No.

# The Study for Development of the Rural Electrification Master Plan in Zambia

# Final Report

January 2008

Japan International Cooperation Agency
(JICA)

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# PREFACE

In response to a request from the Government of the Republic of Zambia, the Government of Japan decided to conduct a study for development of Rural Electrification Master Plan in Zambia and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Hitoshi Koyabu of Tokyo Electric Power Co., Inc. and consists of Tokyo Electric Power Co., Inc. between May 2006 and January 2008.

The team held discussions with the officials concerned of the Government of Zambia and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Zambia for their close cooperation extended to the study.

January 2008

Seiichi NAGATSUKA,

Vice President

Japan International Cooperation Agency

**January 2008**

**Mr. Seiichi NAGATSUKA**

**Vice President**

**Japan International Cooperation Agency**

**Tokyo, Japan**

# Letter of Transmittal

**We are pleased to submit to you the report of the Study for Development of Rural Electrification Master Plan in Zambia. The report reflects the comments made by Department of Energy, Ministry of Energy and Water Development in Zambia, Rural Electrification Authority and related institutions in the Republic of Zambia, as well as the advice of the related institutions of the Government of Japan.**

**This report presents appropriate rural electrification planning and recommendations on power system development from the viewpoint of financial perspective and environmental and social considerations in Zambia. Specifically, we evaluate the financial aspects of the plan on the basis of Least Life Time Costs calculated from the results of our field demand survey, and consider the system reliability and environmental friendliness. We firmly believe that it will help promote the rise in standards of living and industrial development in the country.**

**We wish to take this opportunity to express our sincere appreciate to the officials concerned of JICA, Ministry of Foreign Affairs and Ministry of Economy, Trade and Industry. We would also like to express our gratitude to the officials concerned of the Government of Zambia, Department of Energy, Ministry of Energy and Water Development in Zambia, Rural Electrification Authority, JICA Zambia Office and Embassy of Japan in the Republic of Zambia for their cooperation and assistance throughout our field survey.**

**Very truly yours,**

**Hitoshi KOYABU**

**Team Leader,**

**The Develop for Rural Electrification**

**Master Plan in Zambia**

# The Study
# for
# Development
# of
# the Rural Electrification Master Plan
# in
# Zambia

## Final Report

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# Acronyms

| | |
|---|---|
| ACSR | Aluminium Conductor Steel Reinforced |
| AfDB | African Development Bank |
| CA | Catchment Area |
| CBR | Crude Birth Rate |
| CEC | Copperbelt Energy Corporation |
| CHESCO | Chipata Energy Service Company |
| CSAA | Client Service Accounts Assistants |
| CSO | Central Statistics Office |
| DDACC | Direct Debit and Credit Clearing |
| DoE | Department of Energy |
| DWA | Department of Water Affairs |
| ECZ | Environmental Council of Zambia |
| EIA | Environmental Impact Assessment |
| EIRR | Economic Internal Rate of Margin |
| EIS | Environmental Impact Statement |
| EPPCA | Environmental Protection and Pollution Control Act |
| ERB | Energy Regulation Board |
| ESCO | Energy Service Company |
| ESU | Environment and Social Affairs Unit of ZESCO |
| FIRR | Financial Internal Rate of Return |
| FNDP | The Fifth National Development Plan |
| FY | Fiscal Year |
| GEF | Global Environmental Facility |
| GIS | Geographical Information System |
| GNI | Gross National Income |
| GRZ | Government of the Republic of Zambia |
| IEE | Initial Environmental Examination |
| IMR | Infant Mortality Rate |
| IPP | Independent Power Producer |
| JBIC | Japan Bank for International Corporation |
| JICA | Japan International Corporation Agency |
| K | (Zambia) Kwacha |
| KG-PS | Kafue Gorge Power Station |
| KNB-PS | Kariba North Bank Power Station |
| KPLC | Kenya Power & Lighting Company |
| KSh | Kenya Shilling |
| kW, MW | kilowatt, megawatt |
| kWh, MWh, GWh | kilowatthour, megawatthour, gigawatthour |
| LDC | Least Developed Countries |
| LEB | Life Expectancy at Birth |
| LESCO | Lundazi Energy Service Company |

| | |
|---|---|
| Mc-HP | Micro-hydropower plant |
| MEWD | Ministry of Energy and Water Development |
| MFNP | Ministry of Finance and National Planning |
| MTENR | Ministry of Tourism, Environment and Natural Resources |
| NEP | National Energy Policy |
| NESCO | Nyimba Energy Service Company |
| NRSE | New and Renewable Source of Energy |
| PB | Project Brief |
| PRP | Power Rehabilitation Project |
| REA | Rural Electrification Authority |
| REF | Rural Electrification Fund |
| REMP | Rural Electrification Master Plan |
| REP | Rural Electrification Programme |
| RGC | Rural Growth Centre |
| ROA | Return on Assets |
| SAPP | Southern African Power Pool |
| SEA | Strategic Environmental Assessment |
| TEPCO | Tokyo Electric Power Company, Inc. |
| TFR | Total Fertility Rate |
| Tr | Transformer |
| UNIDO | United Nations Industrial Development Organization |
| UTM | Universal Transverse Mercator |
| VF-PS | Victoria Falls Power Station |
| WB | World Bank |
| ZAMSIF | Zambia Social Investment Fund |
| ZCCM | Zambia Consolidated Copper Mines |
| ZESCO | Zambia Electricity Supply Corporation<br>(Currently “ZESCO Ltd.” is the company’s official name) |
| ZMD | Zambia Meteorological Department |

# Chapter 1

# Introduction

# Chapter 1. Introduction

## 1.1. Background

Rural electrification has long been identified as a vehicle to eradicate poverty by stimulating the rural economy in the Republic of Zambia. In 1994, the Government of the Republic of Zambia (GRZ) established the Rural Electrification Fund (REF) by committing the sales tax on electricity, and has been trying to increase the electrification rate in rural area by executing projects funded by REF. The household electrification rate, however, still remains at approximately 20% countrywide, and only 2 –3% in rural area. As a mid-term target, achieving 35% of household electrification rate (50% in urban area and 15% in rural area) by 2010 was set in the Poverty Reduction Strategy Paper published in 2002. For aiming to achieve this goal, GRZ has been strengthening policies and institutions related to rural electrification. In December 2003, the Rural Electrification Act was enacted to establish Rural Electrification Authority (REA) and to improve the management of REF.

In order to enhance rural electrification efficiently, preparation of the Rural Electrification Master Plan in Zambia (REMP) was considered as an urgent issue, and GRZ requested the Government of Japan to assist the development of Master Plan in 2004. Accordingly, Japan International Cooperation Agency (JICA), an official agency responsible for the implementation of the technical cooperation program on behalf of the Government of Japan, sent a study team to Zambia for project formulation in September 2005, followed by the preliminary study team in January 2006. The study team held discussion with GRZ on the Scope of Work of the Master Plan Study, and execution of the study was approved.

JICA selected the Tokyo Electric Power Company, Inc. (TEPCO) as consultant to execute this Master Plan Study. The Study Team of TEPCO commenced the study in May 2006.

## 1.2. Purpose of the Study

The objective of the Master Plan Study is to formulate the Master Plan for rural electrification in Zambia up to the year 2030 and to bring about technology transfer to counterparts so that they can continue updating and implementing the Master plan by themselves.

The Study consists of the following items:

(1) Rural Electrification Plan up to 2030

(a) Development of selection criteria for rural electrification projects
(b) Selection of candidate site for rural electrification considering socio-economic and technical aspects
(c) Selection of electrification methods
- Extension of existing grid
- Isolated mini-grid with renewable energy, such as mini- and micro-hydro power generation
- Solar home system (SHS)
- Mini-grid with diesel power generation, if none of the above is feasible

(d) Case study executions

(2) Financial Plan for Rural Electrification

(a) Study on financing strategy
(b) Cost estimation of implementing the Master Plan at each phase
(c) Evaluation of the validity of rural electrification projects (EIRR / FIRR)

(3) Policy Recommendations for Acceleration and Dissemination of Rural Electrification

(a) Organization structure for promoting rural electrification
(b) Operational management of Rural Electrification Fund
(c) Framework of promoting the participation of private sector (IPP and ESCO)
(d) Affordable initial connection fee and sustainable electricity tariff
(e) Policy on curbing the negative impact of electrification on society and environment

(4) Development of Comprehensive Rural Electrification Program

(a) Implementation procedure of long-term rural electrification plan
(b) Prioritisation of execution plans
(c) Consensus-oriented rural electrification plan with donors; ex. Japanese Bank for International Cooperation (JBIC), African Development Bank (AfDB) and World Bank (WB)

## 1.3. Scope of Works

This study started at the beginning of May 2006, and is scheduled to continue until the beginning of December 2007. The terms of reference of work as provided to TEPCO was shown in Appendix-A. The scope of works is summarized in Figure 1-1.

## 1.4. Study Flow and Schedule

This study will be carried out in five stages and completed by December 2007. The flow and the schedule of the study are shown in

Figure 1-2 and Table 1-1 respectively.

## 1.5. Study Team

Member of the Study Team and their respective Zambian counterparts, are shown in Table 1-2.

**Table 1-2 Members of JICA Study Team**

| No. | Position | Name | Zambian Counterpart |
|---|---|---|---|
| 1 | Team Leader<br>Rural Electrification Planning Expert | Hitoshi Koyabu | Charles Mulenga |
| 2 | Deputy Team Leader<br>Electrification Policy & Organization Expert | Tomoyuki Yamashita | Arnold Simwaba |
| 3 | Hydro Power Planning Expert | Takayuki Abe | Nkusuwila Silomba |
| 4 | Renewable-Energy-Based<br>Rural Electrification Planning Expert | Genshiro Kano | Malama Chileshe |
| 5 | Transmission and Distribution Planning Expert | Kenichi Kitamura | Mushimbwa Fred |
| 6 | Socio Economic Expert | Yasushi Iida | Wankunda Siwakiwi<br>Langiwe Chandi |
| 7 | Environmental and Social Impact Analysis Expert | Yasuharu Sato | Michael Mulasikwanda<br>Mundu Mwila |
| 8 | GIS Database Development Expert | Atsushi Yuihara | Aggrey Siuluta<br>C.Kasango / B.Mukala |
| 9 | Power System Analysis Expert | Takashi Chujo | William Sinkala |
| 10 | Project Coordinator | Osamu Matsuzaki | Patrick Mubanga |

Note: List of Zambian counterpart is the one originally approved and does not reflect the personnel reshuffle during the Study period.

## 1.6. Outline of Report

This report consists of 15 chapters. Back ground, purpose, scope, schedule of the study, and so on are introduced in Chapter 1. General profile and current status of the power sector in Zambia are summarized in Chapter 2 and Chapter 3. The selection methods of electrification targets (Rural Growth Centers) in this master plan are explained in Chapter 4. The social aspect analysis results, such as ability and willingness to pay and prioritized property for electrification, are also shown in this chapter. The potential power demand for selected electrification targets is forecasted and an initial ranking for electrification for these targets is given in Chapter 5. Transmission system analysis, such as the capacity analysis of the system based on a simulation, is executed in Chapter 6. Plans for distribution system, micro-hydropower generation, solar power, and other renewable energies to realize rural electrification are provided in Chapter 7, Chapter 8, Chapter 9, and Chapter 10 respectively. Environmental and social considerations are explained in Chapter 11. Results of case studies (or pre feasibility studies), 3 sites for distribution lines, 2 sites for mini-hydropower, and 2 sites for environmental impact assessment, are introduced in Chapter 12. In Chapter 13, development process of GIS database is explained. The optimal electrification method for each target, final electrification priority based on financial indicators, and project execution phase from 2008 to 2030 are specified as a comprehensive rural electrification master plan in Chapter 14. Finally, conclusion and recommendation are provided in Chapter 15.

