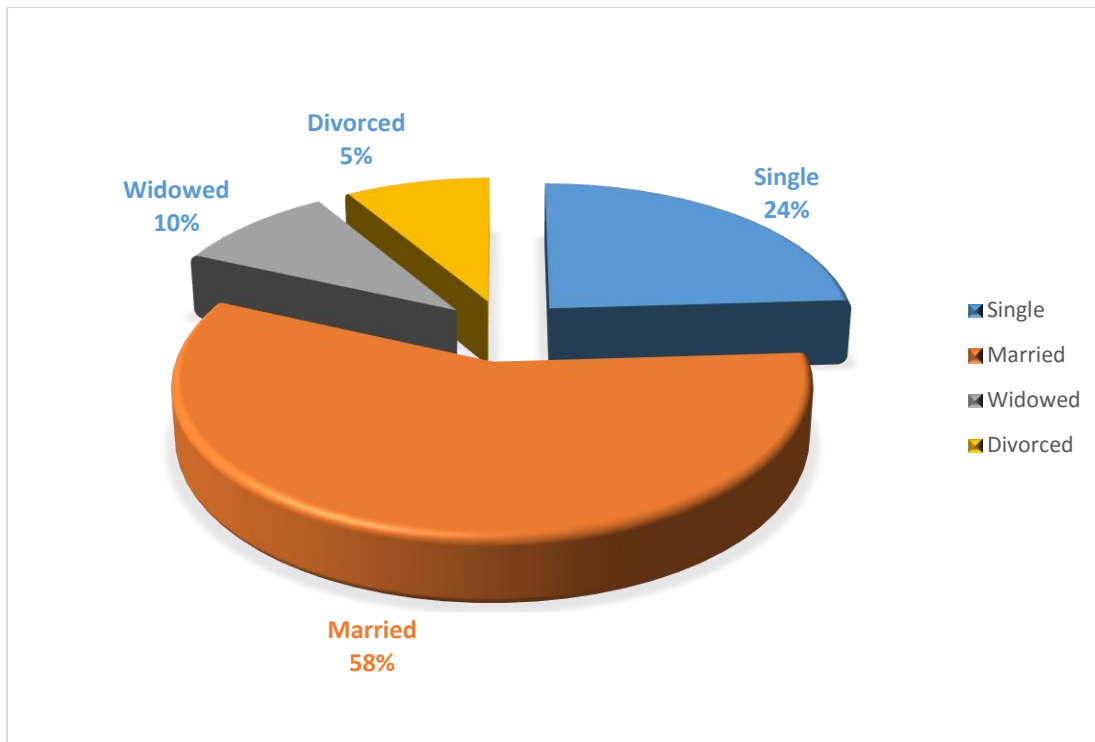
Source: Field Data (2020)

Discussion

Figure 4.1.2. Reveals that the majority of the respondents (40%) were between the age of 46-55 years and hence can be classified as being mature and responsible people who understood the needs of the household.

Figure 4.1.3: Shows the Marital Status of the Respondents

Findings



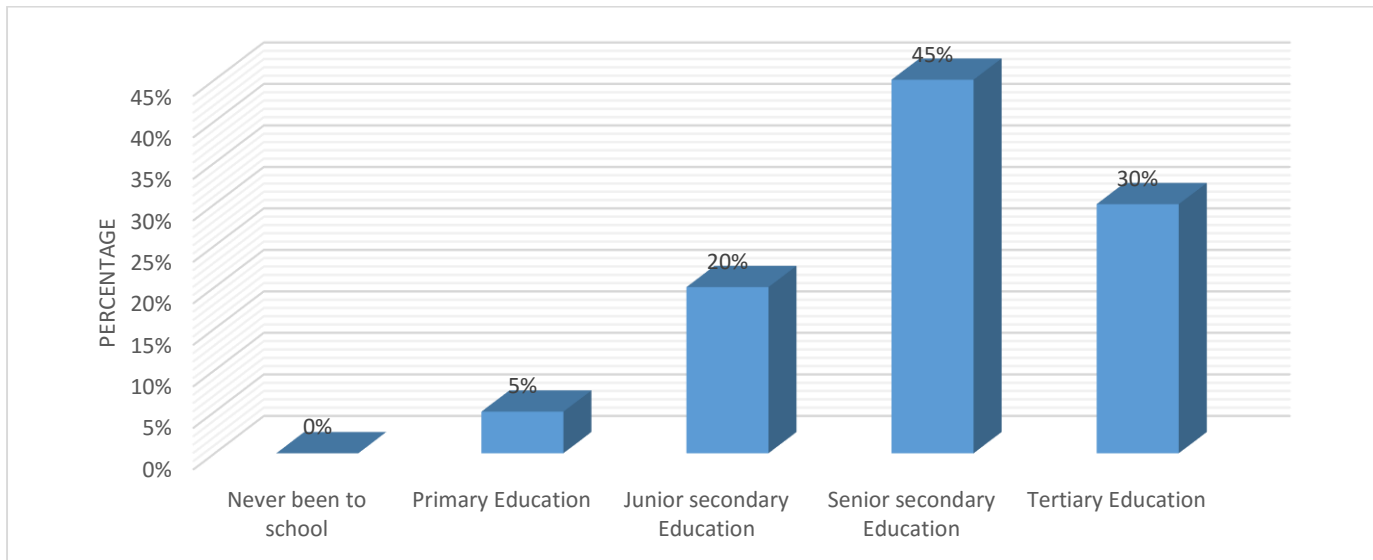
Source: Field Data (2020)

The illustration on the pie chart above indicates that 114 (58%) respondents were married. This is followed by 48 respondents (24%) represented as single. 19 respondents, represented by 10%, were widows while 9 of the respondents were divorced and these were represented by 5% respectively.

Discussion

According to figure 3 above, most of the respondents who were involved in the research were married in Lusaka District, implying that these are respondents who are settled in life with some form of responsibility on their shoulders and hence were the right people to participate in this research.

Figure 4.1.4: Indicates the Education Background of the Respondents



SOURCE: Field Data (2020)

The figure 4.1.4. Above reveals that about 85 (45%) respondents had reached senior secondary school, followed by 57 (30%) who had reached tertiary level, while 38 (20%) only went as far as junior secondary education. None of the respondents who participated in this study indicated that that they had never been to school.

Discussion

The figure above simply means that most of the respondents (45%) who were involved in the study had at least reached senior secondary school. This means that they had at least some basic knowledge about ZESCO’S effort to reduce power outages in their area.

4.2 Social-economic status of the respondents

The following shows the social economic status of the residents of Kanyama and Mtendere compounds of Lusaka district.

Table 4.2.3: Indicates respondent’s employment status

Findings

Employed	Frequency	Percentage
Yes	67	35.3
No	123	64.7
Total	190	100

Source: Field Data (2020)

Table 4.2.3. above shows that most respondents, 123, representing (64.7%) were not employed while 67 representing 35.7%, indicated that they were employed.

Discussion

The presentation above means that a larger percentage of respondents were not in formal employment, and therefore, depended on their own businesses for survival.

Table 4.2.4: shows respondents' monthly income

Findings

Monthly Income	Frequency	Percentage
Below K1000	28	14.7
Between K1000-K3000	86	45.3
Above K3000	76	40.0
Total	190	100

Source: Field Data (2020)

Table 4.2.4: above shows the monthly income of the respondents.

Of the 190 heads of households who responded to this question, 86 (45.3%) indicated that their monthly income was between K1000-K3000, followed by 76 (40%) whose monthly income was above K3000, while those who earn below K1000 were 28 (14.7%).

Discussion

This means that the majority of the respondents (86=45.3%) get between K1,000 –K3,000. This shows that only very few get the minimum wage (K3,300) as required by law. They can therefore, be classified as people that are struggling to make earnings meet.

4.3 Summary of findings on the background information of heads of households.

From the respondents background information, it was revealed that the majority of the respondents who took part in the study were male (124= 65.3%). The study also revealed that the majority of respondents were between the ages (45-56=40%), while 114 (58%) were married. In terms of education, the majority of the respondents (85=40%) were exposed to senior secondary education. The study noted that the majority of the respondents (123 =64.7%) were not employed. 86 respondents (43.3%) indicated that their income ranged between K1, 000-K3, 000) while 76 (40.0%) had an income above K3, 000).

4.4 Efforts by ZESCO to reduce power outages in Lusaka’s high density areas

This was in line with the first objective which aimed at evaluating the efforts by ZESCO to reduce power outages in Lusaka’s high density areas.