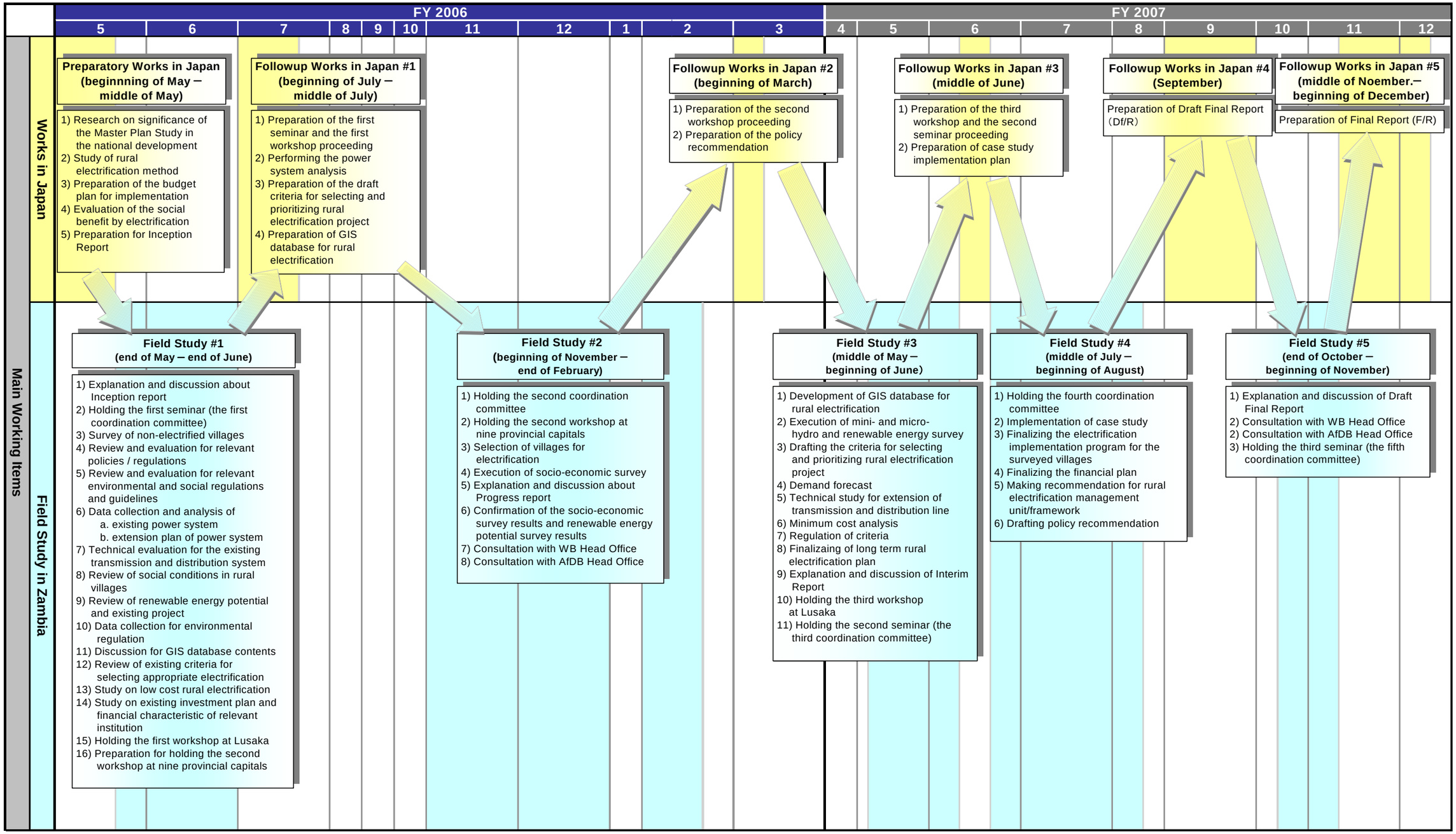



**Figure 1-1 Scope of Works**

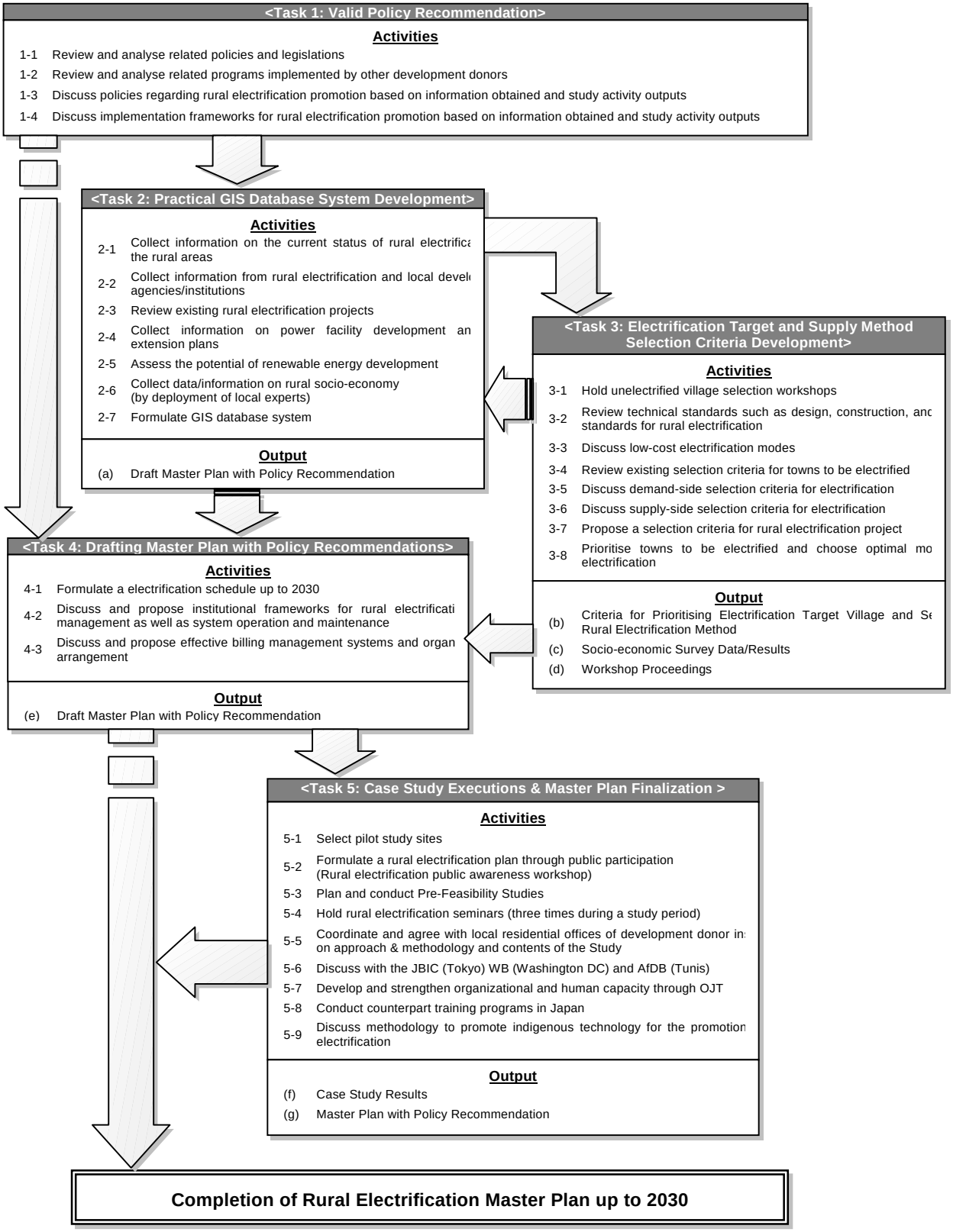



**Figure 1-2 Flow of the Study**

## Table 1-1 Schedule of the Study

| Stage | Activity | 2006 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 2007 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Output |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <Stage 1><br>Valid Policy Recommendation | 1-1 Review and analyze related policies and legislations | | | | | | | | | | | | | | | | | | | | | <Stage 1> |
| | 1-2 Review and analyze related programmes implemented by other development donors | | | | | | | | | | | | | | | | | | | | | |
| | 1-3 Discuss policies regarding rural electrification promotion based on information obtained and study activity outputs | | | | | | | | | | | | | | | | | | | | | |
| | 1-4 Discuss implementation frameworks for rural electrification promotion based on information obtained and study activity outputs | | | | | | | | | | | | | | | | | | | | | |
| <Stage 2><br>Practical GIS Database System Development | 2-1 Collect information on the current status of rural electrification in the rural areas | | | | | | | | | | | | | | | | | | | | | <Stage 2> |
| | 2-2 Collect information from rural electrification and local development agencies/institutions | | | | | | | | | | | | | | | | | | | | | a. GIS Database |
| | 2-3 Review existing rural electrification projects | | | | | | | | | | | | | | | | | | | | | |
| | 2-4 Collect information on power facility development and grid extension plans | | | | | | | | | | | | | | | | | | | | | |
| | 2-5 Assess the potential of renewable energy development | | | | | | | | | | | | | | | | | | | | | |
| | 2-6 Collect data/information on rural socio-economy (by deployment of local experts) | | | | | | | | | | | | | | | | | | | | | |
| | 2-7 Formulate GIS database system | | | | | | | | | | | | | | | | | | | | | |
| <Stage 3><br>Electrification Target and Supply Method Selection Criteria Development | 3-1 Hold unelectrified village selection workshops<br>- 1st WS : Preliminary workshop in Lusaka<br>- 2nd WS : Province workshops in nine provincial capitals<br>- 3rd WS: Dissemination workshop in Lusaka | | | | | | | | | | | | | | | | | | | | | <Stage 3><br>b. Criteria for Prioritizing Electrification Target Village and Selecting Rural Electrification Method |
| | 3-2 Review technical standards such as design, construction, and safety standards for rural electrification | | | | | | | | | | | | | | | | | | | | | c. Socio-economic Survey Data/Results |
| | 3-3 Discuss low-cost electrification modes | | | | | | | | | | | | | | | | | | | | | d. Workshop Proceedings |
| | 3-4 Review existing selection criteria for towns to be electrified | | | | | | | | | | | | | | | | | | | | | |
| | 3-5 Discuss demand-side selection criteria for electrification | | | | | | | | | | | | | | | | | | | | | |
| | 3-6 Discuss supply-side selection criteria for electrification | | | | | | | | | | | | | | | | | | | | | |
| | 3-7 Propose a selection criteria for rural electrification project | | | | | | | | | | | | | | | | | | | | | |
| | 3-8 Prioritize towns to be electrified and choose optimal modes of electrification | | | | | | | | | | | | | | | | | | | | | |
| <Satge 4><br>Drafting Master Plan with Policy Recommendations | 4-1 Formulate a electrification schedule up to 2030 | | | | | | | | | | | | | | | | | | | | | <Stage 4> |
| | 4-2 Discuss and propose institutional frameworks for rural electrification fund management as well as system operation and maintenance | | | | | | | | | | | | | | | | | | | | | e. Draft Master Plan with Policy Recommendation |
| | 4-3 Discuss and propose effective billing management systems and organizational arrangement | | | | | | | | | | | | | | | | | | | | | |
| <Stage 5><br>Case Study Executions and Final Master Plan Development | 5-1 Select pilot study sites | | | | | | | | | | | | | | | | | | | | | <Stage 5> |
| | 5-2 Formulate a rural electrification plan through public participation (Rural electrification public awareness workshop) | | | | | | | | | | | | | | | | | | | | | f. Case Study Results |
| | 5-3 Plan and conduct Pre-Feasibility Studies | | | | | | | | | | | | | | | | | | | | | g. Master Plan with Policy Recommendation |
| | 5-4 Hold rural electrification seminars (three times during a study period) | | | | | | | | | | | | | | | | | | | | | |
| | 5-5 Coordinate and agree with local residential offices of development donor institutions on approach & methodology and contents of the Study | | | | | | | | | | | | | | | | | | | | | |
| | 5-6 Discuss with the JBIC (Tokyo) WB (Washington DC) and AfDB (Tunis) | | | | | | | | | | | | | | | | | | | | | |
| | 5-7 Develop and strengthen organizational and human capacity through OJT | | | | | | | | | | | | | | | | | | | | | |
| | 5-8 Conduct counterpart training programs in Japan | | | | | | | | | | | | | | | | | | | | | |
| | 5-9 Discuss methodology to promote indigenous technology for the promotion of rural electrification | | | | | | | | | | | | | | | | | | | | | |
| Reporting Schedule | | | ▲ Ic/R | | | | | | | | ▲ Pr/R | | | | ▲ It/R | | | Df/R ▲ | | F/R ▲ | |

# Chapter 2

# General Profile of Zambia

# Chapter 2. General Profile of Zambia

## 2.1. Land

Zambia used to be the colony of United Kingdom and gained its independence on 24th October 1964. The country is located in southern Africa, with the area of 752,614 square kilometres. Zambia is a land-locked country sharing borders with the Democratic Republic of the Congo (DR Congo) and Tanzania to the north; Malawi and Mozambique to the east; Zimbabwe and Botswana to the south; Namibia to the south-west and Angola to the west.

## 2.2. Administrative Organization and Local Social Structure

Lusaka is the capital city of Zambia and the seat of Government. The Government comprises the Central and Local Authorities. The province is the highest level of local administration of Zambia, and there are nine provinces, namely Central, Copperbelt, Eastern, Luapula, Lusaka, Northern, North-Western, Southern and Western provinces. The provinces are broken down into 72 districts, as seen in Figure 2-1. Districts are further broken down into wards, which are the smallest unit of local administration. There are 1,286 wards in total as of the Census of 2000.

## 2.3. Population

The census of Population and Housing has been executed by GRZ once in a decade. The total population of Zambia has been increasing from 5.7 million of the 1980 Census to 7.8 million of the 1990 Census, then 9.8 million of the 2000 Census. Population growth is getting moderate gradually, from 3.1% p.a. in 1970s (1970-1980) to 2.7% p.a. in 1980s (1980-1990), then 2.4% p.a. in 1990s (1990-2000).

Breaking down the population by Provinces, Copperbelt Province with 1,581,221 people is the largest Province in population (or 16.1% of the country's total population) according to the Census in 2000. The smallest Province in population is North-Western Province, with 583,350 people or 5.9 % of total population. Provinces with high population growth in 1990s are Lusaka (3.4% p.a.), Luapula (3.2% p.a.), and Northern (3.1% p.a.). Copperbelt Province recorded the population growth rate of 0.8% p.a., the lowest among 9 Provinces during the decade (refer to Table 2-1).

According to the population projections published by the Central Statistics Office, 34.6% of the population (or 3.9 million out of 11.4 million total population) is estimated to live in urban area while the remaining 65.4% (or 7.5 million) is estimated to reside in rural area. Lusaka and Copperbelt Provinces have high percentage of urban population at 82% and 81 % respectively, while that in Eastern Province is only 9%. Urban population is expected to increase from 3.9 million in 2005 to 5.6 million in 2025 at the average annual growth rate of 1.75%. Rural population is estimated to grow more rapidly at the average annual growth rate of 3.34%: from 7.5 million in 2005 to 14.4 million in 2025. In total, Zambia's population is expected to grow at 2.84% per annum up to 2025, and to reach approximately 20 million by 2025 from 11.4 million in 2005, as shown in Figure 2-2.

Population density has been increasing from an average of 5.4 people/$km^2$ in 1970 to 7.5 people/$km^2$ in 1980, 9.8 people/$km^2$ in 1990, and 13.0 people/$km^2$ in 2000. Population density of each Province reveals the significant gap between Provinces with high density (e.g. Lusaka: 63.5 people/$km^2$ in 2000) and those with low density (e.g. North-Western: 4.6 people/$km^2$), as shown in Table 2-1 and Figure 2-3).

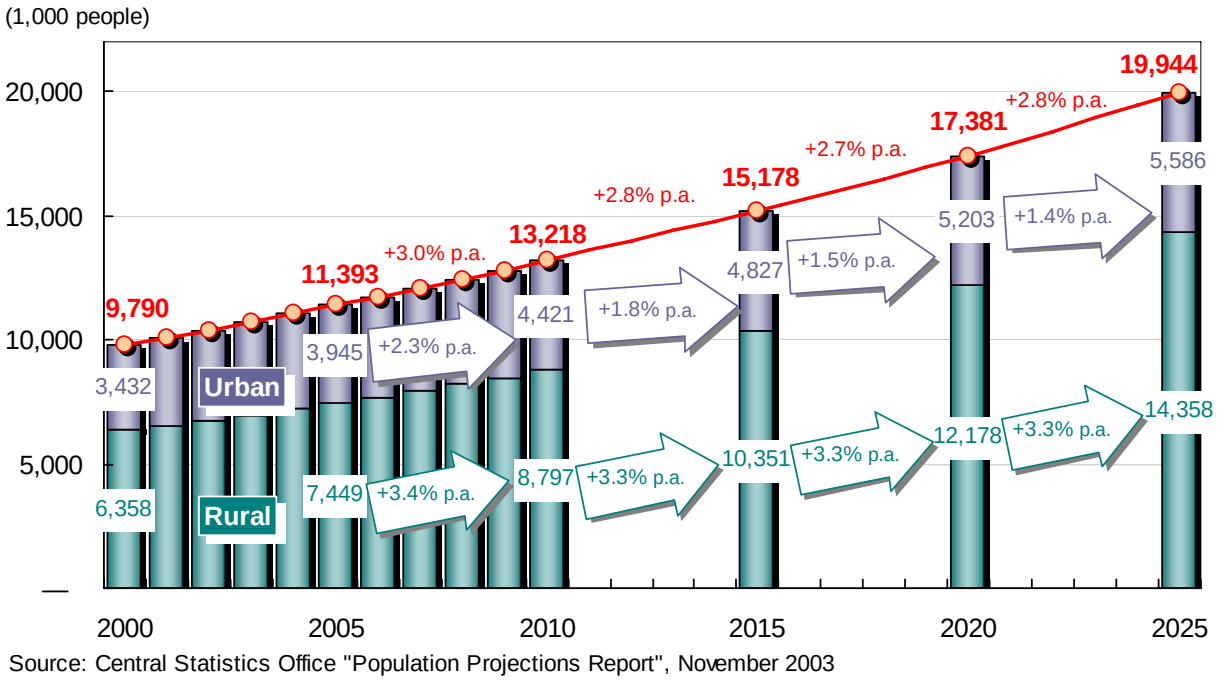

Source: JICA Zambia Office Web Site
(http://www.jica.go.jp/zambia/activities/haichi.html)

**Figure 2-1 Provinces and Districts in Zambia**

**Table 2-1 Populations, Area, Density and Growth Rate (2000 Census)**

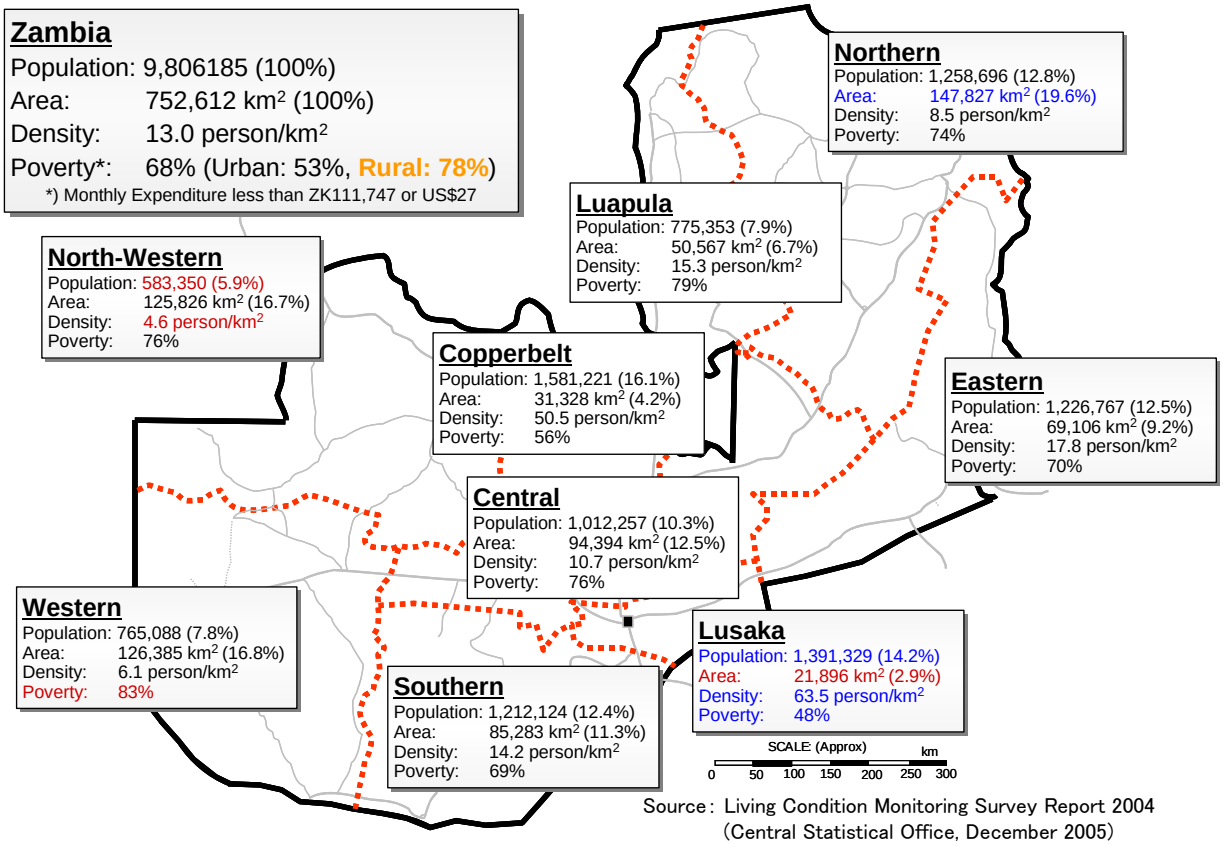
| | Population (% of total population) 2000 | Population Density [person/km$^2$] 2000 | Annual Growth Rate [%] 1990 – 2000 | Area [km$^2$] |
|---|---|---|---|---|
| **Zambia** | **9,806,185 (100.0%)** | **13.0** | **2.4%** | **752,612** |
| *Central* | 1,012,257 (10.3%) | 10.7 | 2.7% | 94,394 |
| *Copperbelt* | 1,581,221 (16.1%) | 50.5 | 0.8% | 31,328 |
| *Eastern* | 1,226,767 (12.5%) | 17.8 | 2.0% | 69,106 |
| *Luapula* | 775,353 (7.9%) | 15.3 | 3.2% | 50,567 |
| *Lusaka* | 1,391,329 (14.2%) | 63.5 | 3.4% | 21,896 |
| *Northern* | 1,258,696 (12.8%) | 8.5 | 3.1% | 147,827 |
| *North-Western* | 583,350 (5.9%) | 4.6 | 2.9% | 125,826 |
| *Southern* | 1,212,124 (12.4%) | 14.2 | 2.3% | 85,283 |
| *Western* | 765,088 (7.8%) | 6.1 | 1.8% | 126,385 |

Source: Summary Report 2000 Census of Population and Housing
(Central Statistical Office, November 2003)




Source: Central Statistics Office "Population Projections Report", November 2003

**Figure 2-2 Population Projections**




Source: Living Condition Monitoring Survey Report 2004
(Central Statistical Office, December 2005)

**Figure 2-3 Populations, Area and Density by Province**

## 2.4. Ethnic Composition, Language and Religion

The overwhelming majority of Zambian people are ethnically African, with the variety of 73 tribes, while there also exist some minorities, such as Europeans, who mostly derive from immigrants since the modern times. Although each of these African tribes has its own vernacular language, English is used as the official language of Zambia and most of urban residents speak it fluently. In rural areas, communication in daily life is usually done in vernacular languages, which can be roughly divided into seven major groups: Bemba, Kaonde, Lozi, Lunda, Luvale, Nyanja and Tonga. Bemba is spoken in Northern, Luapula, Copperbelt, and Central Provinces. Kaonde, Lunda and Luvale languages are commonly used in North-Western Province. Lozi is commonly used in Western Province. Nyanja is spoken in Eastern and Lusaka provinces. Tonga is spoken in Southern Province.

The predominant religion in Zambia is Christianity, among which Roman Catholic is said to be the majority, while various traditional religions also exist, which is especially believed in rural area.

## 2.5. Fertility, Mortality and Life Expectancy

Total Fertility Rate (TFR), which is defined as the number of births a woman will have assuming that she survives to the end of her childbearing age, namely 50 years old, is estimated at 5.8 in 2004. TFR is higher in rural area (6.6) than that in urban area (4.5), which is considered to be the main drive of higher population growth in rural area than that in urban area, as discussed in Section 2.3. despite the general trend of migration from rural area to urban area. TFR in Luapula Province is 7.0, the highest among 9 Provinces, while that in Lusaka Province is the lowest at 4.3.

Crude Birth Rate (CBR), which is defined as the number of births that occurred in the 12-month period prior to the census against 1,000 people, is about 47.1 in urban area and 39.3 in rural area respectively. The average CBR of the whole nation is 44.2 in 2004. Among Provinces, Lusaka Province has the lowest CBR (37.6), followed by Copperbelt Province (39.3) while the highest CBR was recorded in Northern Province (48.4).

Infant Mortality Rate (IMR), which is defined as the number of deaths in a year that occurred to infants under one year of age against 1,000 live births, is higher in rural area (117 in 2000 and 91 in 2004) than urban area (91 in 2000 and 75 in 2004). Luapula Province saw the highest IMR among 9 Provinces both in 2000 (132) and 2004 (108), while the lowest IMR among Provinces is that in North-Western Province in 2000 (83) and that in Lusaka Province in 2004 (67). In comparison between 2000 and 2004 data, IMR improved in all Provinces.

Life Expectancy at Birth (LEB), which is defined as the average number of year that a newly born babies would live if subjected to the prevailing mortality conditions, is 52.4 in 2004, prolonged by 2.4 years from 50.0 in 2000. No significant difference in LEB was found between rural and urban areas as of 2004 though, according to the statistics of 2000, LEB in urban area was rather higher than that in rural area. The same trend is observed in the statistics broken down by sex, in that a significant difference is of LEB found between both sexes in 2004 though in 2004 female LEB was considerably higher than male's. Copperbelt Province (57.6 years) indicates the highest LEB among Provinces in 2004 while Northern Province (45.5 years) saw the lowest.

**Table 2-2 Fertility, Crude Birth, Infant Mortality Rates and Life Expectancy at Birth**

| Area / Sex / Province | TFR | | CBR | | IMR | | LEB | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | 2004 | 2000 | 2004 | 2000 | 2004 | 2000 | 2004 |
| **Zambia Total** | **6.0** | **5.8** | – | **44.2** | **110** | **83** | **50.0** | **52.4** |
| Rural | 6.7 | 6.6 | – | 47.1 | 117 | 91 | 48.0 | 50.5 |
| Urban | 4.9 | 4.5 | – | 39.3 | 91 | 75 | 54.0 | 50.0 |
| Male | – | – | – | – | – | – | 48.0 | 52.3 |
| Female | – | – | – | – | – | – | 52.0 | 52.6 |
| Central | 6.1 | 6.0 | – | 44.6 | 100 | 70 | 52.0 | 55.0 |
| Copperbelt | 5.2 | 4.8 | – | 39.3 | 91 | 63 | 54.0 | 57.6 |
| Eastern | 6.7 | 6.6 | – | 46.7 | 129 | 100 | 46.0 | 47.0 |
| Luapula | 7.1 | 7.0 | – | 46.9 | 132 | 108 | 45.0 | 47.5 |
| Lusaka | 4.6 | 4.3 | – | 37.6 | 88 | 67 | 54.0 | 54.1 |
| Northern | 7.0 | 6.7 | – | 48.4 | 130 | 100 | 46.0 | 45.5 |
| North-Western | 6.6 | 6.4 | – | 46.1 | 83 | 74 | 56.0 | 55.6 |
| Southern | 6.3 | 6.1 | – | 45.2 | 93 | 79 | 53.0 | 51.6 |
| Western | 5.9 | 5.9 | – | 44.3 | 140 | 104 | 44.0 | 48.2 |

Source: Selected Socio-Economic Indicators 2003-2004
(Central Statistical Office, November 2003)

## 2.6. Education and Literacy

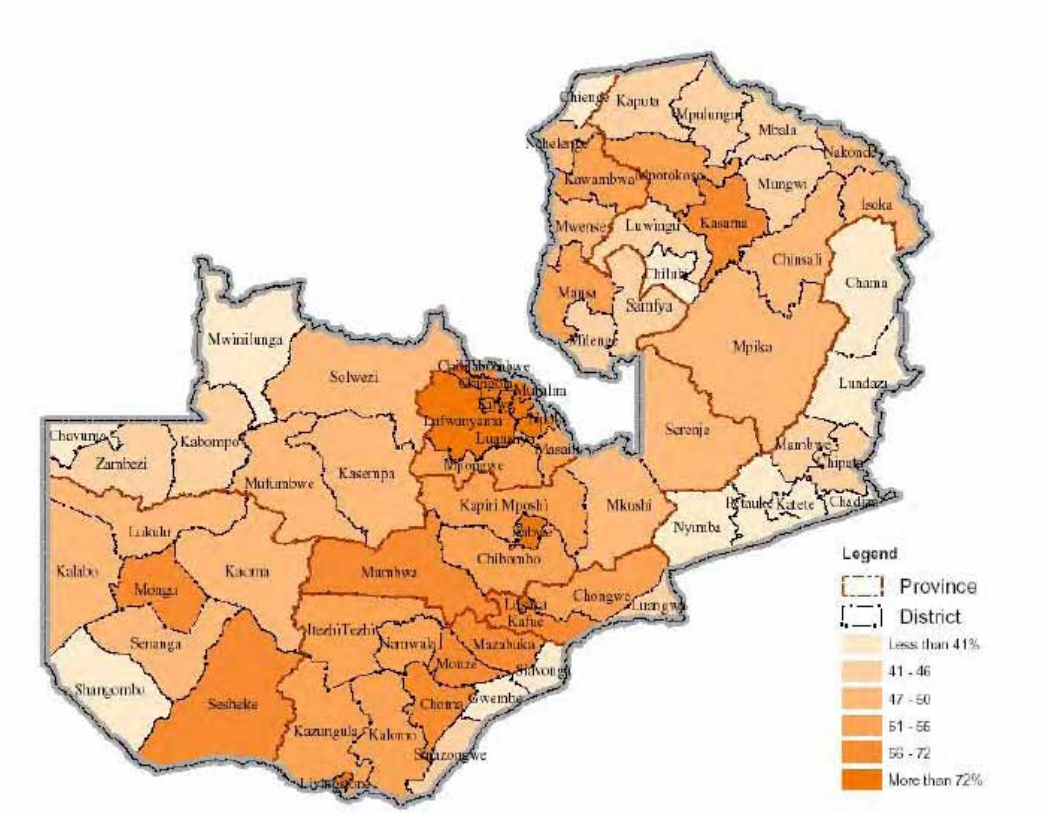
A large segment of the Zambian Population remains uneducated and illiterate. As shown in Table 2-3, literacy rate of the population aged 5years old and above is 55.3% as of 2000. And no improvement has been seen compared to that as of 1990. There's a significant gap in literacy rate between rural area (45.0% in 2000) and urban area (73.5% in 2000), which is also observed in Figure 2-4 that illustrates the literacy rate of each District: Districts in Copperbelt Province, Lusaka, Livingstone, and Kabwe Districts, which are mostly categorized as urban area, are showing a relatively high literacy rate while Eastern Province recorded the lowest literacy rate among 9 Provinces. On top of that, the comparison between 1990 and 2000 data indicates a growing gap of literacy rate between urban and rural areas: literacy rate in urban area saw improvement more or less in all Provinces while in rural area not remarkable improvement is observed (except Lusaka Province). The problem of illiteracy lies more common in rural area than urban area.

There is also a significant gap in literacy rate regarding sex, that is, the literacy rate of female population (49.8% in 2000) is much lower than that of male population (61.1%), and no remarkable mitigation of this gap can be seen during the decade with some exceptions (Western Province).

**Table 2-3 Literacy Rate (5 years old and above)**

| | 1990 | | | | | 2000 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Total** | Rural | Urban | Male | Female | **Total** | Rural | Urban | Male | Female |
| **Zambia Total** | **55.3%** | 44.7% | 71.5% | 61.6% | 49.2% | **55.3%** | 45.0% | 73.5% | 61.1% | 49.8% |
| Central | **56.2%** | 50.3% | 70.0% | 61.8% | 50.6% | **55.8%** | 50.4% | 71.8% | 60.8% | 50.9% |
| Copperbelt | **69.9%** | 53.4% | 72.7% | 74.2% | 65.4% | **70.5%** | 52.6% | 75.3% | 74.3% | 66.8% |
| Eastern | **37.7%** | 34.9% | 65.8% | 45.8% | 30.8% | **37.9%** | 35.0% | 67.1% | 45.5% | 30.8% |
| Luapula | **49.4%** | 46.5% | 64.9% | 56.9% | 42.4% | **48.4%** | 45.3% | 68.2% | 56.0% | 41.2% |
| Lusaka | **68.6%** | 50.3% | 72.0% | 73.5% | 63.6% | **70.1%** | 55.0% | 73.3% | 74.7% | 65.5% |
| Northern | **47.5%** | 44.2% | 67.3% | 55.5% | 40.1% | **47.0%** | 43.3% | 68.7% | 55.3% | 39.3% |
| North-Western | **42.4%** | 38.3% | 66.4% | 50.4% | 35.1% | **43.4%** | 40.1% | 67.0% | 50.5% | 36.6% |
| Southern | **56.5%** | 51.4% | 72.5% | 61.1% | 52.1% | **56.2%** | 50.5% | 76.0% | 60.2% | 52.3% |
| Western | **48.1%** | 44.9% | 69.3% | 54.2% | 42.9% | **50.6%** | 46.7% | 77.9% | 55.3% | 46.4% |

Source: 2000 Census Analytical Report
(Central Statistical Office, October 2004)




Source: Census Atlas 2000
(Central Statistical Office, November 2003)

**Figure 2-4 Literacy Rates by District**

The level of education is summarized in Table 2-4. In Zambia, 27.2% of the population aged 5 years and above have had no formal education, 25.9% completed lower primary (4 years or less), 24.5% completed upper primary (5-7 years), 10.7% accomplished junior secondary (8-9 years), and 9.0% accomplished senior secondary (10-12 years). Only 1.2% of the population has completed Grade 12 Graduate Certification with A level, and 1.5% completed Bachelor's degree or above. 24.6% of males and 29.7% of females have never had any formal education, and more males have attained secondary school or higher levels than females. There is also a gap in education level between urban population and rural population: about 40% of urban people completed secondary school or higher while less than 13% of rural population had same opportunity.

**Table 2-4 Percentage Distribution of Population by Highest Level of Education Attended**

| | Highest Level of Education | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | None | Lower Primary (1 - 4) | Upper Primary (5 - 7) | Junior Secondary (8 - 9) | Senior Secondary (10 - 12) | Grade 12 GCE (A) / Collage / Undergraduate | Bachelors Degree and Above | |
| **Zambia Total** | **27.2%** | **25.9%** | **24.5%** | **10.7%** | **9.0%** | **1.2%** | **1.5%** | **100.0%** |
| Male | 24.6% | 25.1% | 24.3% | 11.3% | 11.5% | 1.3% | 1.9% | 100.0% |
| Female | 29.7% | 26.7% | 24.8% | 10.1% | 6.5% | 1.0% | 1.2% | 100.0% |
| **Rural** | **33.0%** | **29.6%** | **25.0%** | **7.6%** | **3.8%** | **0.5%** | **0.5%** | **100.0%** |
| Male | 29.4% | 29.0% | 26.1% | 8.8% | 5.4% | 0.6% | 0.7% | 100.0% |
| Female | 36.4% | 30.1% | 24.0% | 6.3% | 2.5% | 0.4% | 0.3% | 100.0% |
| **Urban** | **16.9%** | **19.5%** | **23.7%** | **16.2%** | **18.0%** | **2.4%** | **3.3%** | **100.0%** |
| Male | 16.1% | 18.1% | 21.0% | 15.6% | 22.4% | 2.6% | 4.2% | 100.0% |
| Female | 17.7% | 20.8% | 26.3% | 16.7% | 13.7% | 2.2% | 2.6% | 100.0% |

Source: Selected Socio-Economic Indicators 2003-2004
(Central Statistical Office, January 2006)

## 2.7. Poverty and Living Standards

In Zambia, poverty line is set based on the Food-Energy Intake (FEI) approach. The methodology of this approach is to establish a monetary value, at which the predetermined average food energy requirements for normal bodily functions are met, i.e. the minimum intake of 2,094 calories per day per person. People in the Extremely Poor status cannot afford to meet the basic minimum food requirements, even if they allocate all the expenditure on food. Households whose total monthly expenditure is less than K78,223 per adult equivalent at 2004 price level are categorized as "extremely poor". People who can afford the basic minimum food requirements but cannot afford minimum basic non-food items, such as health, shelter, and education, are categorized as "moderately poor", i.e. K111,747 per adult equivalent. Poverty lines at "extremely poor" and "moderately poor" levels from 1991 to 2004 are summarized in Table 2-5. People whose expenditure exceeds the upper poverty line (or the expenditures on basic minimum food requirements as well as minimum basic non-food items) are categorized as "non poor.

**Table 2-5 Poverty Levels**

(K/adult/month)

| Year | 1991 | 1993 | 1996 | 1998 | 2002 | 2004 |
|---|---|---|---|---|---|---|
| Extremely Poor | 961 | 5,910 | 20,181 | 32,861 | 64,530 | 78,223 |
| Moderately Poor | 1,380 | 8,480 | 28,979 | 47,187 | 92,185 | 111,747 |

Source: Living Conditions Monitoring Survey Report 2004
(Central Statistical Office, December 2006)

Trends of population living in poverty from 1991 to 2004 are summarized in Table 2-6. Poverty ratio saw an improvement recently, dropping from 73% in 1998 to 68% in 2004, after the period of stagnation during 1990s, when the country experienced economic recession triggered by drought and falling copper prices, the country's main export. In rural area, the poverty ratio dropped remarkably from 88% in 1991 to 78% in 2004, though there was a reverse trend in early 1990s. In urban area, the poverty ratio worsened in 1990s increasing from 49% in 1991 to 56% in 1998, though it improved slightly afterwards, dropping to 53% in 2004, which is considered due to the overall economic recovery in 2000s. The improving trend in rural area and the worsening trend in urban area might be a trade-off caused by the population migration, by which those people in villages who are too poor to earn minimum requirement to sustain their lives settled in so-called peri-urban area.

Broken down by province, the poverty ratio saw an improvement in all Provinces from 1998 to 2004, but the trend between 1993 and 1998 shows a clear contrast among Provinces: considerable worsening is observed in Copperbelt (from 49% to 65%) and Lusaka (from 39% to 53%) Provinces while in other Provinces the poverty ratio improved more or less during the same period, especially in Eastern (from91% to 79%), North-Western (from 88% to 77%), and Southern (from 87% to 75%) Provinces.

**Table 2-6 Poverty Trends from 1991 to 2004**

| | | | 1991 | 1993 | 1996 | 1998 | 2004 |
|---|---|---|---|---|---|---|---|
| **Zambia Total** | | **Poverty Ratio** | **70%** | **74%** | **69%** | **73%** | **68%** |
| | | Extremely Poor | 58% | 61% | 53% | 58% | 53% |
| | | Moderately Poor | 12% | 13% | 16% | 15% | 15% |
| **Rural / Urban** | **Rural** | **Poverty Ratio** | **88%** | **92%** | **82%** | **83%** | **78%** |
| | | Extremely Poor | 81% | 84% | 68% | 71% | 65% |
| | | Moderately Poor | 7% | 8% | 14% | 12% | 13% |
| | **Urban** | **Poverty Ratio** | **49%** | **45%** | **46%** | **56%** | **53%** |
| | | Extremely Poor | 32% | 24% | 27% | 36% | 34% |
| | | Moderately Poor | 17% | 21% | 19% | 20% | 19% |
| **Provinces** | **Central** | **Poverty Ratio** | **70%** | **81%** | **74%** | **77%** | **76%** |
| | | Extremely Poor | 56% | 71% | 59% | 63% | 63% |
| | | Moderately Poor | 14% | 10% | 15% | 14% | 13% |
| | **Copperbelt** | **Poverty Ratio** | **61%** | **49%** | **56%** | **65%** | **56%** |
| | | Extremely Poor | 44% | 28% | 33% | 47% | 38% |
| | | Moderately Poor | 17% | 21% | 23% | 18% | 18% |
| | **Eastern** | **Poverty Ratio** | **85%** | **91%** | **82%** | **79%** | **70%** |
| | | Extremely Poor | 76% | 81% | 70% | 66% | 57% |
| | | Moderately Poor | 9% | 10% | 12% | 13% | 13% |
| | **Luapula** | **Poverty Ratio** | **84%** | **88%** | **78%** | **82%** | **79%** |
| | | Extremely Poor | 73% | 79% | 64% | 69% | 64% |
| | | Moderately Poor | 11% | 9% | 14% | 13% | 15% |
| | **Lusaka** | **Poverty Ratio** | **31%** | **39%** | **38%** | **53%** | **48%** |
| | | Extremely Poor | 19% | 24% | 22% | 35% | 29% |
| | | Moderately Poor | 12% | 15% | 16% | 18% | 19% |
| | **Northern** | **Poverty Ratio** | **84%** | **86%** | **84%** | **81%** | **74%** |
| | | Extremely Poor | 76% | 72% | 69% | 66% | 60% |
| | | Moderately Poor | 8% | 14% | 15% | 15% | 14% |
| | **North-Western** | **Poverty Ratio** | **75%** | **88%** | **80%** | **77%** | **76%** |
| | | Extremely Poor | 65% | 76% | 65% | 64% | 61% |
| | | Moderately Poor | 10% | 12% | 15% | 13% | 15% |
| | **Southern** | **Poverty Ratio** | **79%** | **87%** | **76%** | **75%** | **69%** |
| | | Extremely Poor | 69% | 76% | 59% | 59% | 54% |
| | | Moderately Poor | 10% | 11% | 17% | 16% | 15% |
| | **Western** | **Poverty Ratio** | **84%** | **91%** | **84%** | **89%** | **83%** |
| | | Extremely Poor | 76% | 84% | 74% | 78% | 73% |
| | | Moderately Poor | 8% | 7% | 10% | 11% | 10% |

Source: Living Conditions Monitoring Survey Report 2004
(Central Statistical Office, December 2006)

Relations between poverty and household characteristics in 2004 are summarized in Table 2-7. Regarding household head, there are more female-headed households below the Poverty Lines (71%) than male-headed ones (66%), and especially household in “extreme poverty” is more prevalent for female-headed ones (57%) than male-headed ones (51%), though the difference might not be too serious. Households headed by an old person are more likely to be below the Poverty Line, especially in “extremely poor” category.

Education level of household head shows strong correlation to the poverty status. Poverty ratio of households headed by a person with no educational background is 81%; among which 70% is categorized in “extremely poor”. On the other hand, poverty ratio of households headed by a person

with tertiary education stays as low as 30%, among which 16% is categorized in "extremely poor". The incident of poverty also worsens with the increase of household size. Only 32% of single-person households are living below the poverty line, while the 73% of households with family of six or more members are categorized as living below poverty line. This correlation becomes clearer when the poverty status is limited to "extremely poor".

**Table 2-7 Poverty and Household Characteristics in 2004**

| | Poverty Status | | | | Total Population |
|---|---|---|---|---|---|
| | Poor | | | Non Poor | |
| | Extremely | Moderately | Total | | |
| **Zambia Total** | 53% | 15% | 68% | 32% | 10,898,614 |
| **Rural/Urban** | | | | | |
| Rural | 65% | 13% | 78% | 22% | 6,632,709 |
| Urban | 34% | 18% | 53% | 47% | 4,265,905 |
| **Sex of Household Head** | | | | | |
| Male | 51% | 15% | 66% | 34% | 8,815,110 |
| Female | 57% | 14% | 71% | 29% | 2,106,981 |
| **Age of Household Head** | | | | | |
| 12 – 19 | 23% | 42% | 65% | 35% | 27,716 |
| 20 – 29 | 43% | 16% | 59% | 41% | 1,604,459 |
| 30 – 59 | 52% | 15% | 67% | 33% | 7,860,620 |
| 60 + | 66% | 12% | 78% | 22% | 1,429,296 |
| **Education of Household Head** | | | | | |
| None | 70% | 11% | 81% | 19% | 1,185,678 |
| Primary School | 63% | 14% | 77% | 23% | 4,781,457 |
| Secondary | 43% | 17% | 60% | 40% | 4,108,386 |
| Tertiary | 16% | 14% | 30% | 70% | 846,570 |
| **Household Size** | | | | | |
| 1 | 22% | 10% | 32% | 68% | 112,910 |
| 2 – 3 | 34% | 17% | 51% | 49% | 1,280,614 |
| 4 – 5 | 48% | 16% | 64% | 36% | 2,914,579 |
| 6 + | 59% | 14% | 73% | 27% | 6,613,988 |
| **Province** | | | | | |
| Central | 63% | 12% | 76% | 24% | 1,130,372 |
| Copperbelt | 38% | 18% | 56% | 44% | 1,650,981 |
| Eastern | 57% | 13% | 70% | 30% | 1,507,974 |
| Luapula | 64% | 15% | 79% | 21% | 859,170 |
| Lusaka | 29% | 19% | 48% | 52% | 1,526,381 |
| Northern | 60% | 14% | 74% | 26% | 1,400,650 |
| North-Western | 61% | 15% | 76% | 24% | 649,414 |
| Southern | 54% | 14% | 69% | 31% | 1,352,699 |
| Western | 73% | 10% | 83% | 17% | 820,973 |

Source: Living Conditions Monitoring Survey Report 2004
(Central Statistical Office, December 2006)

# Chapter 3

# Current Status
# of
# the Power Sector

# Chapter 3. Current Status of the Power Sector

## 3.1. Policy and Organizations

### 3.1.1. History of Electrification and Policy

Rural Electrification in Zambia dates back to the colonial period when electricity lines were extended to European settler farmers in rural areas. Since Zambia's independence in 1964, the electrification of district administrative centres has received high priority. As a result, nearly all the district centres have been electrified either through national grid or by isolated grid systems supplied from micro-hydro power stations or diesel generators.