The Key informants were asked what ZESCO was doing to reduce power outages in Lusaka’s high density areas. The findings were as follows:

Responses from key informants about what ZESCO was doing to reduce power outages in Lusaka’s high density areas

1. “We are increasing generation by building more power stations.” (Interview, 18th January, 2020)
2. “We are building more transmission lines to increase our power transfer capacities from across the grid.” (Interview, 18th January, 2020)
3. “We are also undertaking system reinforcement by putting more transformers close to the load centers. (6th January, 2020)
4. “We have introduced load balancing.” (6th January, 2020)

Discussion

1. Building more power stations

One of the key informants stated that ZESCO was increasing generation capacity by “building more power stations.” He cited the Kariba north power station as the flagship project for ZESCO (Interview, 18th January, 2020). This finding is in harmony with what is documented by the Republic of Zambia (2019) that the Kariba North Bank power station is expected to add about 750 MW to the country’s national grid. This will significantly reduce or even better still bring to an end the load shedding which the country is facing. Mwila et’al (2017) highlighted some of the significant developments in the electricity sector which indicated the efforts being made by ZESCO to increase the generation and transmission of power in order to reduce power outages. For instance, Mwila et’al (2017) argued that there was an increase in national electricity generation from 14,460 GWh recorded in 2017 to 16,189GWh in 2018, translating into an increase of 12 percent. This increase was as a result of the upgrading of the Musonda falls from 5MW to 10 MW installed generation capacity. The Musonda falls hydro power station was launched by President Edgar Lungu on 29th August, 2020. In addition, Mwila et’al (2017) states that ZESCO’s four major hydro power plants which include Kafue Gorge (990MW), Kariba North Bank (720MW), Kariba North Bank Extension (360MW) and Victoria falls (108MW) recorded an increase in electricity generation by 9.9 percent from 11,335 GWh in 2017 to 12,458 in 2018. The increase was also

attributed to the increase in generation from the KNBE power station, a power station that was designed as a peaking plant to run when there was an increase in demand for power. Thus the observed increase came at a time when there was a shutdown of some power plants at the Kafue Gorge to facilitate maintenance (Mwila et'al, 2017).

Furthermore, the Independent Power Producers contributed an increase to the electricity generation in Zambia by 17.1 percent from 3,006.3 GWh in 2017 to 5,519.26GWh in 2018. This increase was as a result of the full operation at Maamba collieries in the year 2018. Lusemfwa Hydro Power Company also recorded an increase in power generation of 9.8 percent from 292.6GWh to 318.6GWh in 2018 (Mwila et'al, 2017). These IPPs sell the power they generate to ZESCO under the power purchase agreement. The implication of this is that efforts were being made to increase power generation and transmission by the power utility company (ZESCO) working in collaboration with Independent Power producers to ensure that they reduce the effects of power deficit in the country. However, despite the increase in power generation in the year 2018 compared to 2017, Zambia was still hit with serious power outages in the 2019 and 2020 which affected both the households and industries. This means that the demand for power was greater than the supply and hence the need to ensure that more investment is made in the generation and transmission of power in the country. In addition, the electricity tariff in Zambia remains a major hindrance, as it is still not cost reflective. This hinders the participation of more private players in the electricity supply industry (Phiri and Ziba, 2019).

2. System re-enforcements

Another key informant stated that ZESCO was undertaking system reinforcement by putting more transformers closer to the load centers. He elaborated that, “the capacity of the transformer has a limit on the number of customers it can take. If that limit is crossed, then it results into power interruption” (Interview, 6th January, 2020). He further stated that a 200kv transformer can only take up to a maximum of 228 customers. Therefore, if the load goes beyond the filled rating, reinforcement or load balancing is done. This involves quickly identifying an area where they can put up another transformer in order to offload some existing customers to the new transformer. This results in load balancing and reduces the frequent power interruptions that happen when one transformer is overloaded. In addition to this, he indicated that ZESCO had upgraded Chelstone substation, Ngwelele substation, chainda and the latest one was Avondale substation from 33/11KV to 132 /11KV. Similarly, the regional manager from the Lusaka Central regional office confirmed that ZESCO had managed to put up transformers and a 33/11kv substation in Kanyama, Kamwena and

Chawama (Interview, 6th January, 2020). These were placed right in the load centers and closer to customers.

3. Building and maintaining of Transmission lines

Key informants also emphasized that “ZESCO was building transmission lines as another measure aimed at facilitating the transmission of generated power to various substations.” (Interview, 18th January, 2020). A substation is a part of an electrical transmission system that transforms voltage from high to low or the reverse. On the other hand, electricity transmission lines are lines which carry electricity at voltages of 69kv or greater and are used to transmit electric power over relatively long distances, usually from a central generating station to the main substation. According to Owen (2016) Zambia National Grid is composed of 330 kilovolts (kV) main lines that span a total of 2,241km across the country. It is these lines which are used to transmit power from the hydro power stations in the south to the Copperbelt province in the north, where the mines and the main load center are located. He further revealed that the rest of the transmission network consists of 571km of 220kv lines, serving as interconnectors with neighboring DRC, Namibia, and Zimbabwe, 202km of 132kv lines and 754km of 88kv mainly in the Lusaka area, and 3033km of load transmission line, and 66kv in the north eastern and western part of the country. In addition to this ZESCO (2017) revealed that:

In the way leave for transmission system backbone (330kv, 220kv and some 132kv lines) was also maintained in the year commencing 2017 over a period of three months. A total of 29,445 hector of the transmission lines way leave was cleared in house, while 11,805 hectors were outsourced. The in-house way leave maintenance includes all 220kv and 330kv transmission lines with other nominated substation lines. The way leave was maintained at a cost of K39, 731,980.75 against a budget of K42, 000,000.00.

This shows that ZESCO had invested a lot of money in the transmission subsector to ensure smooth transmission of power to its customers.

The process of receiving clean energy begins with generation. The bulk generated power is then evacuated through transmission lines to the substations located near the demand centers. These transmission lines, when interconnected together, become transmission network. The combined transmission and distribution network is known as power grid or national grid. At substation, transformers reduce the voltage to lower levels in order to facilitate the

distribution process to consumers. At the point of use, the energy is transformed to low voltage and distributed to users as per requirement which differs from one household to the other and from one commercial industrial use to another (ZESCO, 2013).

4. Importation of power

Key informants also confirmed that “ZESCO had engaged their counterpart in South Africa (ESKOM) to import about 300MW of power for a period of six months.” This was an immediate short term measure aimed at mitigating the current power deficit the country was experiencing. However, to effectively combat power outages, long term solutions needed to be found. This includes investing in other alternative sources such solar, thermal power and wind energy, among others.

5. REFIT Strategy (2017)

The REFIT strategy is another measure which the government has adopted and is aimed at harnessing the renewable energy sector’s potential to drive economic growth and improve the quality of life of all Zambians. In order to achieve this goal, the REFIT strategy focuses on the promotion of small and medium sized renewable energy projects of up to 20MW, quick deployment of private investment for small and medium sized renewable energy projects and ensuring cost reflective tariffs through transparency and competition in the sector (Republic of Zambia, 2017). Generally, diversification of the power sector by adding a portfolio of small and medium renewable energy projects in the short term is the anticipated result of this strategy.

Key informants also revealed that ZESCO had committees which look at specific programmes of reducing power outages and responding to customer complaints. The objectives of these committees include:

1. To monitor the load growth and plan for network expansion.
2. To undertake grid extensions through building of distribution lines.
3. To monitor the quality of supply through monthly technical performance reports and proposes system reinforcement that reduces overloads and ultimately keeps unplanned outages to barest minimum. (Interview, 18/01/ 2020).

In Lusaka East for instance a key informant disclosed that:

Lusaka east starts from Manda Hill to Chongwe. We have zoned the area and each zone has a technician. For example, zone one incorporates Roma, Chadleigh, Kalundu and Ng’ombe. Zone four (4) consists of

Mtendere, Kaunda Square, kalingalinga, Vera Chiluba, Mass media and Show grounds. Each zone has a technician and if there are faults in that area it is him and his team who are tasked to manage those faults.

(Interview, 6th January, 2020)

From the above information it can be deduced that ZESCO has put in place committees or teams which look at specific programmes of power outages. This is evident from the segmentation of the region (Lusaka East Region for instance) into small manageable areas called zones. These zones have teams which are led by a technician who are operating in those areas to deal with all faults. The implication of this is that teams act as an instrument that ZESCO uses to deal with power cuts, thereby increasing the reliability of power supply to its customers.

4.5 Effort by engaging various stake holders

In an effort to ensure that there was increase in power generation and transmission in order to reduce power outages, one of the key informants informed this researcher that “they were working with independent power producers to ensure that the country’s power generation capacity matches the ever increasing load demand.” (Interview, 18th January, 2020). He cited companies such as Ndola energy, Lusemfwahydro power, Maamba collieries limited and Bangweulu solar company at the Lusaka Multi-Facility Economic Zone (MFEZ) as examples of stake holders that ZESCO was working with to increase power generation, thereby mitigating the power outages which high density areas were experiencing.

However, in response to the same question another informant said:

No, in power outages we cannot engage a company to go and resolve the faults because we are dealing with electricity and it kills. People go through special safety procedures before they are given to go and work on ZESCO line.