On the other hand, household electrification, especially in rural areas, has not made significant progress due to the high capital costs involved. The wide scatter of the Zambian rural population raises the cost of building distribution lines, especially as most villages are distant from the national electricity grid.

The Government has funded electrification projects from annual national budgets since the early 1980s. However, the funds proved inadequate for the large number of projects embarked upon, which prolonged completion times.

In January 1994, the Government established the Rural Electrification Fund (REF) under the Ministry of Energy and Water Development (MEWD) in order to increase the funding and improve the management of the rural electrification programme. A levy of 3.45% on electricity consumption was introduced and the Ministry of Energy and Water Development was charged with ensuring that the funds allocated to the REF were disbursed in accordance with the best principles of transparency and accountability.

Accordingly in January 1995, MEWD issued the "Guidelines on Selection of Rural Electrification Projects for Funding by Government", which outlined the procedure of selecting projects proposed by Provincial Planning Units for support from the REF. The criteria were in two categories: primary and secondary considerations. The primary considerations consisted of (1) economic aspects, (2) regional distribution, and (3) social aspects. "Economic aspects" were to be evaluated from the aspects of agricultural development potential and the evidence of industrial/commercial growth. "Regional distribution" was also a key factor to ensure that the projects were equitably distributed in the country. "Social aspects" gave due consideration to the electrification of public facilities, such as hospitals, clinics, health centres, schools and community centres.

The secondary considerations comprised (1) technical aspects and (2) willingness of recipients to contribute to the capital cost and the cost of internal wiring. "Technical aspects" were the selection criteria of the most suitable electrification method among all possible options, such as grid extension, micro-hydro, SHS, and diesel. The last criterion, "willingness of recipients" was in intended to avoid supplying electricity to areas where the target communities were unprepared for it. For that reason, preference was given to communities that demonstrated capacity to meet part of the project capital cost and/or a practical willingness to meet the cost of internal wiring of their houses/buildings. Based on these five criteria, MEWD developed a scoring system for ranking projects for funding.

Despite the development of the REF and the adoption of project selection criteria in the mid-1990s, rural electrification did not take off as expected. Although the REF was established as Government Excise Duty collected exclusively for financing rural electrification projects, a portion of the levy was actually diverted to the Government's general-account. In addition, it is often pointed out that the selection criteria were not strictly adhered to. To improve matters, the Rural Electrification Authority (REA) was established in 2004 under MEWD as an independent administrator to manage REF. The main responsibilities of REA are to elaborate annual electrification programs, to implement approved rural electrification projects using the REF, and to monitor the status of projects contracted to institutions/organizations/companies in order to ensure that they fulfil their obligations

and perform in accordance with set standards. MEWD / REA with the assistance from JICA undertook the development of Rural Electrification Master Plan (REMP) inline with Zambia's Vision 2030.

### 3.1.2. Key Players of the Power Sector

The overall responsibility for energy administration and policy formulation lies with the **Ministry of Energy and Water Development** (**MEWD**). The organizational chart of MEWD, focusing on the Department of Energy (DoE) is summarized in Figure 3-1.

The **Rural Electrification Authority** (**REA**) is a statutory body created under the MEWD through the enactment of the Rural Electrification Act No. 20 of 2003. Functions of REA are as follows:

- Administer and manage REF
- Develop, implement and update REMP for systematic electrification of rural area
- Promote utilization of available rural electrification technological options to enhance the contribution of energy to develop agriculture, manufacturing, mining and other economic activities in rural area
- Mobilize funds from within and outside of Zambia to support rural electrification
- Offer, on a competitive basis, the opportunity of rural electrification projects for contractors and developers, and periodically publish information on programs being carried out
- Design and offer, on a competitive basis, smart subsidies for the capital cost of projects to enhance energy supply for development in rural areas
- In conjunction with stakeholders, develop mechanisms of the operation of grid network for rural electrification and other rural energy supply networks
- Finance project preparation studies for rural electrification projects in accordance with guidelines that are developed and approved by the Authority
- Provide recommendations to the Government for the enhancement of access to electricity by the rural population
- Undertake such other activities as are conducive or incidental to the performance of its functions under the Act.

The current organization chart of REA is shown in Figure 3-2. .

The **Energy Regulation Board** (**ERB**), formed through an Act of Parliament of 1995, is responsible for licensing generating plants, regulating transmission and distribution operations, regulating power tariffs, especially retails, and mediating conflicts regarding these issues.

**ZESCO Limited**,is a vertically integrated public power utility, with the functions of generation, transmission, and distribution. The organizational chart of ZESCO is shown in Figure 3-3. ZESCO owns most of the power stations, transmission lines, and distribution facilities in Zambia, including small hydro and diesel power plants. ZESCO is undergoing commercialisation to improve its performance though the Government still retains 100% stake in the company. ZESCO sells approximately half of its electricity to the Copperbelt Energy Corporation and the remaining half to its own retail customers through its own transmission and distribution networks.

The **Copperbelt Energy Corporation** (**CEC**) is a private power utility that owns and controls small gas power plants, 220kV and 66kV transmission lines, and distribution facilities in Copperbelt Province. CEC used to be a division of Zambia Consolidated Copper Mines (ZCCM) but was separated as a private entity in November 1997. CEC has most of the mining and large industrial customers that are supplied at 66kV or higher voltage in Copperbelt Province as its customers, while small customers within CEC's service area are supplied by ZESCO.

The **Lunsemfwa Hydropower Company Plc** is a private Independent Power Producer (IPP) that owns Mulungushi and Lunsemfwa Hydropower Stations with the total capacity of 38MW. The

largest shareholder is ESKOM, the power utility of South Africa, who has 51% of the stake.

In some rural areas where ZESCO's national grids do not cover, small IPP and Non-Governmental Organizations (NGOs) are supplying electricity with either small hydro or diesel power plant through the isolated distribution network. In Eastern Province, there are three **Energy Service Companies** (**ESCOs**) established with the support from international donor agencies. ESCOs are leasing Solar Home Systems to several hundred of households and collecting a fixed monthly fee.

The overall structure of electricity sector in Zambia is summarized in Figure 3-4.

### 3.1.3. Acts Related to Rural Electrification

There are three main statutes related to rural electrification: Electricity Act (enacted in April 1995 and amended in December 2003), Energy Regulation Act (enacted in April 1995), and Rural Electrification Act (enacted in December 2003).

The **Electricity Act** was enacted to regulate the generation, transmission, distribution, and supply of electricity. This Act was amended in 2003.

The **Energy Regulation Act** was enacted to establish the Energy Regulation Board and to define its functions and responsibilities, and to manage the licensing of undertaking for the production of energy or production or handling of certain fuels.

The **Rural Electrification Act** was enacted to establish Rural Electrification Authority and to define its functions and to provide for matters connected with or incidents to the foregoing.

### 3.1.4. Policy Related to the Renewable Energy

Currently, firewood and charcoal account for 80% of Zambia's total energy consumption. From the viewpoint of environmental conservation, GRZ has been promoting the efficient use of wood fuels and the reduction of charcoal consumption by 400,000 tonnes by 2010. As a country that imports 100% of the petroleum consumed domestically, the Government recognizes the importance of New and Renewable Sources of Energy (NRSE). The Policies regarding NRSE as stated in the revised National Energy Policy of 2007 are as follows:

- Promotion of the NRSE technology
- Promotion of the wider application of NRSE technology
- Promotion of information dissemination on the use of NRSE
- Promotion of education, research and training in NRSE at various levels

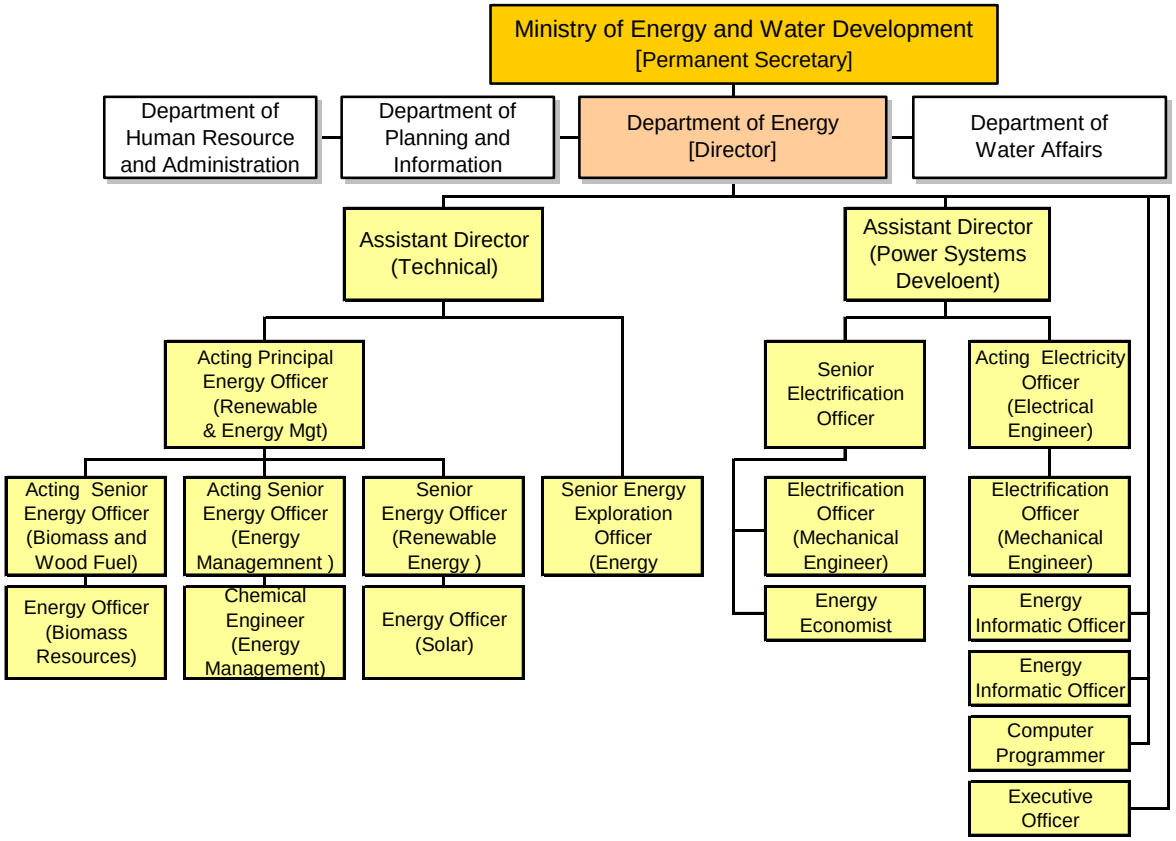



**Figure 3-1 Organization Chart of MEWD and DoE**

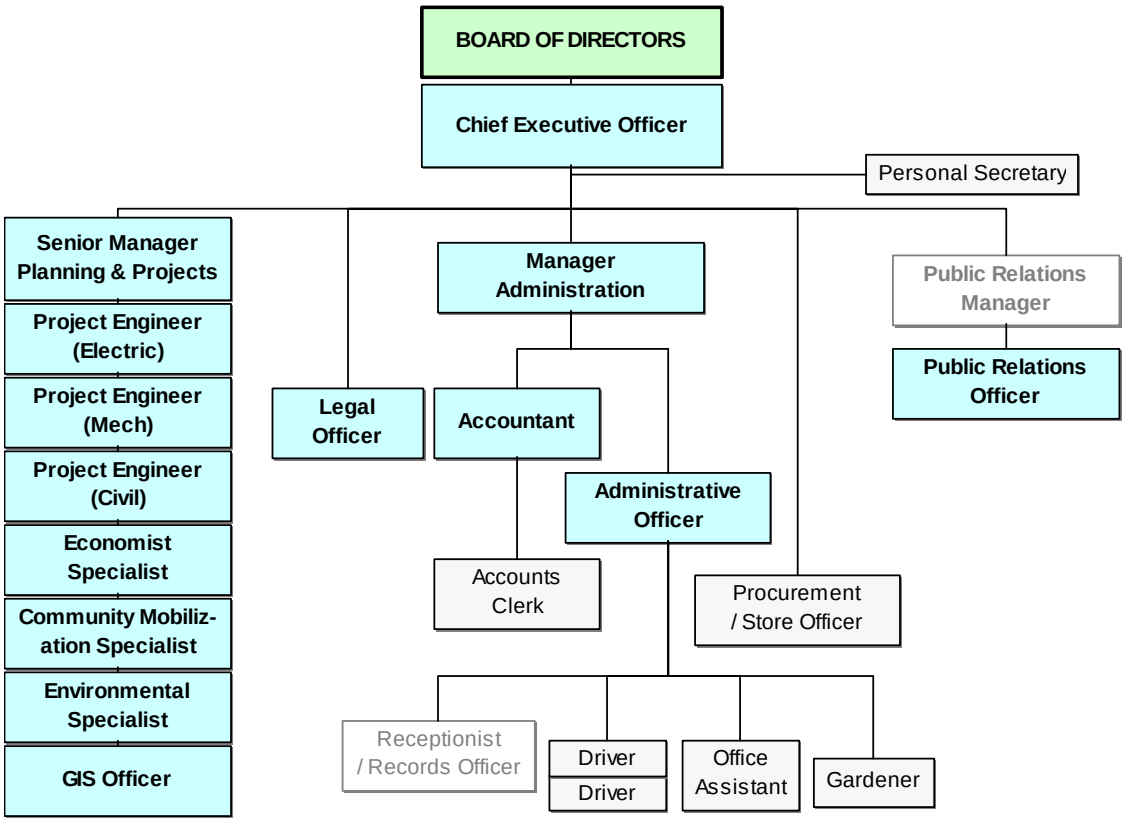



**Figure 3-2 Organization Chart of REA**

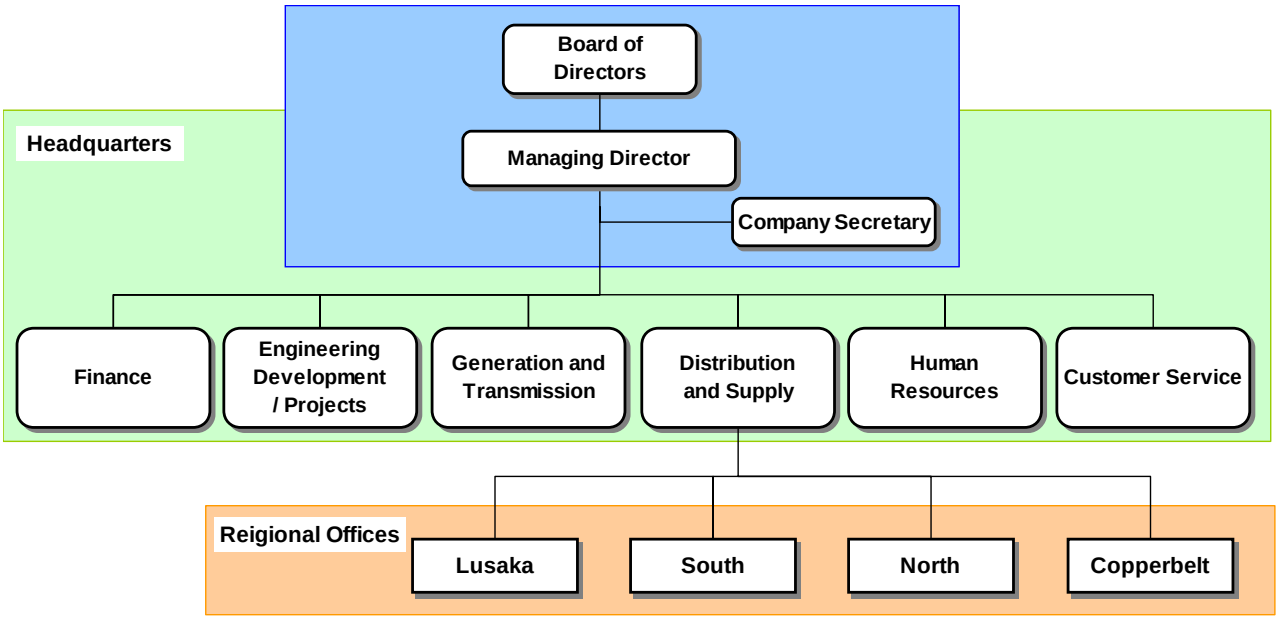
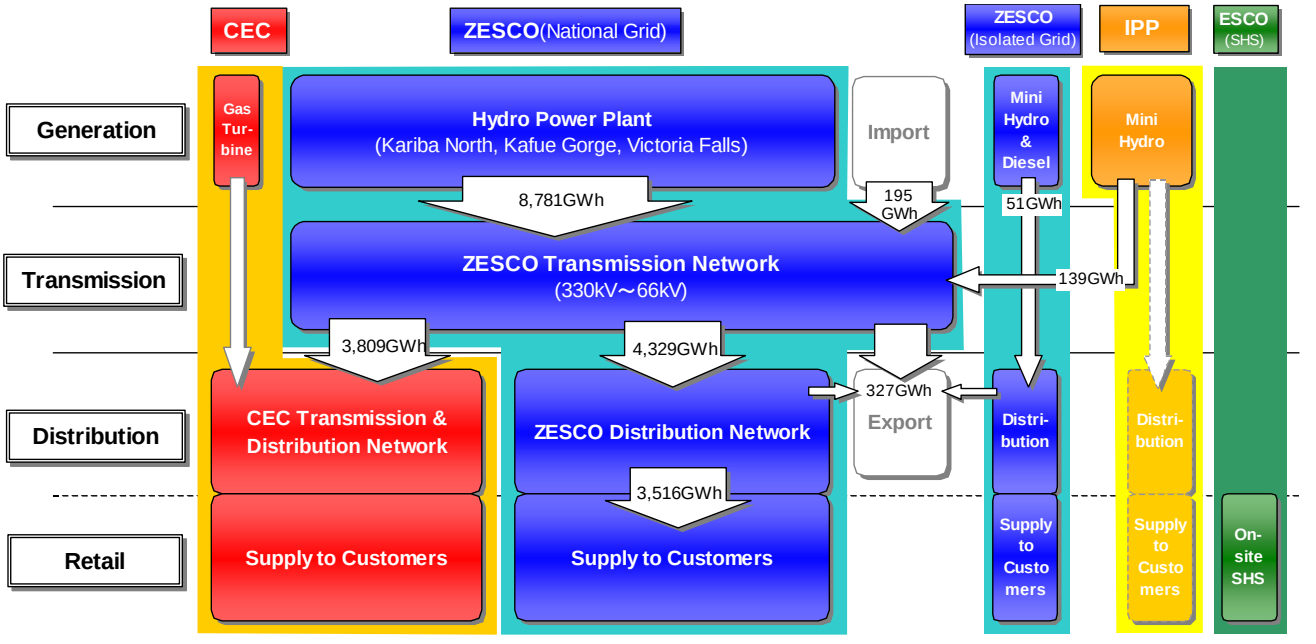



**Figure 3-3 Organization Chart of ZESCO**




Source：ZESCO Statistical Yearbook of Electricity Energy 2005/2006 [1]

**Figure 3-4 Electricity Sector Structure**

[1] CEC's "Distribution Network" in Figure 3-4 means electricity supply to customers with high-voltage lines (66kV or higher), not in a narrower sense of distribution lines (33kV or lower).