They have to go through authorization tests. Once they pass they are given a certificate to manage either on a medium or a high voltage part. It is generally done by ZESCO (Interview, 6th January, 2020).

There was, therefore, a contradiction in the responses by these key informants. However, what is notable is that different stakeholders have been engaged. The government of the Republic of Zambia (2019) has highlighted some of Independent power producers (IPPs) operating in the electricity industry of Zambia. These include the following:

1. Lusemfwahydro power company (LHP), privately owned, with 56 Mw total capacity.
2. Zengamina power company (ZPC), privately owned operates a 0.75 isolated grid.

3. North Western Energy Company (NWEC), privately owned with installed HFO thermal power capacity of 105 MW.
4. Maamba Collieries Limited (MCL), privately owned with installed coal thermal power plant capacity of 300MW.
5. Itezhi Tezhi power corporation (ITPC), jointly owned by Tata Power and ZESCO Limited in a 50-50 share ownership, has an installed capacity of 120MW.
6. Kariba North Bank Extension (KNBE), special purpose vehicle (spv) company wholly owned by ZESCO, has an installed capacity of 360 MW.

From the highlighted IPPs above, it is evident that there are some stake holders who have been engaged and are participating in the generation of power, though the number is not very adequate. According to Eberhard et'al (2016) private sector participation is critical in that the large funding gap that holds back investments in new power projects cannot be bridged by the public sector alone. This means that these IPPs help to supplement government efforts by investing in power projects thereby helping in mitigating the power deficit in the country. However, though the generation subsector has embraced some stake holders, Phiri and Ziba (2019) bemoan the lack of competition or open and non-discriminatory access to transmission and distribution network. This is because the rights to access the distribution grid and transmission lines remain limited in practice and are almost exclusive to ZESCO, CEC and NWEC on account of ZESCO's monopoly power and its vertical integration.

This factor was also pointed out by one of the informants who said, "In this industry people can only participate at the generation level." (Interview, 6th January, 2020). He elaborated that the reason is that there was no competition at the distribution level because the sector was very highly subsidized and that the cost of generating power was higher than what ZESCO was selling. This discourages private participants in the sector whose aim is to get a return from their investments. These findings also agree with the literature reviewed where Eberhard, Gratwick, Morella and Antmann (2016) observed that investments in Africa's IPPs are growing, though not so fast enough. Another significant development noted from the list above which is also similar to the findings by Phiri and Ziba (2019) is that the country is still highly dependent on hydro power which is susceptible to climate variability. This, in turn, exposes the country to climate shocks, as was the case in the 2014/2015 rain season and the 2019/2020 rainy season. There is therefore a need for the Ministry of Energy comes up with policy measures that would attract investments in alternative sources of energy.

4.6 Efforts to reduce dependence on hydro power sources

The key informants were also asked what ZESCO was doing to reduce dependence on hydro power so as to avoid power outages. It was revealed that ZESCO was “buying power from other alternative sources such as Maamba Collieries which runs a thermal power plant and Bangweulu/Ngonye at the Lusaka Multi-Facility Economic Zone which is a solar scaling project” (interview, 18th January, 2020).

Another key informant stated “that ZESCO alone had built 50 MW solar power plants in Lusaka South Economic Facility Zone” (Interview, 6th January, 2020). He also indicated that the Japanese were putting up another 300MW solar power plant in Mpika and Copperbelt by the end of 2020. The two power plants would produce power which would be pushed into the national grid and this would benefit the country, including high density areas. This revelation shows that ZESCO was making strides not to depend on hydro power alone but was venturing into solar energy as an alternative source of energy. “Zambia has an average solar potential of 5.5KWh per m² per day with an approximately 3,000 sunshine hours annually” (Republic of Zambia, 2019:19). This implies that the country has potential to tap into this area as another source of energy that can help in reducing the current power deficit the country is experiencing. However, despite the enormous potential that solar energy has to contribute to increased power generation, the government of Zambia noted that solar energy’s contribution to the country’s energy mix was still very low due to the high investment capital costs, which needed guarantees of long term income stream to ensure financial viability (Republic of Zambia, 2019).

Another measure that the government of Zambia has undertaken to promote solar includes the development of the solar resource map which began in 2015, with the support of the World Bank Energy Sector Management Assistance Programme (ESMAP). This programme ended in 2017 and was basically aimed at delivering high quality solar resource mapping and measurement services for renewable energy development in Zambia. Six measuring station were installed (Republic of Zambia, 2019).

In order to supplement ZESCO’s efforts, the Ministry of Energy, in collaboration with the German Development Bank (KfW), is implementing the Global Feed-in Tariff program to fulfill the government’s Renewable Energy Feed in Tariff (REFIT) strategy. The main objective of the REFIT strategy is “to harness the renewable energy sector’s potential to drive economic growth and improve the quality of life for all Zambians.” (Republic of Zambia, 2017:2). In order to realize this objective, the government would promote the use of small

and medium size renewable energy projects of up to 20 MW. The REFIT strategy, is therefore, anticipated to expand the renewable energy deployment by creating a platform to remove barriers. It would also provide effective processes for licensing technology –based standardized Power Purchase Agreements (PPAs) in order to increase private sector’s involvement in power generation. Basically, the REFIT-strategy will promote diversification of the power sector by adding a portfolio of small and medium size renewable energy projects in the short term (Republic of Zambia, 2017).

4.7 Steps to diversify energy generation by investing in alternative sources

Key informants were again asked about steps that were taken by ZESCO to diversify its generation portfolio by investing in other alternative sources of energy such as geo-thermal, solar and wind energy to compliment hydro sources.

One of the key informants at the Lusaka East Regional office revealed that ZESCO had formed a new department to look at alternative energy sources (Interview, 6th January, 2020). In addition to this, another key informant said, “We are putting up solar farms at both the Kafue Gorge Lower and Kariba North Bank power stations as a way of improving the generation mix. “We will also be buying power from Mpembo Energy in Serenje, a flagship project by an independent producer in wind generation.” (Interview, 18th January, 2020). This is in addition to the solar power plants stated earlier.

This has been done with the understanding that in order to increase power generation which would meet the ever increasing demand for power, different energy sources have to be developed. However, in order for households in Lusaka’s high density areas to benefit from alternative energy, there must be deliberate plans to address issues of access, range of service levels, dependability and quality, as well as affordability and usability (Mudenda et al, 2017).

4.8 ZESCO’S development plans in the generation, transmission and distribution subsectors

Generation

Key informants were asked whether ZESCO had any development plans that lay out the investment required in all segments of the power sector such as generation, transmission and distribution. In response to this question one of the key informants indicated that “ZESCO was building the Kafue Gorge lower power plant that would increase generation capacity by 750MW” (Interview 6th January, 2020). This project started in 2016 and was at 80 percent

completion point. The first generator is scheduled for completion by mid-2020, while the last phase would be commissioned by the end of 2020 (ZESCO, 2020). Another informant indicated that a similar project that ZESCO was carrying out was at Lusiwasi phase 1 and 2, with an installed capacity of 15 and 8MW respectively. Though the Kafue Gorge lower had delayed in its completion, it is anticipated that the commissioning of this project would significantly reduce the current load shedding hours from 8 hours per day to at least bearable levels.

In an effort to effectively implement the 2008 National Energy Policy and now the 2019 National Energy Policy, the government of the Republic of Zambia developed the power system development master plan (Republic of Zambia, 2011). The main objective of this plan is to provide a blue print for the power system in the country up to the year 2030 (NEP, 2019). The plan highlights least cost expansion options for generation, transmission and distribution in the country. According to the Republic of Zambia (2019), the plan also prioritized generation projects which, when developed, would add a total of 4,337 Megawatts to the national grid by 2030. The estimated cost of implementing the plan is US\$9.5Billion for generation project, US\$2.3Billion for transmission projects and US\$179.7Million for distribution projects. The total estimated cost is, therefore, US\$12.1Billion by the end of 2030 (Republic of Zambia, 2011). It is however, doubtful as to whether the plan would achieve its objectives, considering the pace at which it is being implemented and also the economic challenges the country is going through.

According to Nkuwa (2019) the Ministry of Energy and ZESCO had come up with mitigating measures to accelerate the implementation of projects which include Chishimba falls, a 15MW hydro power project by fourth quarter of 2023. He disclosed that the government had received US\$41Million from the Germany government.



Kafue Gorge Lower under construction

Source (Mwila et'al, 2017)



Musonda Falls Hydropower Station -Source: Lusaka times (2020)

4.9 Transmission development plan

Transmission

With regard to transmission, one of the key informant revealed that the Lusaka Transmission and Distribution Rehabilitation Project (LTDRP) was a major investment at Transmission and Distribution level to improve quality of supply in both low and high density areas.