## 3.2. Rural Electrification Fund and Its Management

### 3.2.1. Rural Electrification Fund Scheme in Zambia

ZESCO's customers are obliged to pay Government Excise Duty on their monthly electricity bills. This Excise Duty amounts to 5% of total electricity bill which is broken down as follows: 3% is appropriated for Rural Electrification Fund (REF), which is used to finance rural electrification projects and 2% is for the other Government programs. ZESCO's bulk supply to CEC and exports are exempt from this Government Excise Duty.

The 3% levy was originally established in 1995, but this scheme did not work well for the following reasons:

- Revenues and expenses of REF were not separated from those of the Government's general account budget, thus the disbursements to the REF were delayed.
- MEWD was responsible for selecting rural electrification projects to be financed using REF, but did not have enough capacity to assign its staff to investigate and evaluate the cost and benefit of proposed rural electrification projects and to manage ongoing projects.
- ZESCO was a contractor but at the same time it was responsible for planning and managing of rural electrification projects.

Figure 3-5 is a flow chart illustrating the raising and release of REF. The 5% Excise Duty, is collected by ZESCO on behalf of Government. Ministry of Finance and National Planning (MFNP) appropriates 3% for REF, however the amount allocated to REA as REF does not exactly match this 3%, because REA receives its income based on a budget approved by the Government, and not the exact amount that MFNP receives from ZESCO.

It is expected that once the REMP is finalized REA will be able to attract loans, grants and donations from international cooperating partners to augment the REF.

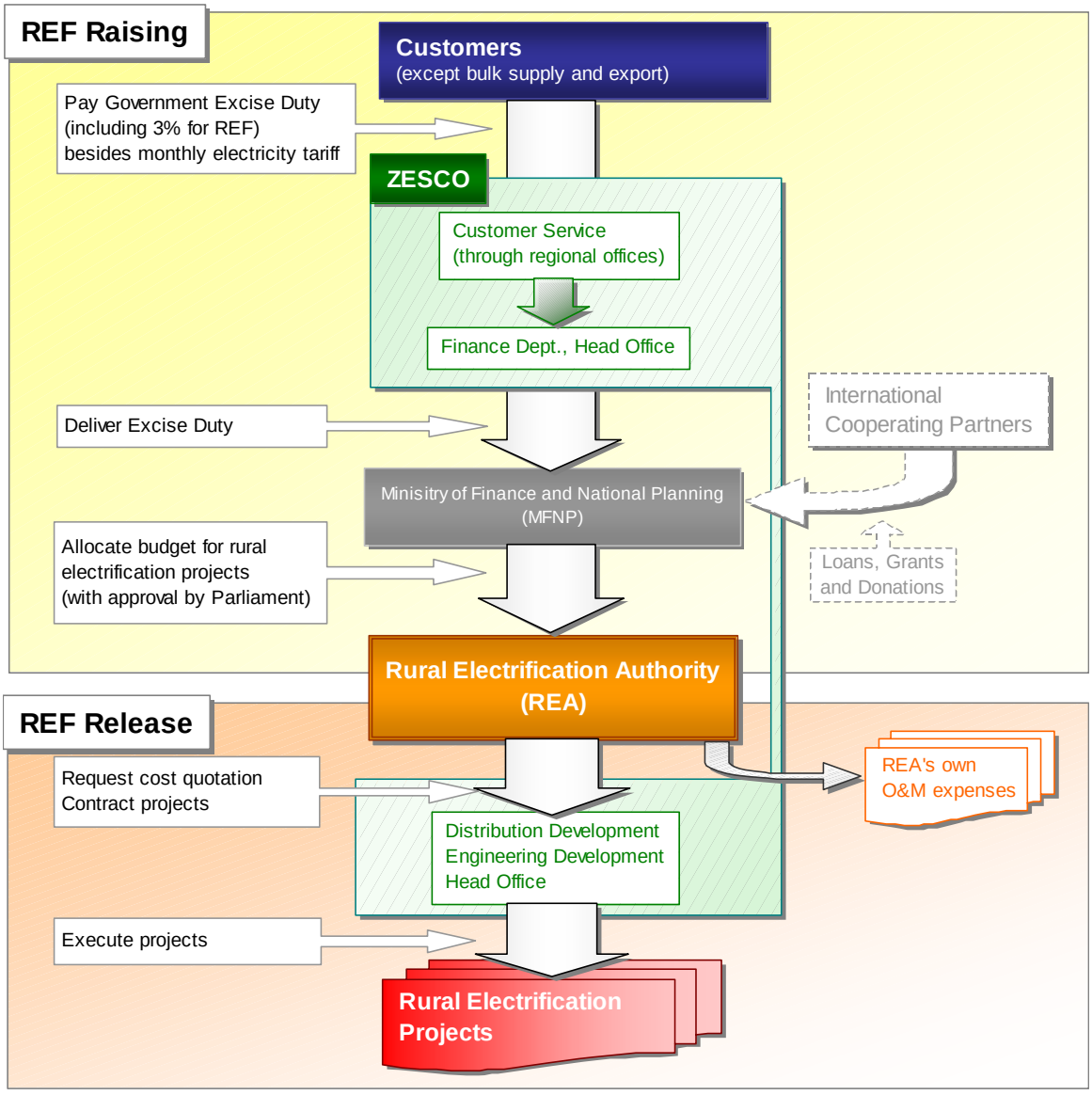



**Figure 3-5 Current Flow of Rural Electrification Fund (REF)**

### 3.2.2. REA's Budget

The initial budgetary allocation to REA for the year 2005 was K11.3 billion, which roughly matches the expected REF levy for the year, that is, 3% of ZESCO's revenue from retail sales (K353 billion in FY 2004/05). And according to this budget, REA's expenditure would consist of K1.3 billion for administration and K10 billion for projects. As opposed to this original plan, however, REF release for projects in 2005 was done by MEWD while REA only handled funds for own operation and management.

The first audited accounts of income and expenditure for the year 2005 (from 1st January to 31st December) for REA, together with the pre-audit statement of FY 2004, are summarized in Table 3-1. REA's income for FY2005 was around K5.7 billion, about half of that was originally budgeted, and REF release is not accounted for in this statement[2]. REA's expenditure was about K1.3 billion for its operations and related costs, and the remainder, about K4.4 billion, was carried forward to the next year.

[2] REA had planned its first release of REF in the name of REA by the end of 2005, however, due to the delay in Government approval, it was postponed to 2006.

**Table 3-1 REA's Audited Income and Expenditure Account (Jan-Dec 2005)**

| | (K1,000) | | *(1,000US$)* | |
|---|---|---|---|---|
| | ***FY2004*** | ***FY2005*** | ***FY2004*** | ***FY2005*** |
| **Income** | ***348,750*** | **5,674,053** | ***(91.8)*** | **(1,493.2)** |
| **Expenditure** | | | | |
| Administration | *156,530* | 545,835 | *(41.2)* | (143.6) |
| Personnel | *2,355* | 546,398 | *(0.6)* | (128.3) |
| Board Expenses | *50,218* | 111,320 | *(13.2)* | (29.3) |
| Movable Assets | *13,597* | 75,449 | *(3.6)* | (19.9) |
| Bank Charge | *589* | 2,251 | *(0.2)* | (0.6) |
| Miscellaneous | *1,348* | 15,145 | *(0.4)* | (4.0) |
| | ***224,638*** | **1,296,398** | ***(59.1)*** | **(341.2)** |
| **Surplus** | ***124,112*** | **4,377,656** | ***(32.7)*** | **(1,152.0)** |

Note: Exchange rate of 1US$ = K3,800 was applied for currency conversion

The gap between REA's initial budget (K11.3 billion) and its actual income (K5.7 billion) is partly, covered by the REF release from the MEWD, which, according to ZESCO's internal report, was about K3.8 billion in 2005 Clearly the gap between the two figures needed to be closed

In 2006, REA took over the full responsibility of managing REF. After the signing the Project Implementation Agreement with ZESCO in May 2006, REA published the list of rural electrification projects to be executed in 2006 (see Table 3-2). In its 2006 budget, K11.66 billion was allocated to REA, of which 90% (K10.44 billion) was released for rural electrification projects. REA's financial statements of FY2006, which covers not only its own administration costs but also the REF release for projects, are still in progress and are expected to be completed by the end of 2007.

Figure 3-6 summarizes the difference between REF levy and REA's budget.

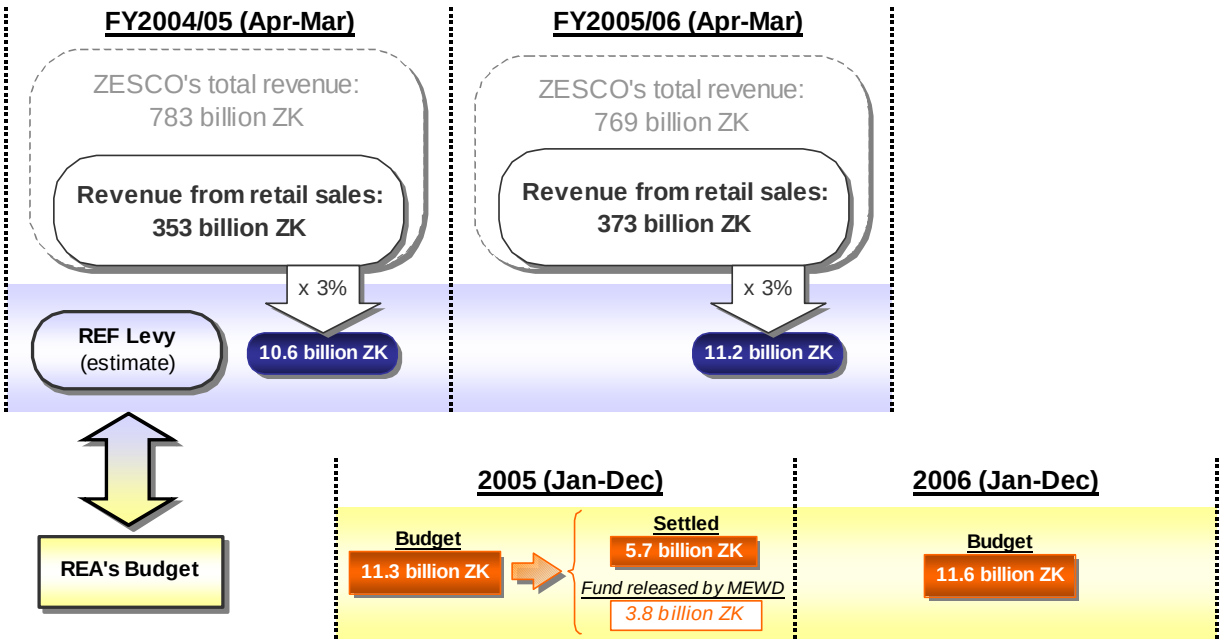



**Figure 3-6 Difference between REF Levy and REA's Budget**

**Table 3-2 Rural Electrification Projects Approved by REA for Implementation in 2006**

(K million)

| Province | Project Name | Estimate Cost | 2006 Allocation |
|---|---|---|---|
| Central | Mungule's Area – Phase 1 Clinic Court & Mutakwa School | 920 | 500 |
| | Mutombe Basic School | 250 | 250 |
| | Nambala High School | 443 | 443 |
| | Serenje's Area Muzamene Basic School | 215 | 215 |
| Copperbelt | Lubendo Basic School | 181 | 181 |
| | Mushili School | 175 | 175 |
| | Kabushi – Phase 1 | 6,000 | 500 |
| | Kankoyo | 1,231 | 231 |
| Eastern | Mphamba School | 112 | 112 |
| | Mtenguleni's Area Katinta Basic School, Chipungu RHC & Chankanga Basic School | 630 | 630 |
| | Ndake Area – Ndake Basic School, Court House, Ndake RHC | 500 | 500 |
| | Lumezi | 3,424 | 500 |
| Luapula | Lukwesa High School | 87 | 87 |
| | Bakashiwa Home Care | 85 | 85 |
| | Nsengaila Basic Schools | 45 | 45 |
| | Nshungu Basic Schools | 75 | 75 |
| | Mashitolo Basic Schools | 55 | 55 |
| | Mambilima Mwenge Basic School | 62 | 62 |
| | Lubansa & Kalasa Basic Schools | 64 | 64 |
| | Chabilikila School | 80 | 80 |
| Lusaka | Palabana | 200 | – |
| | Mupelekese Area (Schools & Health Centres) | 1,200 | – |
| | Luangwa | 1,200 | – |
| North-Western | Kamiteto Primary Schools | 168 | 168 |
| | R.Mwepu Primary Schools | 67 | – |
| | Kisalala Primary Schools | 126 | – |
| | Tumvwananai Primary Schools | 9 | 9 |
| | Kapijimpanga Primary Schools | 134 | 134 |
| | Kaimbwe School | 527 | – |
| | Chitokoloki Mission * | N.A. | 100 |
| | Zengamene * | N.A. | 100 |
| Northern | Chikwanda Basic School, Court House, Market & RHC | 100 | 100 |
| | Luwingu High School | 93 | 93 |
| | Saili Basic School | 77 | 77 |
| | Kaputa to the Grid – Phase 1 | 12,000 | 1,000 |
| | Chozi- Waitwika Area | 535 | 535 |
| | Mpumba Basic School & Court House | 221 | 221 |
| | Mulilansolo – Phase 1 | 2,500 | 243 |
| | Kafwimbi's Area | 784 | – |
| | Chitimukulu RHC & Police Kapolyo Basic And Kanyanta Basic School | 543 | 543 |
| Southern | Sianjalika's Area – School And RHC | 73 | 73 |
| | Sikalongo Mission – Choma | 567 | – |
| | Mwanachingala's Area - School And RHC | 42 | 42 |
| | Gwembe Tonga | 200 | 200 |
| | Nansenga Basic Mulawo APU, Kaunga Basic, Kaunga Basic and Malala Basic Schools | 250 | 250 |
| | Choongo's Area – Ntema Basic School | 200 | 200 |
| Western | Shang'ombo – Phase 1 | 3,500 | 1,000 |
| | Luampa Mission | 760 | 360 |
| | Sikongo-Phase 1 (Kalabo Basic & Kalabo Farm Training Centre) | 7,600 | – |
| | Mwandi B School Royal Court & Market | 200 | 200 |
| | Kaoma to the Grid | N.A. | N.A. |
| | Lukulu | N.A. | N.A. |
| **Total** | | **48,512** | **10,439** |

Note: "Chitokoloki Mission" and "Zengamene" projects in North-Western Province are micro-hydro projects contracted to private investors, not ZESCO

In FY 2007 REA's total budget was K23.21 billion, whose source consisted of the REF levy (about K13 billion) and additional Government funding amounting to about K10 billion. According to REA, 78% (about K18 billion) of the budget would be allocated to rural electrification projects (16 grid extension projects, 1 pre-feasibility study for a mini hydro, and 2 solar panel installation projects, refer to Table 3-3), and the remaining 22% (about K5 billion) for REA's administrative costs. ZESCO was expected to undertake 7 projects out of the 16 grid extension projects (including the continuation of 4 ongoing projects), while the remaining 9 projects were expected to be carried out by private entities on a turnkey basis. The selection of private entities to undertake the projects (9 projects are grouped into 5 lots) would through a tender process,.

**Table 3-3 Rural Electrification Projects Approved by REA for Implementation in 2007**

| Province | District | Project Name | Note |
|---|---|---|---|
| Central | Chibombo | Mungule's Area – Phase II (Mungule Clinic & Court and Mutakwa School) | Grid extension by ZESCO |
| Central | Chibombo | Moombo Clinic & School | Grid extension by private sector (Lot-1) |
| Central | Chibombo | Kayosha Basic School & Rural Health (RH) Centre | Grid extension by private sector (Lot-1) |
| Copperbelt | Mpongwe | Machiya Basic School, RH Centre & GRZ Offices | Grid extension by private sector (Lot-2) |
| Eastern | Chipata | Undi RH Centre, Undi School & Local Court | Grid extension by private sector (Lot-3) |
| Eastern | Lundazi | Mwase | Grid extension by private sector (Lot-3) |
| Eastern | Chama | Chama | Grid extension by ZESCO |
| Luapula | Mansa | Mutiti, Chimfula, Kalaba, Lupende & Chibinda | Grid extension by private sector (Lot-4) |
| Luapula | Milenge | Pre-feasibility Study for a Mini-hydro at Mumbotuta Falls | Pre-FS for mini-hydro |
| Lusaka | Kafue | Chipapa School & Clinic | Grid extension by private sector (Lot-1) |
| North-Western | Kasempa | Kaimbwe School | Grid extension by ZESCO |
| North-Western | Kasempa | Selauke School & RH Centre | Grid extension by private sector (Lot-2) |
| Northern | Kaputa | Kaputa to the Grid – Phase II | Grid extension by ZESCO |
| Northern | Chinsali | Muliansolo – PhaseII | Grid extension by ZESCO |
| Southern | Sinazongwe | Gwembe Tonga: Ngoma Basic School & RH Centre | Grid extension by private sector (Lot-5) |
| Western | Kaoma | Luampa Mission | Grid extension by ZESCO |
| Western | Kalabo | Sikongo – Phase II | Grid extension by ZESCO |
| Luapula | Samfya | Rural Solar Energy Systems | Solar panel installation in partnership with UNIDO |
| Various Areas | | Solar Energy Systems | Continuition of ongoing projects |

### 3.2.3. The Way Forward

An important observation regarding REA's accounting system was that it consisted only of cash accounting. Thus no distinction was made between capital expenditure and operating expenses, a system typical of Government financial reporting. There were no "balance sheets" or "profit and loss accounts" which could be used to assess the effectiveness of the capital expenditures .

According to the policy of REF, funds released for rural electrification projects to ZESCO (or other contractors if any) were treated as grants. REA did not account for these releases as "assets", which should be recorded by ZESCO as "Capital Grants and Contributions" (= liabilities) in its balance sheet. Similarly ZESCO, did not keep maintain separate accounts of the fixed (tangible) assets that acquired through the REF. Thus no information at all was available on the performance of the rural

electrification schemes. In cases where revenues from such REF schemes fell short of the operating cost, the losses were generally covered by ZESCO's total revenue without clear distinction. The Study Team recommends that REA, which is responsible not only for each year's fund allocation but also for monitoring the performance of released REF, should consider developing "balance sheet" and "profit and loss account" of REF schemes in close coordination with ZESCO, in order to improve the monitoring of the effectiveness of the Fund.

### 3.2.4. Rural Electrification Programme in Kenya

Kenya's Rural Electrification Programme (REP) is an example of more advanced and established scheme of rural electrification than Zambia's in that Kenyan scheme can provide statistical data regularly that are useful for monitoring its performance.

REP in Kenya was established in 1973 under the agreement between the Government of Kenya and East African Power & Lightning Company, predecessor of the existing Kenya Power & Lighting Company Limited (KPLC). The REP is funded through the Government, whose fund source is not only REP levy collected by KPLC (5% on "all electricity consumed in the country") but also donor-funding that is usually financed as project-based. Its conspicuous difference from Zambian scheme is the ownership of facilities. Under the Kenyan scheme, any property acquired by REP remains the property of the Government even after the completion of construction works, and KPLC, which is virtually the monopoly in transmission and distribution, only acts as a management agent to contract distribution lines extension and electricity supply on behalf of the Government. KPLC provides the customers of REP with same services as KPLC's own customers, that is, the same electricity tariff is applied universally whether it's for REP customers or KPLC's own customers.

Financial statements ("balance sheet" and "profit and loss accounts") of REP are compiled by KPLC staff, but separately from those of KPLC. These financial statements are reported to the Government (Ministry of Energy), who audits them with the support of hired external auditors.

REP's operational and financial performances are summarized in KPLC's annual report.