Other development projects that ZESCO was undertaking in the transmission sub-sector included the replacement of protection relays for generators and transformers at Kariba, Victoria falls, Musonda falls and Chishimba falls power stations. The company was also installing new protection and control relays at major substations and on transmission lines. In addition, ZESCO was implementing the substation control system for 33Kv main sub-station. This project involves the replacement of the existing control system at all the major transmission substation with a modern control system. For instance, a substation control system would be installed at Luano and existing SAT and PSCN control systems at Kitwe and other substations. The old electro mechanical relays would be replaced during the project (ZESCO, 2020).

4.10 Distribution development plans

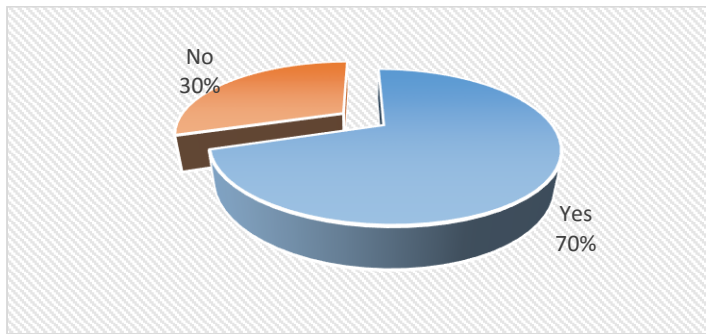
According to ZESCO (2020), the government of the Republic of Zambia had allocated USD 69 million from the USD 750 million Eurobond proceeds towards the rehabilitation and expansion of the distribution infrastructure network. This would carter among other things, the construction of substations, upgrading of existing substations, replacement of obsolete switch gears, and upgrading of the high tension underground cables in major towns.

Apart from these projects which would be funded by the government, the company had financed a number of distribution projects such as the upgrading of the Luangwa 66/11kv substation in Kitwe, upgrading of skyways in 66/33/11kv substation in Ndola and construction of Kamwena 33/11kv substation in Lusaka. The total cost of the ZESCO financed projects is USD 15.7million. With regard to Lusaka, ZESCO was implementing the Lusaka Transmission and Rehabilitation Project which aimed at installing new protection and control relays at the major transmission lines (ZESCO, 2020). This information is similar to the information given by one of the key informants who indicated that the main purpose of the LTDRP is to increase the transmission, sub-transmission and distribution capacities of our lines and substations within Lusaka that would ultimately reduce forced outages occasioned by an overload system.

Responses from respondents on whether they were aware about what ZESCO was doing to reduce power outages in Lusaka's high density areas.

Figure 4.10.5. Awareness about ZESCO’S efforts to reduce power outages in Lusaka’s high density areas

Findings:



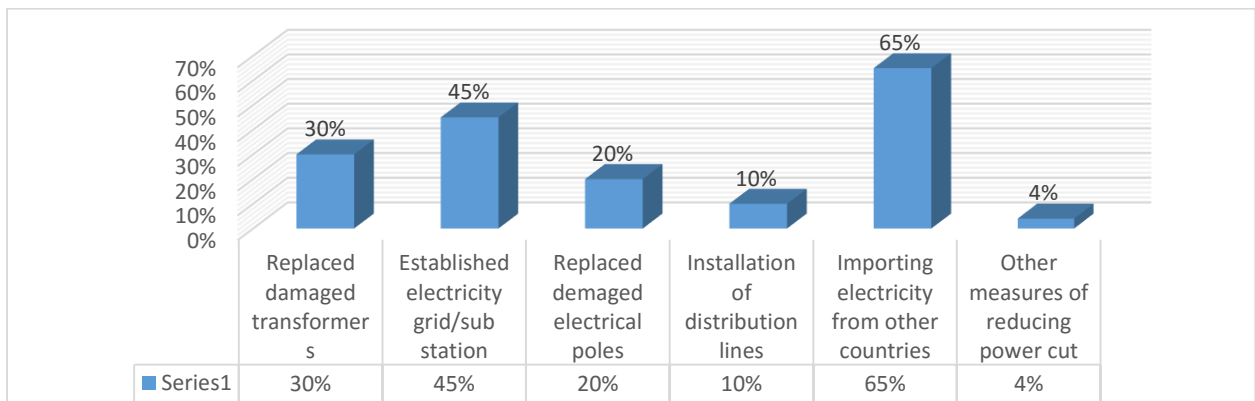
Source: Field Data (2020)

Out of 190 residents who participated in the study, 133 (70%) indicated that they were aware about what the ZESCO was doing to reduce power outages in their area while 57 (30%) were not aware.

Discussion

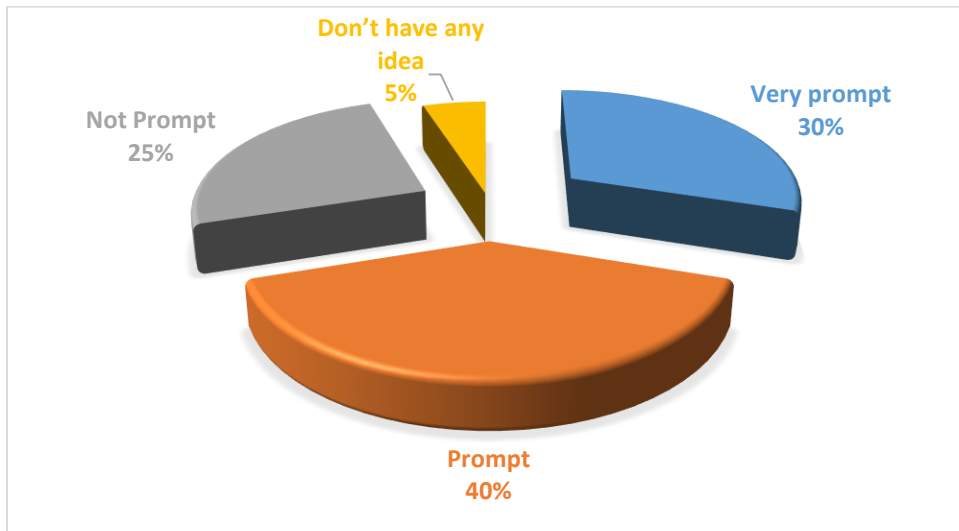
Figure 4.11.5. Indicates that most people in Kanyama and Mtendere were aware about what ZESCO was doing in order to deal with the problem of power outages affecting their areas.

A follow up question was asked to the heads of households on what exactly ZESCO was doing to reduce power outages and the results were as shown below:



Source: Field data 2020

Figure 4.10.6. Indicating ZESCO's response to customer complaints



Source: Field Data (2020)

From the figure 4.10.6. above, it clearly shows that 76 respondents representing (40%) indicated that ZESCO's response to customer complaints was prompt, 57 respondents representing (30%) indicated that ZESCO was very prompt in responding to customer complaints. Only 48(25%) indicated that ZESCO was not prompt to respond to customer complaints, while 9 (5%) of respondents stated that they had no idea about the question. These results show that generally ZESCO was responsive to customer's complaints. This implies that the company was putting in some effort to deal with power related challenges demanded by the residents.

Key informants added that in terms of responding to emergencies such as problems with the service cable, transformer faults, theft of equipment and burnouts, ZESCO was very quick and does respond within 24hours. Another informant said a call which concerns the above problems is classified as a danger call. He elaborated that the system was computerized and there are people responsible for handling the control room. So if the transformer is burnt they first identify the area and the people at the control room are informed to switch off the line which has a burning transformer. The personnel are then directed to go and isolate the line so that the people in that area are not kept in darkness. They, then, bring back the line to check if it is something they can manage or it needs replacement. From the above description where complaints come from the customers to the service providers, an interaction between the service providers (ZESCO) and its customers (heads of households) is established. This interaction between the two parties is very important in that it accentuates the continuous

monitoring of customer satisfaction by service providers. Through these interaction, customers also have an opportunity to make credible suggestions to the service providers (Sampa, 2003). This, in turn, helps the service providers to provide better services to their customers.

Table 4.10.5: Respondents views on whether there were any sub-station and transformers installed or upgraded by ZESCO to reduce power outage in the area.

Responses	Frequency	Percentage
Yes	152	80
No	38	20
Total	190	100

Source: Field data (2020)

The table 4.10.5 above shows the residents’ responses to the question seeking to establish if there were any sub-stations and transformers installed or upgraded by ZESCO to reduce power outage in the area. Of the 190 respondents, 152, representing (80%) indicated Yes to the question while 38 respondents, representing 20%, indicated No to the question.

Discussion

The results show that the majority of the respondents (152=80%) agreed that ZESCO had installed substations and transformers in the area. A key informant from the Lusaka Central regional office admitted that ZESCO had managed to put up transformers and a 33/11kv substation in Kanyama, Kamwena and Chawama. In Lusaka East, ZESCO had upgraded Chelstone substation, Ngwelele substation, chainda and the latest one was Avondale substation from 33/11KV to 132 /11KV.