Table 3-4 shows the number of customers under REP scheme and the electricity sold to them. The number of customers as of June 2006 is about 110,000, or about 16% of KPLC's own customers, and the electricity sales is 186 GWh, about 4% of KPLC's own electricity sales that include large industrial customers. Both the number of customers and the electricity sales have grown by 54% for the past 5 years, which is a little higher than those of KPLC's own customers respectively.

**Table 3-4 Number of Customers and Electricity Sales (Kenya's REP Scheme)**

| | | 2000/01 | 2001/02 | 2002/03 | 2003/04 | 2004/05 | 2005/06 | FY05/06 against FY00/01 |
|---|---|---|---|---|---|---|---|---|
| **Customers** | **REP** | **71,718** | **78,941** | **87,175** | **93,442** | **101,789** | **110,724** | **154%** |
| | KPLC | 465,361 | 514,680 | 556,099 | 592,752 | 633,355 | 691,525 | 149% |
| **Electricity Sales (GWh)** | **REP** | **121** | **130** | **147** | **150** | **164** | **186** | **154%** |
| | KPLC | 3,091 | 3,498 | 3,654 | 3,940 | 4,200 | 4,420 | 143% |

Source: KPLC Annual Report Note: Statistics of KPLC exclude REP scheme

Table 3-5 shows the profit and loss account of REP. The REP scheme has been in the red, but the loss margin has shown improvement recently, from –115% in FY2001/02 to –53% in FY2005/06. The book value of REP's assets as of June 2006 is 8,277 million KSh, about 20% of KPLC's own assets (38,729 million KSh). The ratio of annual net loss against assets generates an indicator similar to return on assets (ROA), which was around –10% for the past 3 years . This operating loss belongs to the Government thus the levy is also used for compensating for the operating loss of REP.

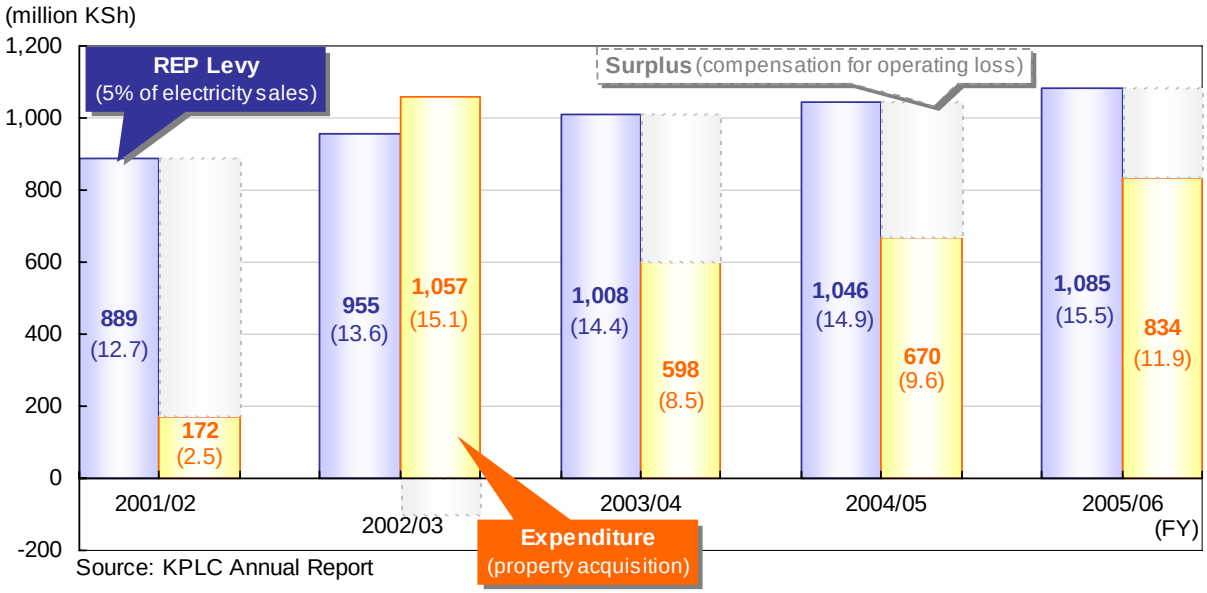
**Table 3-5 "Profit and Loss Account" and "Assets" of Kenya REP**

(million KSh) *(million US$)*

| | 2001/02 | 2002/03 | 2003/04 | 2004/05 | 2005/06 | *2005/06* |
|---|---|---|---|---|---|---|
| **Revenue from Electricity Sales (A)** | **979** | **1,006** | **978** | **1,208** | **1,539** | ***22.0*** |
| Operating Cost (B) | 2,103 | 1,932 | 1,681 | 1,912 | 2,347 | *33.5* |
| **Net Operating Loss (C) = (A)-(B)** | **-1,124** | **-927** | **-703** | **-704** | **-808** | ***-11.5*** |
| (C) / (A) | -115% | -92% | -72% | -58% | -53% | *-53%* |
| **Assets (D)** | **5,777** | **6,694** | **7,066** | **7,634** | **8,277** | ***118.2*** |
| (C) / (D) | -19% | -14% | -10% | -9% | -10% | *-10%* |

Source: KPLC Annual Report
Note: Exchange rate of 1US$ = 70KSh is applied for currency conversion

Figure 3-7 shows the balance between REP levy, i.e.5% of electricity sales collected by KPLC, and expenditure for property acquisition (capital expenditure for REP projects) under this scheme.




Note: Numbers in parentheses are the values in million US$ (1US$ = 70KSh)

**Figure 3-7 Levy and Expenditure of Kenya REP Scheme**

These numbers conceptually corresponds to Figure 3-6 in Zambia's case. As seen in the chart, annual expenditure for projects is less than the collected levy except in FY2002/03, and the surplus is reserved for compensating for REP's operating loss.

According to MoE and KPLC, REP's assets will be transferred to KPLC in the future when the assets become as profitable as KPLC's own, but so far no asset transfer has been made or even discussed.

This Kenyan scheme also has drawbacks, especially in that REP's operation is excluded from KPLC's financial performance, thus little incentive may be imposed to KPLC to improve the profitability than in Zambia's case, where the ownership of assets is transferred to ZESCO once the

construction works are completed and ZESCO has to take the responsibility to improve profitability[3]. However, Zambia's rural electrification scheme, which is still at the very early stage to grasp its financial status, has a lot to learn from the scheme of other countries like Kenya, where at least the tools for monitoring the performance of rural electrification projects are considerably developed.

## 3.3. Power Supply and Demand

### 3.3.1. On-grid Power Plants

#### (1) ZESCO's Major Hydropower Plants

ZESCO owns three large hydropower plants, and on all of them major works were under way under a Power Rehabilitation Project (PRP). Table 3-6 shows the details of the major hydropower plants. In FY 2004/05, they generated in total 8,816GWh, which almost matches the electricity consumption in Zambia.

**Table 3-6 Three Major Hydropower Plants in Zambia**

| Name of Power Station | | Kariba North Bank | Kafue Gorge | Victoria Falls |
|---|---|---|---|---|
| Number of Units | | 4 | 6 | 14 |
| Original Installed Capacity | | 600MW | 930MW | 108MW |
| Available Capacity (Mar.2007) | | 510MW | 750MW | 108MW |
| Expected Capacity after Rehabilitation | | 720MW | 990MW | 108MW (Completed) |
| Electricity Generation | FY2001/02 | 2,886GWh | 5,570GWh | 602GWh |
| | FY2002/03 | 2,790GWh | 4,806GWh | 448GWh |
| | FY2003/03 | 3,158GWh | 4,668GWh | 354GWh |
| | FY2004/05 | 3,644GWh | 4,073GWh | 269GWh |
| | FY2005/06 | 3,661GWh | 4,619GWh | 537GWh |
| | FY2006/07 | 3,949GWh | 5,034GWh | 674GWh |

Source: ZESCO Annual Report

(a) Kariba North Bank Power Station

Kariba North Bank Power Station (KNB-PS), which is located in Southern Province, was commissioned in 1976. KNB is connected with Leopards Substation via 330kV transmission lines. This power station used to belong to the Kariba North Bank Company Limited (KNBC), a company in which the Government had 100% stake and sold all of its electricity generation to ZESCO. In June 2004 the KNBC was formally integrated with ZESCO .

KNB-PS consists of four 150MW units each. The rehabilitation works for Units 1 and 2 were finished in 2005, and the unit outputs of these 2 units were upgraded to 180MW each. The rehabilitation works for unit 3 and 4 were also scheduled for completion from 2007 and 2008, increasing their outputs to 180MW as well. Thus the total capacity of KNB-PS will be increased to 720MW after the completion of rehabilitation works.

[3] In fact, KPLC is obliged to improve the profitability of REP to a certain extent by promising to achieve numerical targets regarding rural electrification, as a part of the Performance Contract agreed between the Government and power utilities (in this case, KPLC), that are also state-owned companies, at the beginning of every fiscal year. Achievement of the numerical targets is monitored by the Government for evaluating the performance of power utilities, which, according to the Government, may also affect the managers' remuneration.

(b) Kafue Gorge Power Station

Kafue Gorge Power Plant (KG-PS), located in Southern Province bordering on Lusaka Province with Kafue River, is the biggest power plant in Zambia. KG-PS is connected to Leopards Hill Substation via 330 kV transmission lines. The six-150MW-units power station have been the central pillar of Zambia's power supply since its inauguration in 1971. The rehabilitation works at Units 3 and 4 were completed at the end of FY2005/06. It was planned to rehabilitate, the rest of the units by 2008. After the rehabilitation, the unit output will be increased to 165 MW, raising the total plant capacity to 990MW.

(c) Victoria Falls Power Station

Victoria Falls Power Station (VF-PS), which is located in Southern Province, was commissioned in 1938. This hydropower station consists of 3 groups of turbines that are called "Station A", "Station B" and "Station C" respectively. Station A has two 1MW units and two 3MW units (8MW in total), Station B has six 10MW units (60MW), and Station C has four 10MW units (40MW). The total output of these fourteen units of VF-PS is 108 MW. With the completion of rehabilitation works in FY2005/06, VF-PS recovered its original available capacity. VF-PS is connected to Muzuma Substation via 220 kV transmission lines.

### (2) ZESCO's Small Hydropower Plants

Table 3-7 shows ZESCO's four small hydropower plants.

**Table 3-7 ZESCO's Small Hydropower Plants**

| Name | | Lusiwasi | Musonda | Chishimba | Lunzua |
|---|---|---|---|---|---|
| Province | | Central | Luapula | Northern | Northern |
| Installed Capacity | | 12MW | 5MW | 6MW | 0.75MW |
| Available Capacity (Mar.2007) | | 9MW | 5MW | 5MW | 0.75MW |
| Number of Units | | 3MW x 4 | 1MW x 5 | 1.2MW x 4<br>0.3MW X4 | 0.25MW x 3 |
| Electricity Generation | FY2001/02 | 9.8GWh | 17.7GWh | 5.5GWh | 2.0GWh |
| | FY2002/03 | 15.7GWh | 15.8GWh | 7.0GWh | 2.7GWh |
| | FY2003/03 | 17.7GWh | 15.4GWh | 16.6GWh | 1.1GWh |
| | FY2004/05 | 13.7GWh | 17.2GWh | 16.9GWh | 1.7GWh |
| | FY2005/06 | 3.7GWh | 17.0GWh | 16.3GWh | 1.7GWh |
| | FY2006/07 | 33.8GWh | 16.0GWh | 11.9GWh | 1.4GWh |

Source: ZESCO Annual Report

Lusiwasi HP is synchronized to the grid. The other three HPs are also connected to the grid via transmission line, but since they do not have synchronizer they must be isolated from the grid by circuit breakers. ZESCO planned not only to synchronize these three HPs to the grid by but also to renovate and increase their capacities. Details of these expansion plans are given in Chapter 8.

### (3) Generating Facilities of Other Private Companies

(a) Lunsemfwa Hydropower Company

Lunsemfwa Hydropower Company (LHPC) is an independent power producer (IPP),. The largest shareholder of LHPC is ESKOM, the power utility of South Africa with a 51% stake. LHPC owns two Hydropower Stations, namely, Lunsemfwa Hydropower Plant (18MW) located in Mkushi District and Mulungushi Hydropower Plant (20MW) in Kabwe District. LHPC sells all its electricity to ZESCO under a long term Power Purchase Agreement (PPA). LHPC's electricity supply to ZESCO was 225GWh in FY2004/05 and 139GWh in FY2005/06, representing 2.7% and 1.6% of the total supply in Zambia.

The Zambian Government plans to of liberalize the electricity market so that IPPs such as LHPC

can supply electricity directly to large customers through ZESCO's transmission lines.

(b) Copperbelt Energy Corporation

Copperbelt Energy Corporation (CEC) buys electricity from ZESCO on a long-term PPA to supply its customers, mostly the mining companies on the Copperbelt, . CEC's power demand constitutes about half of Zambia's total electricity demand, and its power system, wheels power export from DR Congo to Zimbabwe and South Africa. The CEC system handles about 70% of the electricity running through Zambia's national grid.

CEC operates an 80 MW emergency gas turbine station and the transmission and distribution networks consists of 808 kilometres of overhead lines and 36 high voltage substations. Table 3-8 gives the details of CEC's four emergency gas turbines.

**Table 3-8 CEC's Gas Turbines**

| Name | Bancroft | Luano | Maclaren | Kankoyo |
|---|---|---|---|---|
| Installed Capacity | 20MW | 40MW | 10MW | 10MW |
| Available Capacity | 20MW | 40MW | 10MW | 10MW |
| Number of Unit | 2 | 2 | 1 | 1 |
| Unit Capacity | 10MW | 20MW | 10MW | 10MW |
| Generation (FY2005) | 310kWh | 677kWh | 422kWh | 303kWh |

Source: CEC

(c) Konkola Copper Mines

Konkola Copper Mines (KCM) owns a 20MW Nkana Gas Thermal Power Plant located in Kitwe District, Copperbelt Province. KCM is the leading copper mining company in Zambia and purchases electricity from CEC while its own Nkana Gas thermal Power Plant is maintained as an emergency standby facility.

### 3.3.2. Off-grid Power Plants

#### (1) Off-grid Power Generation in Zambia

Off-grid power generation plays an important role of supplying electricity to areas that are remote from the national grid. A possible mode of electrifying these areas is power supply through isolated small distribution networks, called "micro-grids". These may be powered by diesel or hydropower plant. However, in some areas where even an isolated grid is not economically viable, a solar home system (SHS) is another alternative electricity supply, Details of this are discussed in Chapter 9.

The Zambian Government has shown strong interest in the research and development of renewable energy sources, such as biomass and geo-thermal, as sustainable means of electricity supply in remote areas.

#### (2) Diesel Generation

ZESCO has diesel power plants in some remote areas, and about half of them are located in North-Western Province. Table 3-9 shows the list of these diesel power plants. Taking into account the high cost of fossil fuels and their negative impact on the environment, these diesel power plants are unsustainable. ZESCO had plans to replace them by connecting to the national grid or with renewable energy sources such as micro-hydro. Along these lines, Kaoma diesel power plant in Western Province and Kasempa diesel power plant in North-Western Province ceased operations following the connection of their supply areas to the national grid. In FY2004/05, the sales revenue

by diesel generation was only K1,319 million, which was only 6% of their fuel cost of K20,844 million.

Contrary to this general trend, however, some new diesel power plants have been installed and inaugurated recently, which is in line with the Government's policy to electrify all the 72 District Administrative Centres (DAC). This is the only feasible means of supplying DACs that are too remotely located from existing distribution lines. Examples are the Chavuma diesel power plant that started commercial operations in FY2004/05, followed by Shang'ombo diesel power plant in Western Province, which was under construction at the time of reporting and was expected to start operations in January 2007.

**Table 3-9 ZESCO's Diesel Power Plants**

| Name | Province | Capacity | Generation (FY2006/07) |
|---|---|---|---|
| Chama | Eastern | 263kW | 828MWh |
| Luangwa | Lusaka | 732kW | 756MWh |
| Kaputa | Northern | 486kW | 1,196MWh |
| Mwinilunga | North-Western | 1,430kW | 2,729MWh |
| Kabompo | North-Western | 1,560kW | 2,599MWh |
| Zambezi | North-Western | 800kW | 2,075MWh |
| Chavuma | North-Western | 690kW | 688MWh |
| Mufumbwe | North-Western | 320kW | 933MWh |
| Kasempa (operation suspended) | North-Western | 530kW | N.A. |
| Kaoma (operation suspended) | Western | 2,620kW | N.A. |
| Lukulu | Western | 512kW | 1,140MWh |

Source: ZESCO Annual Report

### (3) Micro-Hydro Power Generation

There are many micro hydropower plants owned and managed by local community or local residents especially in remote areas of Zambia. These HPs supply electricity to some specific place or areas via isolated micro-grids. Details of these micro HPs are described below. The information on micro HPs is scanty and unreliable. It is possible that there are more micro HPs than indicated by the data from either DoE or REA.

#### (a) Zengamina Hydropower Plant

Zengamina HP is located 95km north of Mwinilunga District centre, North-Western Province. It uses the water of Zambezi River for power generation, and a 700 kW cross-flow turbine manufactured by Ossberger was installed. The plant started commercial operation in July 2007, supplying electricity to a hospital, clinics, schools, small business and households in Ikelenge RGC and Nyakaseya RGC.

Zengamina Power Company owns and operates this Power Plant. The company offers two types of electricity tariffs to its customers. One is a prepaid-fixed charge of 10US$ per month for which the maximum current is limited at one ampere. The other is commodity charge, which consists of 12.5US$ per month for basic charge and 11US Cents per kWh for electricity usage. Zengamina also plans to adopt another option of cheaper 8US Cents tariff for electricity usage from midnight to 6:00 AM, and for community services like the hospital. The connection fee is fixed at 65US$ for low-end customers, rising to 200US$ for a three phase metered connection. These tariffs are quite different from those of ZESCO. Zengamina HP reasons that its low connection fee enables many customers to afford a connection, while the high electricity charge encourages them to use electricity carefully.. In the micro-grid system such as Zengamina HP, limited electricity must be supplied to as many people as possible. Therefore, this type of tariff is suitable for a rural electrification program.

Nevertheless, these two RGCs have quite large potential demand, and Zengamina Power Company expects that the demand will exceed the maximum capacity of Zengamina HP in eight years. In

anticipation of this, there are plans to construct a new 1,000kW hydropower plant upstream of the existing scheme, including a storage dam (this site was visited by the Study Team and is described in Chapter 8 of this report). Furthermore, the storage dam to be installed at the upper site could enhance the efficiency of water usage, allowing the existing Zengamina HP to use more water for power generation. There are also plans to install the second turbine-generator unit with another 700 kW capacity at the existing Zengamina HP, where the first and end section of second penstock and a bed for second turbine have already been installed. Figure 3-8 shows pictures of Zengamina HP.

a) Weir

b) Silt basin and water channel

c) Penstock and powerhouse

d) Turbine

e) Switchyard

f) Office

**Figure 3-8 Pictures of Zengamina Hydropower Plant**

(b) Nyangombe Hydropower Plant

Nyangombe HP is located about 15 km southeast of Mwinilunga District centre, North-Western

Province. In use is a Cross-flow turbine manufactured by Ossberger with a maximum capacity of 73kW . The plant is owned by the corporative of local residents at Nyangombe and is operated by the resident engineer. The electricity is supplied only to the institution, hammer mill and residences at Nyangombe, and it is not used for commercial purpose. Figure 3-9 shows pictures of Nyangombe HP.

a) Place of the resident

b) Water channel

c) Powerhouse

d) Turbine

**Figure 3-9 Pictures of Nyangombe Hydropower Plant**

(c) Sachibondu Hydropower Plant

Sachibondu HP is located about 25km north of Mwinilunga District centre, North-Western Province. This operation is a 15 kW Cross-flow turbine, owned and operated by a mechanic at the corporative of local residents, and there are no commercial sales, as it is solely for own use.