Table 4.10.6. Respondents’ views on whether they were receiving notices from ZESCO about load shading

Finding

Responses	Frequency	Percentage
Yes	171	90
No	19	10
Total	190	100

Source: Field data (2020)

Table 4.10.6 above shows responses given by the respondents on whether they received notices from ZESCO about load shading. Out of the total number of 190 respondents who participated in the study, 171 which translated as 90%, indicated yes to the question, while 19 respondents representing 10%, indicated No to the question.

Discussion

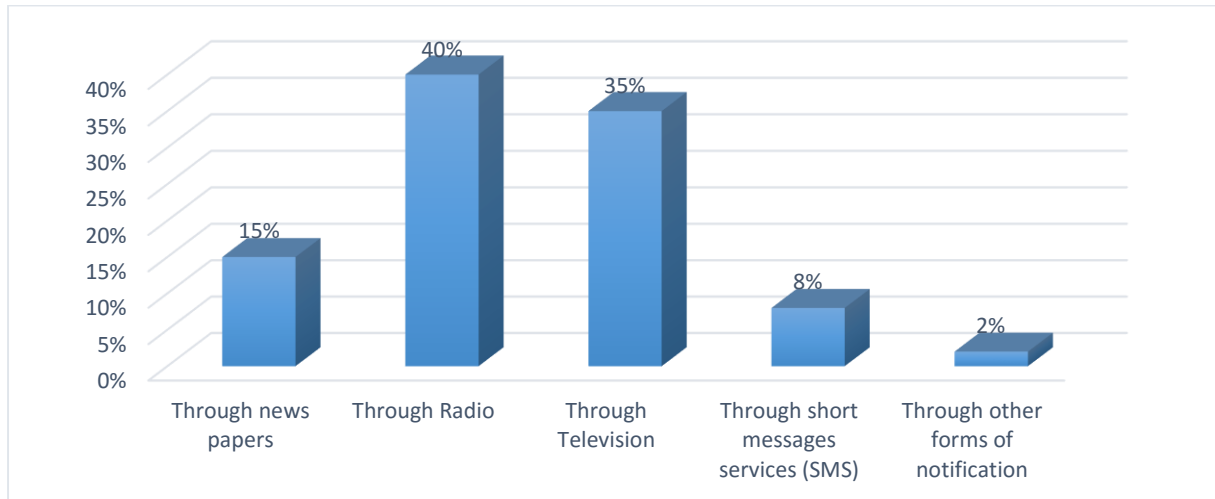
This means the majority of the respondents (171=90%) acknowledged receiving notices from ZESCO about load shedding which is likely to occur in their area.

When asked about the method that ZESCO uses to notify residents about load shedding, 76 of the 190 respondents, representing 40%, chose radio, 66 respondents representing 35% indicated television while 29 representing, 15% indicated newspapers. 15 respondents, representing (8%), chose SMSs. Only 4 respondents, representing 2%, indicated that they were informed through other means of communication. Figure 4.10.7 illustrates the response from the respondents.

Methods of notifying residents

Figure 4.10.7. Indicates the methods of notifying residents about load shading by ZESCO

Finding



Source: Field Data (2020)

Discussion

From figure 4.10.7 above, The majority of the respondents (76=40%) viewed radio as a method that ZESCO used to notify them about power outages that are likely to happen in their area. This is because radio is the most common and longest tool that has been used to disseminate information for a long period of time. A radio is also affordable and therefore accessible by the majority of the citizens including those in rural areas as compared to other forms of media.

However, Mbale (2015) revealed that ZESCO uses different methods of communication. These include but not limited to the following:

1. Newsletters-these are circulated through customer service center to customers to update them about the products and services and the happenings within the power utility company.
2. Organizational/annual reports about the state of the organization which covers performance in the previous year, trends achievements and challenges among others.

3. Notice boards-usually host internal mails and memoranda. These are found in operational office space.
4. Short message broadcasts-used to communicate with customers on planned outages, maintenance works and other information that will be beneficial to customers.

4.11 Conclusion

This chapter discussed the efforts by ZESCO to reduce power outages in Lusaka's high density areas. The study has revealed that among some of the efforts that ZESCO was making to reduce power outages include the building of power stations such as the Kariba North power station and upgrading of the Musonda falls power station from 5MW to 10 MW, among other projects.

In addition to this, ZESCO was carrying out reinforcements. This basically involves putting up new transformers in order to offload some existing customers to the new ones. This helps to avoid overloading customers on one transformer, thereby reducing power outages.

The study has also highlighted that ZESCO was also building and maintaining some transmission lines. These transmission lines transmit electricity over relatively long distances usually from the central generating station to the main substation.

Importation of power from other countries was another measure taken by ZESCO to increase power generation and transmission in order to deal with power outages. For instance, ZESCO had engaged its counterpart in South Africa (ESKOM) to import about 300MW of power for a period of six months as a short term measure.

Other measures that ZESCO had put in place were that it had engaged various stakeholders. These includes IPPs, such as Ndola Energy, Lusemfwa hydro Power, Mamba Collieries Limited and Bangweulu solar Company at the Lusaka Multi Facility Economic Zone. Others includes Zengamina Company, North Western Energy Company (NWEC), Itezhi Tezhi Power Corporation and Kariba North Bank Extension.

In order to reduce dependence on hydro power sources, ZESCO had built a 50MW solar power plant at the Lusaka South MFEZ, while the Japanese were engaged to put up a 300MW solar power project in Mpika and the Copperbelt province respectively. The study also revealed that Zambia had a potential of 5.5kw per hour M² per day with an

approximately 3,000 sunshine hours per year. This implies that the country has the potential to generate electricity from solar which is available in abundance.

The study has further revealed that the government of Zambia and the German Development Bank were implementing the Global Feed in Tariff programme to fulfill the government's Renewable Energy Feed in Tariffs (REFIT) strategy. This strategy aimed at harnessing the renewable energy sector's potential to drive economic growth and improve quality of life of all Zambians. The REFIT promotes diversification of the power sector by adding a portfolio of small and medium size renewable energy projects in the short term.

In order to diversify the generation sector by investing in alternative energy sources, ZESCO had formed a new department to look at renewable energy. In addition to this ZESCO, was putting up solar farms at both the Kafue Gorge and Kariba North Bank stations as a way of improving the generation mix.

In terms of development plans, the study has shown that ZESCO does have development plans in the generation, transmission and distribution segments. For instance, in the generation segment, ZESCO was building the Kafue Gorge lower that would add 750MW of power to the national grid, as earlier alluded. Another development project being carried out was at Lusiwasi phase 1 and 2, with an installed capacity of 15MW and 8 MW respectively.

In order to implement the 2008 NEP and now the 2019 NEP, government developed the Power System Development Master Plan. This plan provides a blue print for the power system in the country up to the year 2030.

With regard to the transmission segment, ZESCO was implementing the Lusaka Transmission Rehabilitation project (LTRP) to improve the quality of supply in both low and high density areas. The company was also implementing the replacement of protection relays for generators and transformers at the Kariba, Victoria Falls, Musonda and Chishimba falls.

In terms of distribution plans, USD 69 Million from the USD 750 Million Euro bond proceeds was allocated towards the rehabilitation and expansion of the distribution infrastructure network. This catered for the construction of substations, replacement of obsolete switch gears and upgrading of high power tension underground cables.

Other efforts, as revealed by the study, are that ZESCO is prompt in responding to complaints such as transformer burnouts, problems with the service cables among others. The study has

also revealed that ZESCO does notify its customers about the impending power outages using the radio as a tool for communication.

CHAPTER FIVE

IMPACT OF THE EFFORTS BY ZESCO TO REDUCE POWER OUTAGES IN LUSAKA'S HIGH DENSITY AREAS

6.0 Introduction

The previous chapter presented the findings on the effort by ZESCO to reduce power outages in Lusaka's high density areas. This section presents the findings on the Second objective, which reads: To interrogate the impact of the efforts by ZESCO to reduce power outages in Lusaka's high density areas. To achieve this objective this chapter is divided into five sections. The first section is the introduction of the chapter; the second section is a presentation on the social and economic impact of the efforts by ZESCO to reduce power outages in Lusaka's high density areas of Kanyama and Mtendere. The third section analyzes the impact of ZESCO's effort on the education sector in Kanyama and Mtendere high density areas. The fourth section assessed the impact of ZESCO'S efforts on the health sector in Kanyama and Mtendere high density areas. The fifth section is the conclusion of the chapter which summarizes the lessons learnt from the presentation.

6.1 Impact of the efforts by ZESCO to reduce power outages on the social and economic life of the people of Kanyama and Mtendere high density areas.

This study has revealed that as a result of the efforts by ZESCO such as building of more power station to increase the generation of power, power outages had reduced in both Kanyama and Mtendere high density areas. For instance, these areas were experiencing at least 16 hours of power outages every day. However, due to the efforts by the power utility company to increase the generation capacity of some power stations like Kafue North Bank Power station, power outages had significantly reduced to less than 2 hours per day while in some places it had become none-existent. This finding is in line with Nkuwa (2020) who revealed that the national power deficit remained at 810 megawatts, with the construction of the 750 megawatts, 150 megawatts would be brought on board in December, 2020 while the remaining 450 megawatts would be added to the national grid by March, 2021. This has significantly reduced load shedding to the minimum impacting positively on the households of Kanyama and Mtendere high density areas as they are now able to use their electrical appliances like radios, television and fridges among others.

The study also revealed that reduction in power outages due to the efforts on the part of ZESCO, resulted in reduced cases of some houses getting burnt due to the increased use of candles for lighting in both Mtendere and Kayama areas.

Socially, the study has also revealed that people in the two high density areas were now able to use their leisure time to watch or listen to their favorite programmes due to the reduction in power outages in their areas. Prior to these measures by ZESCO to reduce power outages, one of the respondents indicated that, “we look as if we are lost, we can’t even watch zee world.” Similarly, another respondent stated that, “we sleep around 20 hours and when we wake up we still do not find power.” This is so unbearable.” The reduction in power outages has made the people happier because the use of electricity has made their lives easy as compared to the period they experienced prolonged power outages. For instance, the use of electricity eliminated the need to fetch firewood or the use of charcoal, unhealthy Kerosene lamps, which also means improved health condition for the people and also increased basic comfort. Further, it sped up cooking time and allowed households to conveniently shift activities from day time to night time.

The efforts by ZESCO to reduce power outages impacted some communities especially with regard to criminal activities. Kanyama and Mtendere areas frequently experienced increased criminal activities like theft, fighting, robbery, murder, including rape cases which were happening especially during the night, but these criminal activities were now on the decline. This is because reduction in power outages had resulted in increased security during the night as electricity provides illumination making people feel secure when moving during the night.

Power outages were also said to have disrupted the supply of water to households, especially those who depended on piped water from the water utility company. A comparative observation and analysis on the two high density areas before and after the efforts by the power utility company-ZESCO were implemented indicated that this state of affairs had also reduced. Residents were able access clean drinking water for a longer period of time as the water utility company which largely relies on electricity to pump water to the communities was able to supply the water efficiently. What this means is that the provision of clean water minimized the risks of diseases such as dysentery and diarrhea, and improved health conditions in the community.

Reduction in frequent power outages in both Mtendere and Kanyama areas reduced the cost of living for the residents as many people who had resorted to using charcoal which was

increasingly becoming expensive due to high demand, were now able use their electrical appliances like stoves to cook their food. This enabled them to save time for other equally useful activities. Further, the reduced usage of charcoal implies that there was a reduction in the levels of pollution caused by charcoal. The world health organization (WHO) estimated that about 1.5 million premature deaths occur annually due to indoor pollution from the use of solid fuels including biomass. Further, emitted smoke from biomass fuels have since been pinpointed as the cause of many respiratory infections and cataracts in some rural areas (Amad, 2015).

The study has also revealed that prior to the efforts which ZESCO had implemented to reduce power outages in the two high density areas, power outages had significantly disrupted the operation of some businesses. This eventually led to the loss of profits for many businesses. For instance, Wamuwi et'al (2019) reveled that salon owners during the load shedding period experienced water supply cut off, many hours were lost up to 8 hours, per day. On the other hand, the bakery had their dough getting spoiled as electricity supply was interrupted in the middle of baking bread and other products. Similarly, stationery shops faced major challenges as they depend on electricity to offer their printing, photocopy and internet browsing services. The emails which they normally send to their clients using computers were equally affected as they are power dependent. However, as a result of the efforts by ZESCO, these small businesses like barbershops, salons, among others which were badly affected to an extent of being forced to close early, were able to operate normally. The losses they incurred due to power outages had become a thing of the past. The owners of these small enterprises were now able to generate some income from the improved power supply by ZESCO by offering their normal services and also extending other services such as phone charging, car battery charging, wiewding and computers to their clients. This contributed to the improvement in their standard of living.

What was also notable about the impact of the efforts by ZESCO to reduce power outages in the two areas is that it stimulated self-employment and increased productivity of home business through higher revenues of existing businesses and the creation of new ones. operations marginally extended their operating hours and other range of products and services. Further customers who were travelling to distant places in search of stable power in order to access electricity dependent goods and services reduced as they were able to purchase the goods and services they wanted within their own geographical proximity.

On the other hand, it is argued that electricity enables people to use surplus resources made possible through their entrepreneurship that contributes to the emergency of credit and saving schemes based on the newly available cash (ZIPAR, 2015). For instance, the people in the two high density areas were able to participate in the community village banking due to the cash generated from their businesses. This enabled them to have access to cheaper loans provided from such saving schemes at lower interest rates compared to the banks.

Reduction in power outages due to the efforts by ZESCO contributed to the credibility of some firms as they were able to win business contracts due to their ability to meet their business obligations.

Due to the efforts put in place by ZESCO to reduce frequent power outages in Lusaka's high density areas, it was noted that in the two high density areas of Kanyama and Mtendere areas, some establishments no longer experienced idle labor costs and over time labor costs. The cost arising from labor was defined as the amount of money paid to a worker otherwise not working due to power outages. On the other hand, over time labor cost was defined as the amount of money paid to a worker for extra hours worked after load shedding (Mwila et'al, 2019). This implies that the reduction in Power outages due to the efforts by ZESCO resulted in less expenditure on the part of the employers of some businesses on labor costs because prior to the implementation of some measures to reduce power outages, workers were asked to work beyond their standard working hours.

Similarly, businesses which had resorted to the use of alternative sources of energy such as backup generators, solar panels and invertors among others were seen to be operating normally using the power supplied by ZESCO. This implies that the cost of doing business on their part had reduced. Amad (2016) argued that uninterrupted access to electricity lowers costs for business and encourages investment therefore facilitating economic growth.

Furthermore, firms could no longer incur costs of raw materials that go to waste and damage to equipment resulting from sudden power outages (ZIPAR, 2015). In the long run the number of workers deemed redundant was reduced as firms operated at full capacity. This reduced the level of unemployment as the majority of the employees were maintained by the firms. This also implies that there was a reduction in the levels of poverty because people had an income to acquire basic needs for their households. The GNESD (2007) highlighted that universal access to electricity is not only critical for improving living standards but deemed indispensable for eradicating poverty and achieving sustainable development.

6.2 Impact of the efforts by ZESCO to reduce power outages on the education sector in Kanyama and Mtendere high density areas

In the area of the education, reduction in power outages resulted in increased education possibilities as school going children, especially those in examination classes, were now able to study either at their homes or their nearby schools during night times. Parents, too, expressed happiness and confidence that the performance of their children in the final examinations would not be severely affected as they now had electricity most of the times which made it easy for their children to study even at night. This finding is in line with Gustavsson (2007) who revealed that electricity enhances literacy because students can read and study even when there is no natural light. In addition to this, reduction in power outages, also enhanced distance learning for both pupils and students. For instance, pupils were able to follow their educational programmes on EDU station, a channel specifically designed to televise lessons to learners from grades 1 to 12 throughout the country in order to help pupils catch up with school work following the negative impact of Covid 19 on the education sector.

Reduction in power outages also facilitated the use of Information and Communication Technologies (ICT) such as television, computers and internet, audio tapes, projectors, printers, radio and copy machines among others in schools. These were used to facilitate the teaching process as they acted as Learning and Teaching Aids (LTAs). UNESCO also highlighted that ICT Can improve student achievement, improve access to schooling, increase efficiencies, and reduce costs, enhance student ability to learn, and promote their lifelong learning, and prepare them for a globally competitive workforce. Moreover, the use of the internet serves as the best tool for exposing students to a broad set of information and experiences that can become central to their education, socialization and future employment (Sovacool, 2014).

Another impact of the efforts by ZESCO to reduce power outages in Lusaka's high density areas is that in some well to do schools, it improved school facilities with fans and other amenities that made them more comfortable. This is very important as it contributed to teacher retention in these schools.

6.3 Impact of the effort by ZESCO to reduce power outages on health sector in Kanyama and Mtendere high density areas

Reduction in power outages as a result of the measures put in place by ZESCO had some positive impact on the health facilities available in both Mtendere and Kanyama high density areas. Service delivery to the people improved as hospitals and clinics were able to continue with their operations during the night. The residents especially expectant mothers, were no longer required to go with candles when going to the health facilities, especially at night, because the health facilities which did not have backup generators to supply electricity now had reliable power supplied to them most the times. In addition, reduction in power outages also improved health care provision because vaccines and medication were safely preserved in hospitals and clinics. Hospitals and clinics were able to use x-ray machines, ultra sound and scanners in their operations.