(d) Lwawu Hydropower Plant

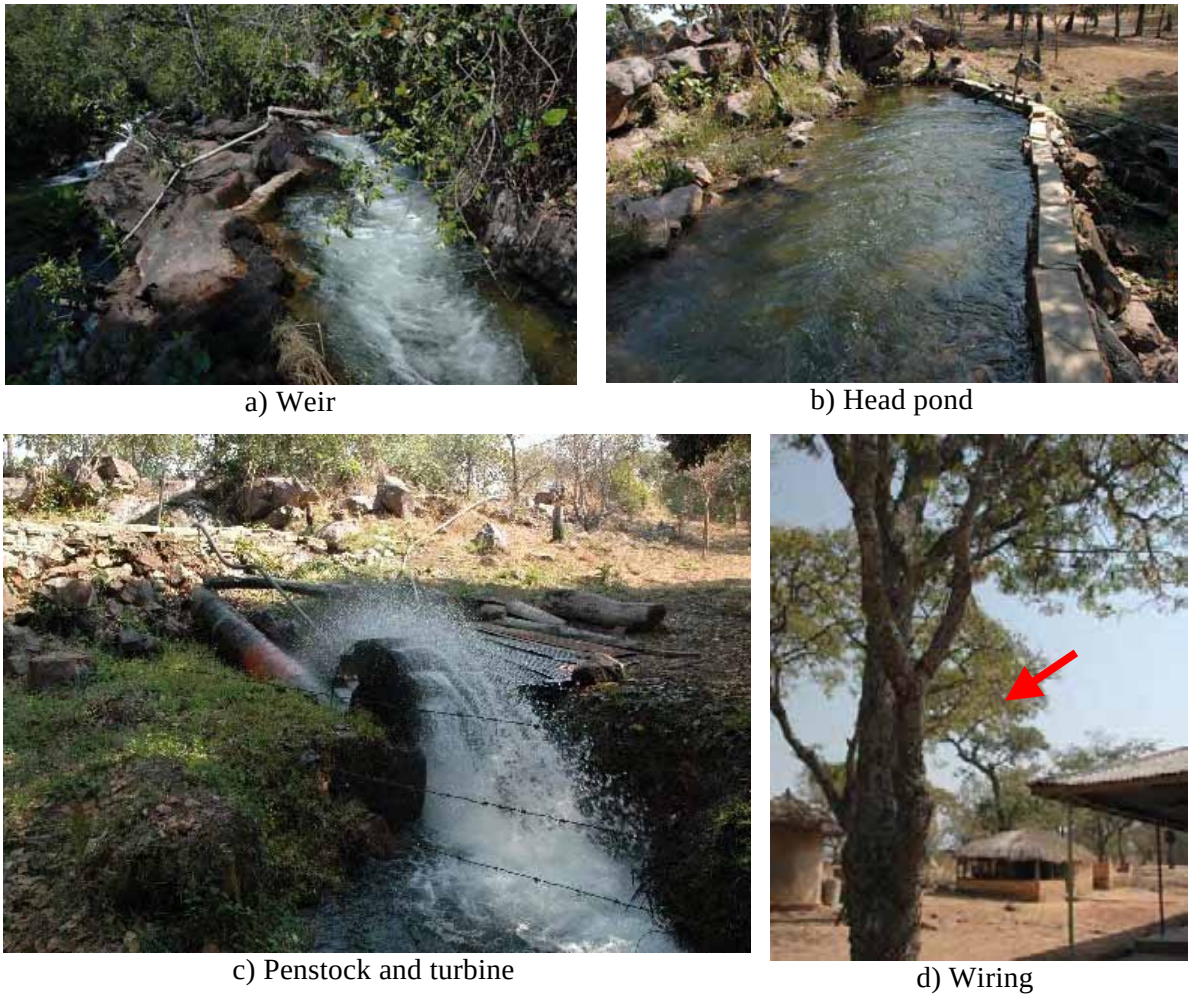
Lwawu HP is located very close to the border with Republic of Angola, about 45 km west of Mwinilunga District centre, North-Western Province. Its generation capacity is 50 kW. Lwawu Mission owns and manages this plant to supply electricity to the institution, a hammer mill and to the residents.

(e) Mutanda Hydropower Plant

The Technology Development and Advisory Unit (TDAU) of the University of Zambia installed 2.5 kW micro-hydro turbine in early 1990s at Mutanda Centre, situated 35 km west of Solwezi, North-Western Province. This power plant was on the Mapunga River and used to supply electricity to a hammer mill, a compressor and a generator. However the supply was inadequate for the ever-increasing local demand. Hence TDAU and Mutanda Evangelical Centre conducted the Pre-investment study on the expansion of the capacity up to 200 kW in 2001. However, this plan was superseded by a 33 kV connection to the national grid.

(f) Mporokoso Hydropower Plant

Mporokoso HP is located in the Mporokoso District centre, Northern Province. This plant is designed and manufactured by a local citizen. The water from a nearby swamp has been dammed by rocks, and then transferred to a turbine via water channel made from cut drums. The turbine is also made from scrapped wheels and drum cut in the shape of runner blade. The flush of water passes through the lower side of horizontal-shaft-type turbine, so this turbine can be categorized as a kind of undershot water wheel. The maximum output is about 5 kW, and the electricity is consumed mainly by the owner, but he also sells electricity to neighbours through a battery charging service. Figure 3-10 shows pictures of Mporokoso HP.



a) Weir b) Head pond

c) Penstock and turbine d) Wiring

**Figure 3-10 Pictures of Mporokoso Hydropower Plant**

(g) Luena River Hydropower Plant

Luena River Hydropower Plant is located about 70 km northwest of Kaoma District centre, Western Province, in Mayukwayukwa Refugee Settlement. This HP is owned and managed by UNHCR (Office of the United Nations High Commissioner for Refugees), and supplies electricity free of charge to 64 households in the settlement. The capacity of Italian Propeller turbine was 24 kW, but its capacity has reduced with age. The plant is operated and maintained by two engineers (mechanical and electrical) trained by the turbine manufacturer. The UNHCR meets all the Operation and Maintenance costs. Figure 3-11 shows pictures of Luena River HP.

a) Households in the refugee settlement

b) Weir

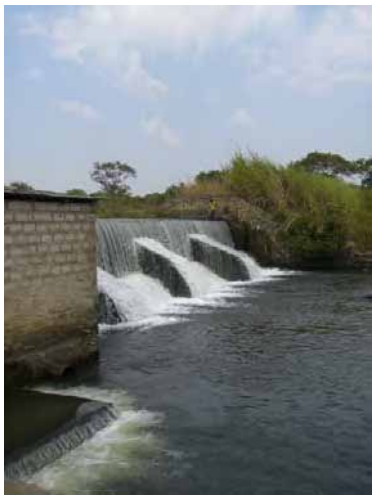
c) Water channel and powerhouse

d) Turbine

**Figure 3-11 Pictures of Luena River Hydropower Plant**

(h) Mangongo Hydropower Plant

Mangongo Hydropower Plant is located in Mangongo Mission, about 35 km northeast of Kaoma District centre, Western Province. Mangongo Mission owns this 17 kW hydropower plant and supplies electricity to the church, clinic, and 54 households. Public facilities are exempted from electricity charges, but the households pay a flat-rate electricity charge of K10,000 per month. Figure 3-12 shows pictures of Mangongo HP.



a) Head pond

b) Spill stream and powerhouse (left side)

**Figure 3-12 Pictures of Mangongo Hydropower Plant**

### 3.3.3. Supply and Demand Balance (National Grid)

After about a decade's slump from mid 1980s, total electricity generation has been gradually recovering since 1997, when ZESCO started the implementation of the Power Rehabilitation Project (PRP) at Kariba North Power Station (installed capacity: 660MW, upgraded from original 600MW), which is in a few years followed by PRPs at Kafue Gorge (installed capacity: 900MW) and Victoria Falls (installed capacity: 108MW) Power Stations. Since FY 2000/01 these power stations have steadily sent out more than 8,000GWh per year. The increase of power generation from FY2004/05 (8,192GWh) to FY2006/07 (9,787GWh) is mainly due to the completion of some rehabilitation works of hydropower stations.

Lunsemfwa Hydropower Company, which owns Mulungushi (20 MW) and Lunsemfwa (18 MW) hydropower stations and is currently the sole IPP to sell electricity to ZESCO's national grid, accounts for less than 3% of the electricity supply countrywide.

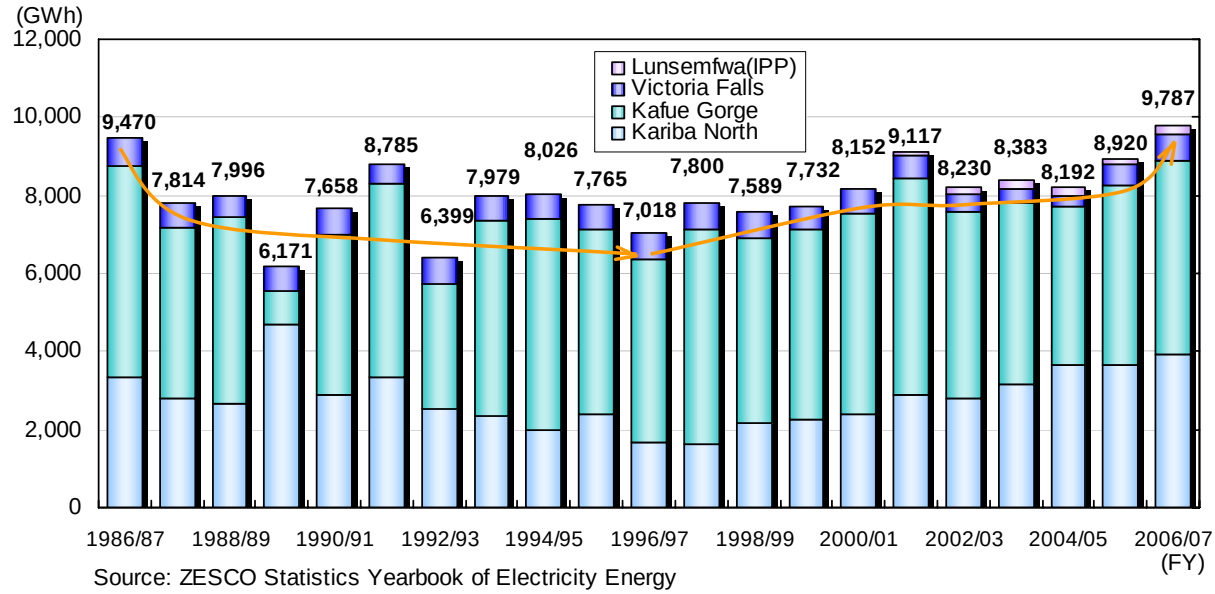



**Figure 3-13 Electricity Generation (sent out to national grid)**

Total domestic electricity consumption on ZESCO's national grid (bulk deliveries, including distribution loss) changed little through the 1990s, when the small increase of electricity consumption in ZESCO's distribution system was offset by a decline of power demand of the copper mining industry currently supplied by CEC. In 2000 consumption started growing rapidly due to the recovery of mining industry. In the six years from FY2000/01 to FY2006/07 national electricity consumption increased by about 34% from 6,724 GWh to 8,421 GWh

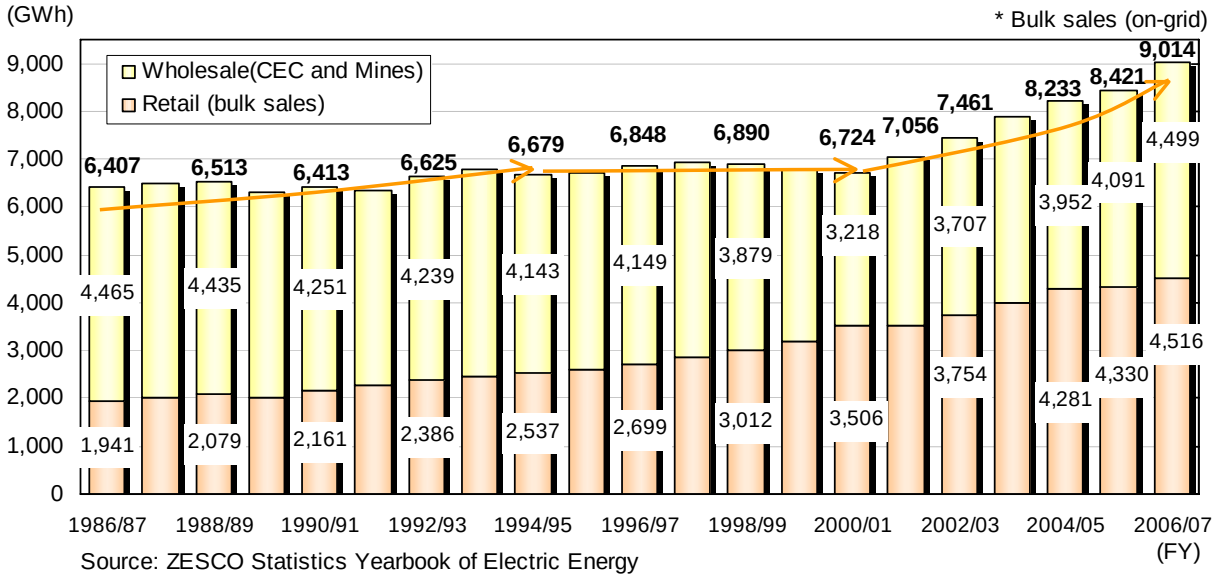



**Figure 3-14 Domestic Electricity Consumption**

Figure 3-15 illustrates the balance between electricity supply and demand. Until early 1990s annual power generation in general overwhelmed domestic consumption, and this allowed Zambia to be a regional power exporter . This excess became smaller and imports began to increase in the 1990s, though the balance varied year-by-year depending mainly on the availability of generation plant. In the 2000s, as the domestic electricity consumption started increasing rapidly, the supply-demand balance has become tighter still. The Power Rehabilitation Projects and new generation projects, namely Kafue Gorge Lower Hydroelectric Power Project (750MW), Kariba North Power Station Extension Project (300MW), and Itezhi-tezhi Hydropower Project (120MW), when completed, were expected to mitigate this situation, However, if demand continues go grow at the current pace, the the supply-demand balance could be even tighter..

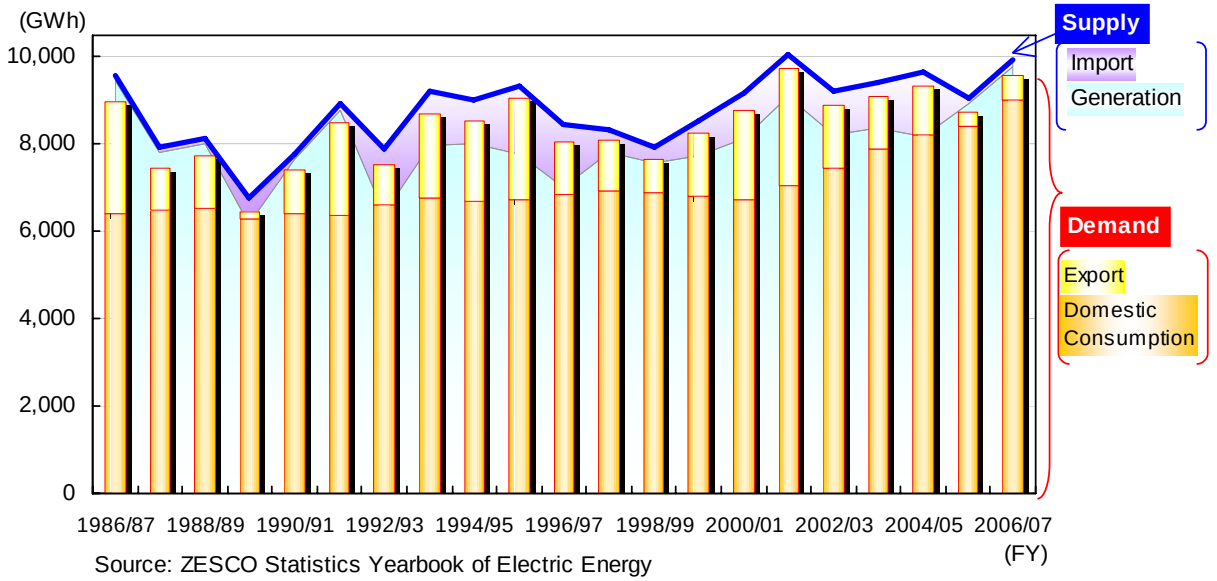



**Figure 3-15 Electricity Supply and Demand**

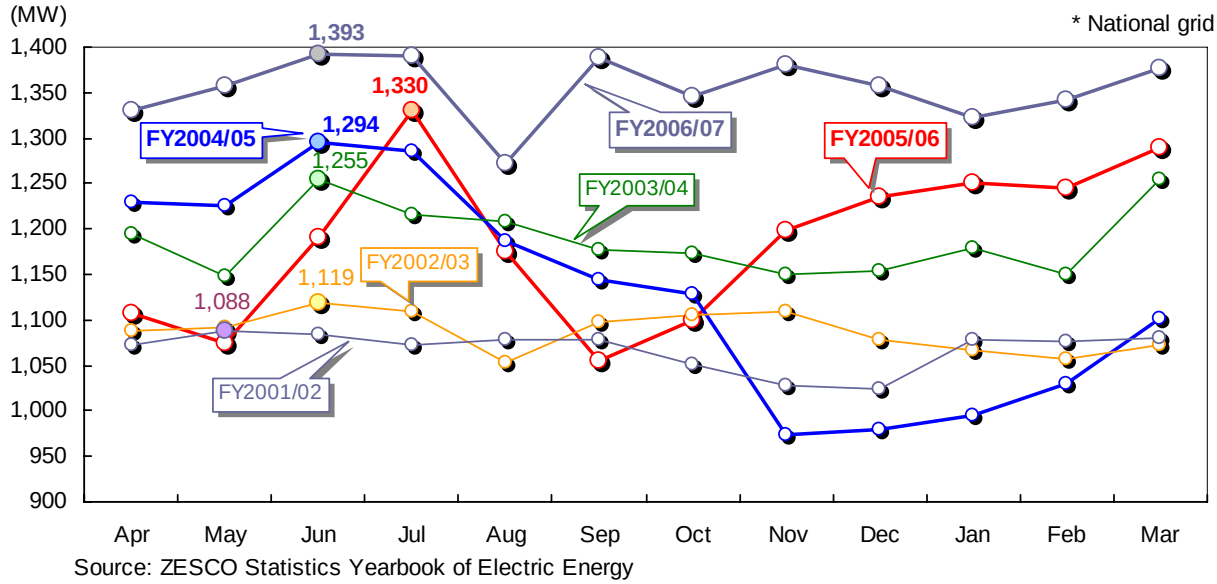
### 3.3.4. Seasonal and Daily Characteristics of Power Demand

Figure 3-16 shows the monthly peak demand of ZESCO's national grid for the past 6 years (from FY2001/02 to FY2006/07), and the numbered points in the chart indicate each year's peak demand. For the six-year period up to 2006/07 the annual peak load grew from 1,088 MW to 1,393 MW, an increase of about 22% increase. For the past 6 years, the annual peak load occurred in the winter, months between May and July.