6.4 Conclusion

In conclusion, the impacts of the efforts by ZESCO to reduce power outages in Lusaka's high density areas can be categorized in to social and economic impact, impact of the efforts on the education and health sectors in Kanyama and Mtendere high density areas. In terms of the impact of the efforts by ZESCO to reduce power outages on the social and economic life, the study has demonstrated that load shedding which was previously lasting for 16 hours per had drastically reduced to less than 2 hours a day while in other places it was almost nonexistent. This impacted positively on the livelihood of the people of both Kanyama and Mtendere high density areas as the residents in these areas were now able to use electrical equipment like radio, television, fridges and stoves.

The study has also demonstrated that due to the efforts by ZESCO to reduce power outages, cases of houses getting burnt due to the frequent use of candles had also reduced. In addition, reduction in power outages also contributed to reduced criminal cases such as fighting, murder, stealing and rape cases which frequently took place especially at night.

The other impact of the efforts by ZESCO to reduce power outages in the two areas is that it stimulated self-employment and increased productivity of home business through higher revenues of existing businesses and the creation of new ones.

Furthermore, firms could no longer incur costs of raw materials that go to waste and damage to equipment resulting from sudden power outages. In the long run the number of workers deemed redundant was reduced as firms operated at full capacity.

In the education sector, reduction in power outages resulted in increased education possibilities as school going children, especially those in examination classes, were now able to study either at their homes or their nearby schools during night times while in the health sector Service delivery to the people improved as hospitals and clinics were able to continue with their operations during the night.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

7.0 Introduction

The purpose of this chapter is to present the conclusion and recommendation of the dissertation. In order to achieve its objectives, the chapter will begin by presenting the conclusion and then the recommendations.

7.1 Conclusions

The conclusion of the dissertation is presented in accordance with the objectives of the research. The first specific objective of the research was to evaluate the efforts by ZESCO to reduce power outages in Lusaka's high density areas. The finding shows that ZESCO was making a lot of efforts to reducing power outages by building more power stations. For instance, ZESCO was building the Kariba North power station which is expected to add 750MW to the national grid. In addition, ZESCO was upgrading the Musonda falls from 5MW to 10MW among other projects. In addition, ZESCO was undertaking system reinforcement by putting more transformers close to the load centers. These include Chelstone sub stations, Ngwelele substation, chainda and Avondale sub stations in the Lusaka East Region, while in Lusaka Central Region Kanyama, Kamwena and Chawama substations were being upgraded to 33/11kv sub stations. Apart from carrying out system reinforcement, ZESCO was building more transmission lines to increase power transfer capacities from across the grid. In order to supplement the power supply in the country, ZESCO was also importing power from other countries such as South Africa (ESKOM) where they imported about 300MW of power in the year 2019.

In order to ensure that the country's generation capacity matches the ever increasing load demand, ZESCO had engaged various stake holders. These included Independent Power Producers such as Maamba Collieries, Ndola Energy Company, Bangweulu Solar Company at the Lusaka Multi Facility Economic Zone. Others include the Lusemfwa Hydro Power Company, Zengamina Power Company and the North Western Energy Company. These IPPs supplement the efforts of ZESCO by generating and selling power to ZESCO under the Power Purchase Agreement.

The study demonstrated that ZESCO had also made some stride to reduce dependence on hydro power sources by building a 50MW solar power plant at the Lusaka South Multi Facility Economic Zone. Solar farms were also being established at both the Kafue lower and the Kariba North Bank Power stations as a way of improving the generation mix. In addition to this, ZESCO, in partnership with the Japanese, was putting up a 300MW solar power plant in Mpika and the Copper belt. The power produced from these solar plants will be added to the national grid and hence contribute to the reduction of power outages in the country and in the high density areas in particular. Other measures put in place include the implementation of the Global Feed in Tariff programme. This is a joint partnership between the government of Zambia and the Germany development Bank to fulfill the government Renewable Energy Feed in Tariff (REFIT) strategy. This strategy is anticipated to promote the diversification of the power sector by adding a portfolio of small and medium size renewable energy projects in the short term. Further, in order to promote alternative sources of energy ZESCO had formed a new department to look at renewable energy.

Other measures which this study has revealed in order to reduce power outages include the formulation and implementation of the development plans in the generation, transmission and distribution sub sectors. In the generation sub sector, for example, ZESCO was carrying out a project at Lusiwasi phase 1 and 2, with an installed capacity of 15 and 8MW respectively.

In an effort to effectively implement the 2008 National Energy Policy and now the 2019 National Energy Policy, the government of the Republic of Zambia developed the power system development master plan. The main objective of this plan is to provide a blue print for the power system in the country up to the year 2030. The plan highlights least cost expansion options for generation, transmission and distribution in the country.

In the transmission sub sector, ZESCO was implementing the Lusaka Transmission and Distribution Rehabilitation Project to improve the quality of electricity supply in Lusaka, while in the distribution sub sector, government used about USD69 Million from the USD 750 Million Eurobond proceeds towards the rehabilitation and expansion of the distribution infrastructure network. This included the construction of substations, replacement of obsolete switch gear and upgrading of high tension underground cable.

The second objective of this study was to interrogate the impact of the efforts by ZESCO in reducing power outages in Lusaka's high density areas. The study has demonstrated that the efforts by ZESCO to reduce power outages in Lusaka's high density areas had impacted

positively on the social and economic way of life of people. The measures also impacted positively on the education and health sectors of the two high density areas. This study has demonstrated that though power outages were very frequent in high density areas and lasted for at up to 16 hours every day, as a result of the efforts by ZESCO, power outages reduced to less than 2 hours per day while in some areas it was almost non-existent. Residents were now able to use electrical appliances such as fridges, stoves, radios and televisions in their homes. Reduction in Power outages led to the reduction in criminal activities such as theft, robbery, fighting, murder and rape cases. This is because electricity supplied by ZESCO provided illumination especially during night times thereby making the people to move freely and secure.

In the area of the education, reduction in power outages resulted in increased education possibilities as school going children, especially those in examination classes, were now able to study either at their homes or their nearby schools during night times. In addition to this reduction in power outages also enhanced distance learning for both pupils and students.

In the health sector, reduction in power outages as a result of the efforts by ZESCO improved Service delivery to the people as hospitals and clinics were able to continue with their operations during the night. The residents especially expectant mothers, were no longer required to go with candles when going to the health facilities, especially at night, because the health facilities which did not have backup generators to supply electricity to the facilities now had reliable power supplied to them most the times. In addition, reduction in power outages also improved health care provision because vaccines and medication were safely preserved in hospitals and clinics. Hospitals and clinics are able to use x-ray machines, ultra sound and scanners in their operations.

7.2 Recommendations

Policy recommendation

1. ZESCO should consider introducing the cost reflective tariffs in order to attract private sector investment in the electricity supply industry. However, mechanisms to protect low income consumers could be put in place.
2. ZESCO should consider de-bureaucratizing the process of electricity connection.

3. The Ministry of Energy should formulate policies that will attract private sector investment in alternative sources of energy to avoid overdependence on hydro power which is susceptible to climate change.
4. ZESCO should consider making electricity connection free or subsidize the connection fees to electricity. This will enable a lot of households to get connected to electricity.
5. ZESCO should also exploit the full potential of other sources of energy such as thermal power, wind energy, nuclear power and solar energy in order to increase its generation mix. This will prevent the country from being over dependent on hydro power which is susceptible to climate variability.
6. Government should try to break ZESCO'S integrated structure into natural component parts such as generation, transmission, and distribution.
7. ZESCO should consider development of long term power strategies and actions for supply security, energy efficiency, demand –side management and the provision of technical assistance for policy review, and the establishment of an appropriate legal and regulatory framework.
8. ZESCO should consider investing in the construction of more power stations especially in the Northern part of Zambia where the rainfall pattern is relatively stable.
9. ZESCO should engage both local and international lending institutions to fund energy projects at affordable rates especially to the Independent Power Producers who would in turn generate more power for the country's economic stability.

An area of future research

Although this research has provided an insight into the efforts by ZESCO to reduce power outages and their impacts in Lusaka's high density areas, there is need to look at the Rural Electrification Authority's efforts to increase access to electricity in rural areas where the access to electricity is still very low. This could be an area of focus for future research.

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APPENDEIX: 1.

THE INTERVIEW GUIDE FOR ZESCO OFFICIALS

Dear informant,

My name is Blessing Kaela Pambwe, a post graduate student at the University of Zambia in the School of Humanities and Social Sciences. I am conducting a research on the energy policy in Zambia: **The effort by ZESCO to reduce power outages and their impacts in Lusaka’s high density areas.** This research is aimed at enabling me to fulfill the requirement for the award of a degree in Master of Public Administration (MPA). You have been randomly selected as one of the key informants to this research. I will be very grateful if you could spare some few minutes to answer a few questions. The information that you will provide will be treated as confidential and will only be used to for my MPA dissertation. Your participation and openness in answering the questions will be highly appreciated.

BACKGROUND INFORMATION

Date of the interview: -----

Starting time of the interview: -----

Ending time of the interview: -----

Title of the key informant: -----

Gender:

- 1. Male ()
- 2. Female ()

Position held in the organization: -----

EFFORTS BY ZESCO TO REDUCE POWER OUTAGES IN LUSAKA’S HIGH DENSITY AREAS

Questions for key informants from ZESCO.

- 1. Recently, Zambia has been experiencing frequent power outages which affected the industries, houses and the business community. What is ZESCO doing to reduce these power outages especially in Lusaka’s high density areas? -----

- -----
2. What institutional framework has ZESCO put in place to improve power supply in Lusaka's high density areas? -----

 3. Does ZESCO have committees which look at specific programmes of reducing power outages? If any, what are their objectives? -----

 4. Has the company engaged stakeholder such as the private companies to help deal with power outages? If yes who are these stakeholders and what important role have they played to help avert power outages? -----

 5. What legislation is in place to help attract public and private investment and participation in the power sector? -----

 6. What deliberate policy is in place to deal with power outages in Lusaka's high density areas?-----

 7. Are there any substations that ZESCO has installed or upgraded in high density areas to deal with power outages? If yes give any examples -----

 8. Does ZESCO receive any complaint about power outages from the residents living in Kanyama and Mtendere and what do you do to address these problems when they occur?-----

9. How prompt or how long does it take your company to respond to emergencies such as problems with the service capable, theft of the equipment and burnouts of transformers these high density areas of Lusaka city?-----

10. Recently, the power outages that the country experienced were attributed to low water level at the Kariba and Itzhi Tezhi dam. Is there anything that you are doing to reduce dependence on hydro power so as to avoid power outages? -----

11. Does ZESCO have any development plans that lay out the investments required in all segment of power sector such as generation, transmission and distribution, especially in Lusaka’s high density areas?-----

12. What steps have been taken by ZESCO to diversify its generation portfolio by investing in other alternative sources of energy such as geo-thermal, solar and wind energy to complement hydro resource?-----

13. How far has ZESCO gone with the developing of isolated grid systems with cost reflective tariffs? -----

14. Why has ZESCO found it difficult to adopt a cost reflective tariff? -----

IMPACT OF THE EFFORTS BY ZESCO TO REDUCE POWER OUTAGES IN LUSAKA’S HIGH DENSITY AREAS

Questions for key informants at ZESCO.

15. What changes do you think have occurred as a result of ZESCO’S effort to reduce power outages in Lusaka’s high density areas? -----

16. How has improvement in electricity supply affected the consumers in Lusaka's high density areas? -----

17. Recently, the energy regulation board approved ZESCO'S request to move towards a cost reflective tariff. How is this helping you to alleviate the power outages in the affected communities of Lusaka's high density areas? -----

18. How have reduced power cuts affected security in Kanyama and Mtendere areas? -----

19. How have reduced power cuts affected businesses, industrial activities especially the small scale industries? -----

THANK YOU.

APPENDIX: 2.

QUESTIONNAIRE FOR HEADS OF HOUSEHOLDS

Dear informant,

My name is Blessing Kaela Pambwe, a post graduate student at the University of Zambia in the School of Humanities and Social Sciences. I am conducting a research on the **energy policy in Zambia: Effort by ZESCO to reduce power outages and their impacts in Lusaka's high density areas**. This research is aimed at enabling me to fulfill the requirement for the award of a degree in Master of Public Administration (MPA). You have been randomly selected as one of the respondents to this research. I will be very grateful if you could spare some few minutes to answer a few questions. The information that you will provide will be treated as confidential and will only be used to for my MPA dissertation. Your participation and honesty in answering the questions will be highly appreciated.

Thank you in anticipation.

INSTRUCTIONS

1. Do not write your name on the questionnaire.
2. Answer questions by ticking in the spaces provided.
3. For those questions that require explanation, write in the spaces provided.

PART A: BACKGROUND INFORMATION

1. What is your gender?
 - a. Male ()
 - b. Female ()
2. Age
 - a. 18-25 ()
 - b. 26-35 ()
 - c. 36-45 ()
 - d. 46-55 ()
 - e. 56 and above ()
3. Marital status
 - a. Single ()

- b. Married ()
 - c. Widowed ()
 - d. Divorced ()
4. Highest level of education attained.
- a. Never been to school ()
 - b. Primary education ()
 - c. Junior secondary education ()
 - d. Senior secondary education ()
 - e. Tertiary education ()

SOCIAL- ECONOMIC STATUS

5. Are you currently employed?
- a. Yes ()
 - b. No ()
6. If your answer to question 5 is yes, what type of employment?
- a. Formal ()
 - b. Informal ()
7. What is your monthly income?
- a. Below K1,000 ()
 - b. Between 1,000-3,000 ()
 - c. Above K3,000 ()

PART B:EFFORT BY ZESCO TO REDUCE POWER OUTAGES IN LUSAKA’S HIGH DENSITY AREAS

Questions for residents in selected areas

8. Are you aware about what ZESCO is doing to reduce power outages in your area?
- a. Yes ()
 - b. No ()
9. What exactly has ZESCO done to reduce power cuts in your area?
- a. Replaced damaged transformers ()
 - b. Established electricity grid/sub-station. ()
 - c. Replaced damaged electrical poles. ()
 - d. Installation of distribution lines. ()

- e. Importing electricity from other countries. ()
 - f. All of the above. ()
 - g. Other, specify-----
10. What has ZESCO done to inform residents about power cuts which are likely to happen in your area? -----
11. From the list below, what security measures has ZESCO put in place to prevent vandalism or theft of power equipment?
- a) Employed security officers to protect electricity infrastructure ()
 - a. Sensitized community members through the radio, television and social media ()
 - b. Installed cameras at electricity infrastructure. ()
 - c. Taken people arrested of vandalism to court ()
 - d. Engaged different stakeholders. ()
 - e. Other, specify-----
-
12. How do you rate ZESCO in terms of responding to customer complaints to replace damaged electrical equipment?
- a. Very prompt ()
 - b. Prompt ()
 - c. Not prompt ()
 - d. I don't know ()
13. Give reasons for your answer in question 12? -----

14. With increased population in your area, what measures is ZESCO putting in place to expand capacity for power supply and avoid power cuts in your area? -----

15. What maintenance works has ZESCO carried out in your area aimed at reducing power outages?-----

16. Are there any sub stations or transformers in your area that have been installed or upgraded by ZESCO to reduce power outages?

a. Yes ()

b. No ()

17. If your answer to question 16 is yes, give an example? -----

18. What other improvements has ZESCO made to provide electrical energy in your area?

19. Is there any new equipment that ZESCO has installed in your area to improve on electricity supply?

a. Yes ()

b. No ()

20. Give any example to support your answer in question 19? -----

21. To what extent have you been receiving notices from ZESCO about load shedding in your area?

a. To a great extent ()

b. To a moderate extent ()

c. To a less extent ()

d. To no extent ()

22. What methods have been used to notify you about loading shedding in your area?

a. Through newspaper ()

b. Through radio ()

c. Through television ()

d. Through short Message service (S.M.S) ()

e. Other, specify -----

23. What suggestions would you give to ZESCO to help reduce power outages in your area?-----

**PART C: IMPACT OF THE EFFORTS BY ZESCO TO REDUCE POWER OUTAGES
IN LUSAKA'S HIGH DENSITY AREAS**

Questions to residents in selected high density areas.

24. Do you experience power outages in your area?

- a. Yes ()
- b. No ()

25. How frequent do you experience power outages in your area?

- a. Very frequent ()
- b. Moderately frequent ()
- c. Not frequent ()
- d. Not sure ()

26. How long do you experience load shedding in your area?

- a. 4 hours ()
- b. 8 hours ()
- c. 12 hours ()
- d. 16 hours ()
- e. Other, specify-----

27. In cases where you experience power outages in your area, how has this affected your living conditions? -----

28. How have frequent power outages affected your business, if you have any?

- a. Profit has gone down. ()
- b. It has increased the cost of running a business. ()
- c. Lead to loss of customers ()
- d. Resulted in a lot of food stuff going bad. ()
- e. Customers have lost trust in my business. ()

29. What kind of business do you conduct and how has it been affected by power outages? -----

30. How have power outages affected your movements in your area at night? -----

31. How have power outages affected security in your area? -----

32. What kinds of crime are often committed when power goes off? -----

33. Are there any government projects (works) going on in your area? How are they affected when power cuts occur? -----

34. If power cuts in your area are less frequent, how has this affected your living conditions? -----

35. What has improved in your home or area as a result of experiencing less power cuts? -

36. Would you recommend that another company be established to compete with ZESCO in the provision of electricity in your area?
a. Yes ()
b. No ()
37. Give reasons to your answer in question 43? -----

THANK YOU.