As seen in the chart, there are significant variations of the peak load demand curve from year to year . Until FY2002/03 little fluctuation has been observed in every month's peak load, for example, the peak load of August 2002, the lowest in 12 months, was 1,053MW, which is 94.1% of the year's peak load (1,119MW in June 2002). This ratio still remained at 91.5% in FY2003/04 and each month's peak load was higher than that of previous year. In FY2004/05 the monthly peak load started fluctuating significantly: November 2004's peak load dropped to 974MW, which is the lowest in the past 5 years and its ratio against that of June 2004, the year's highest, also went down to 75.2%. This significant fluctuation in monthly peak load is also observed in the next FY2005/06: September 2005's peak load, the lowest among 12months, was 1,056MW and remained at 79.4% of that of annual peak load (1,330MW in July 2005). In November 2005 the monthly peak load rose considerably from the previous month, and this shows a sharp contrast against the previous year, when the peak demand sharply dropped in November. The fluctuation of monthly peak load was mitigated in FY2006/07 and the lowest monthly peak load among 12 months (1,273MW in August 2006) was as high as 91.4% of annual peak load (1,393MW in June 2006).

ZESCO has not given details to explain this trend, but the following hypotheses to clarify this might be possible as far as we assume that these numbers are statistically consistent.

- The increase of electricity consumption for residential use, which is especially remarkable between FY2003/04 (2,052GWh) and FY2004/05 (2,542GWh), has made power consumption more sensitive to weather changes.
- ZESCO's reduction of losses, makes the total system load more responsive to the end-users' actual power consumption. This is also evidenced by the improvement of distribution losses from 20.9% in FY2003/04 to 18.1% in FY2004/05 (discussed in Section 3.3.5). In the same vein, the relatively stable trend of monthly peak load in FY2006/07 may be more or less related to the worsened distribution losses (25.2%).



Source: ZESCO Statistics Yearbook of Electric Energy

**Figure 3-16 Monthly Peak Load**

Figure 3-17 shows the daily load of ZESCO's national grid system. In its annual "Statistics Yearbook of Electric Energy", ZESCO provides "typical" daily load curves, but does not indicate the

date when the data were recorded. However, since the “typical” load curve in for 2005/06” is different from that for 2004/05, it is assumed that the former reflects the newer load data than the latter.

Here we can observe similar changes in the monthly peak load. The red line in the figure, that is, the later daily load curve, shows a larger gap between the peak and bottom loads than the older daily load curve, or the blue line in the figure. This change is considered consistent with the two hypotheses discussed about the monthly peak load.

Another significant difference between the new and the old load curves is that the new load curve shows a second peak in the morning (7:00) besides the highest peak in the evening (19:00) while the old daily load curve only shows a maximum demand in the evening and a relatively flat load throughout the daytime. This change is also considered consistent with the increase of electricity consumption for residential use, which by nature has two peaks, breakfast time and dinner time while during the daytime between them, when family members are out for work or study, the power demand is relatively low.

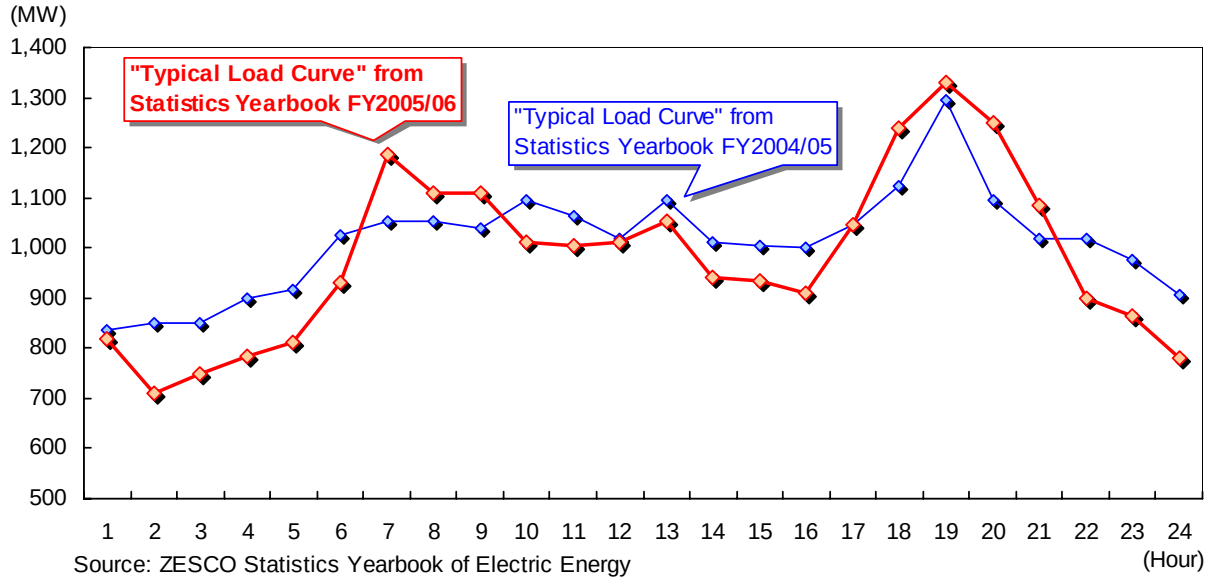



**Figure 3-17 Daily Load Curve**

Reflecting the changes of load curve, whose shape is getting steeper both annually and daily, the load factor, which is the ratio of system consumption (MWh) against peak demand (MW), dropped, though not drastically, from 76.1% in FY2002/03 to 71.4% in FY2003/04, but it has seen a slight improvement since then.

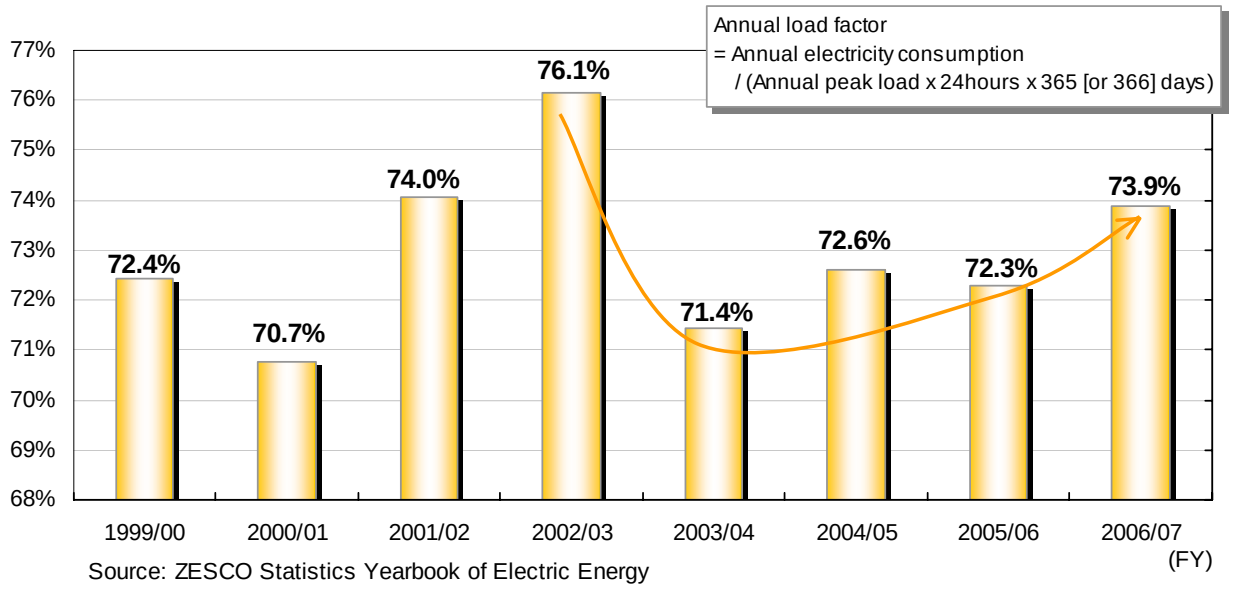



**Figure 3-18 Annual Load Factor**

### 3.3.5. Power System Losses

ZESCO's transmission loss is or the difference between the total energy sent out to the network (including power purchase and import) and the bulk delivery (including power wholesale and export), against the total energy sent out. The transmission loss has been kept stable and low at 3% since late 1980s.

Distribution loss, is the difference between the bulk delivery (only to ZESCO's distribution network) and end-user consumption metered by ZESCO The distribution losses has seen a reduction since FY2000/01, but increased again in FY2006/07.

The otal system energy losses, which comprise both transmission losses and distribution losses, is between transmission loss rate and distribution loss rate[4]. This is because that about half of the energy is delivered for wholesale (to CEC, Kansanshi Mining Plc., and First Quantum Minerals Ltd.) and export, both of which are not affected by distribution loss[5]. The gradual increase of total system losses is mainly attributed to the fact that the consumption of ZESCO's retail customers has grown as a proportion of total energy supply.

[4] When the energy is mostly, if not all, supplied through distribution lines, total system energy loss rate becomes higher than both transmission and distribution loss rates.

[5] Except the energy export through ZESCO's distribution lines to border areas in neighbouring countries, which is minor in total energy supply

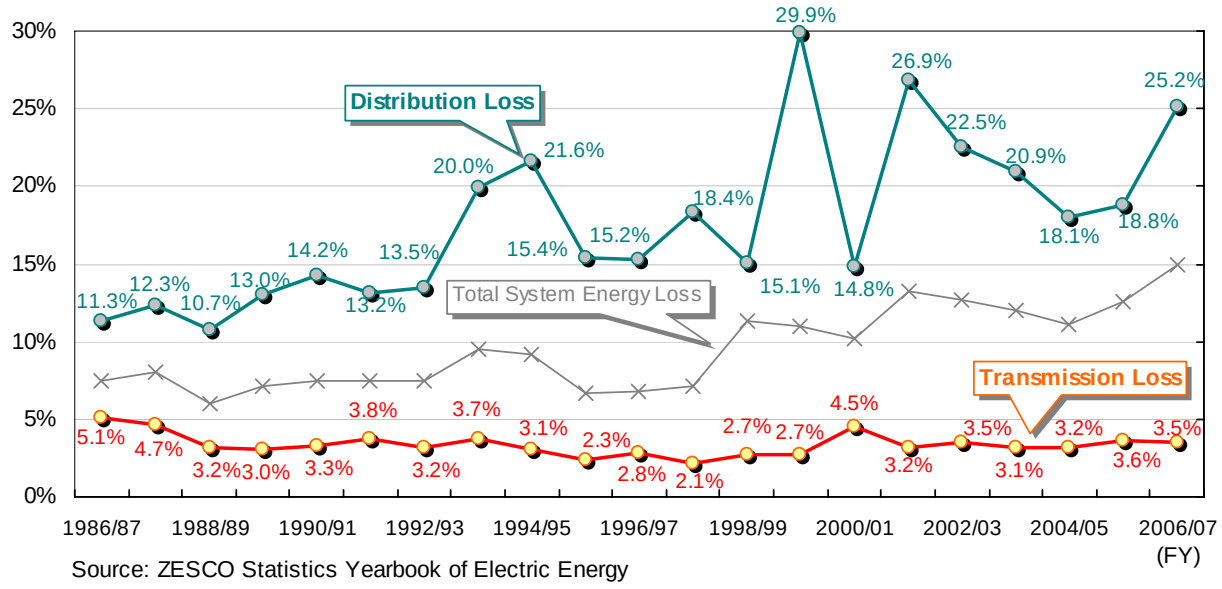



**Figure 3-19 Transmission/Distribution Loss**

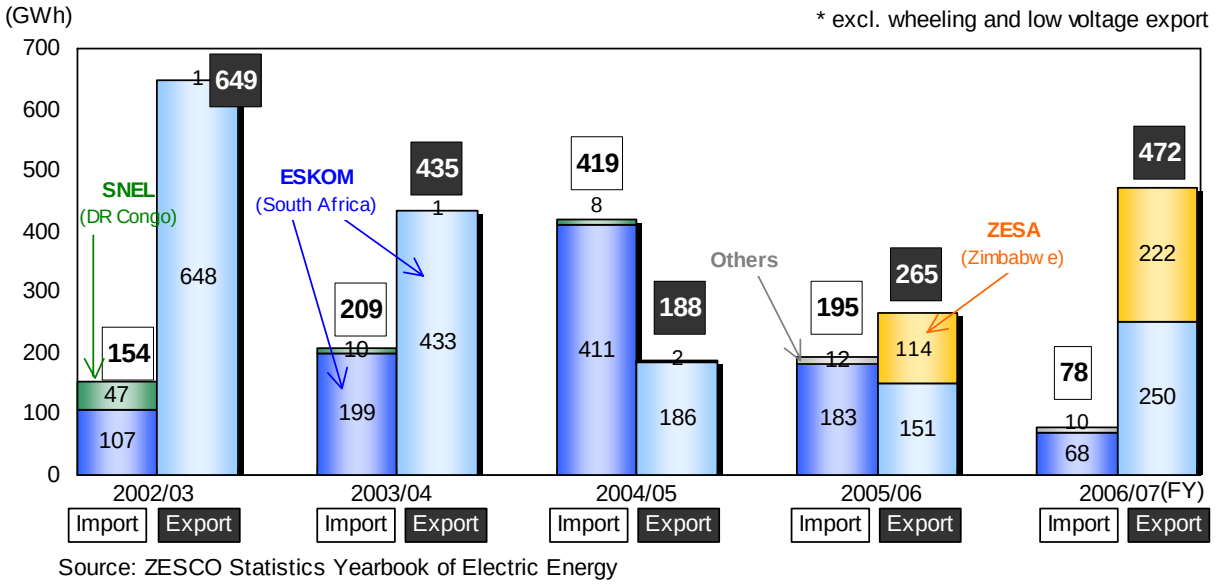
### 3.3.6. Electricity import/Export

As already discussed in Section 3.3.3, balance between electricity supply and demand has been tighter and more dependent on imports than ever.

Figure 3-20 shows ZESCO's electricity import and export for the previous 4 years, broken down by trading partners[6]. In FY2004/05 ZESCO's annual electricity import exceeded electricity export, which meant that Zambia that had long been a power exporter in the region turned into a net importer. With the completion of some Power Rehabilitation Projects (PRPs), ZESCO gained additional electricity supply and returned to the status of net exporter in FY2005/06.

ESKOM of South Africa was ZESCO's largest trading partner in both import and export. ZESCO's exports to ESKOM increased in FY2006/07 after the decreasing trend for the past years. Export to ZESA of Zimbabwe was a rapidly increasing trend, and was related to the serious shortfall of supply in Zimbabwe.

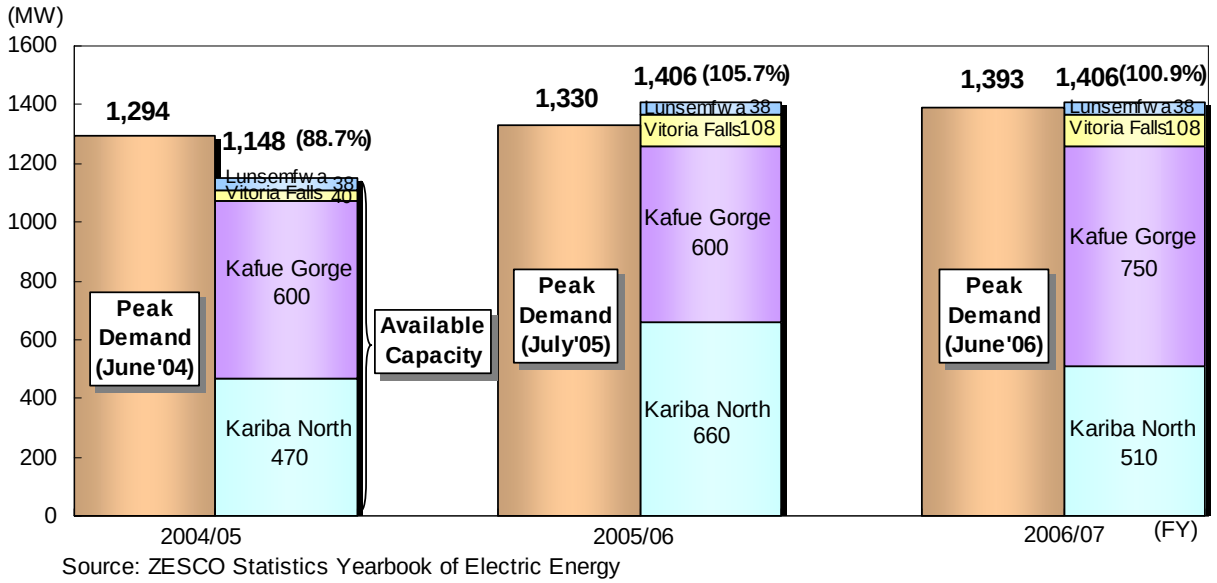
[6] The import and export data in this chart are different from those in Figure 3-15, which includes ZESCO's energy loss caused by wheeling (from SNEL to ZESA and ESKOM) and so on.




Source: ZESCO Statistics Yearbook of Electric Energy

**Figure 3-20 Electricity Import / Export**

The main reason why Zambia needed to import electricity despite its inherent capacity to export was the hourly mismatch between domestic power demand and generation capacity in Zambia. Figure 3-21 shows the comparison between the annual peak demand and the year's available capacity of power plants on the national grid[7]. In FY2004/05, the national grid recorded the peak demand of 1,294MW; but the generation capacity (1,148MW) covered only 88.7%., ZESCO had to import the deficit during peak hours. In FY2005/06 and FY2006/07, with the completion of rehabilitation projects, the generation capacity became higher than the peak demand, but the margin was insufficient when transmission losses (3-4%) and an operation reserve were taken into account. Therefore imports during peak hours were still needed. At the same time, there was sufficient capacity during off-peak hours for Zambia to export..




Source: ZESCO Statistics Yearbook of Electric Energy

**Figure 3-21 Annual Peak Demand and Available Capacity (national grid)**

[7] ZESCO's small hydropower stations and CEC's gas turbine stations are not considered because they are not expected to work with full capacity to cover the peak demand of the whole grid.

The unit cost of the base-load exports was much less than the unit cost of the peak-load imports. As shown in Figure 3-23, ZESCO's average export price is lower than 30 K/kWh until FY2004/05, much lower than its average unit cost, though it increased to about 70 K/kWh in FY2005/06, while the average import price is estimated at much higher than that[8] though the specific information was not availed to the Study Team. In other words, the value of exports was much less than the cost of imports.

Despite ZESCO's diminishing excess for export, Zambia's role as a hub of electricity supply in the region, namely Southern African Power Pool (SAPP), the regional power trading framework, is expected to gain importance in the future. ZESCO's transmission lines that run across the country from Copperbelt to Livingstone, is not only a backbone of the country's power system but also a part of international connection that wheels electricity generated in DR Congo to Zimbabwe and South Africa, the power importers. ZESCO is planning to extend 330kV transmission lines to North-Western Province to build another inter-connector with DR Congo and to enhance international power trade. In addition, studies on the extension of 220kV lines from Livingstone to Namibia, the Zambia-Tanzania-Kenya (ZTK) Interconnection Project, and interconnection with Malawi were underway (refer to Figure 3-22). These grid extension projects were also expected to enhance the capacity and stability of electricity supply to remote area in North-Western, Western, Northern, and Eastern Provinces.

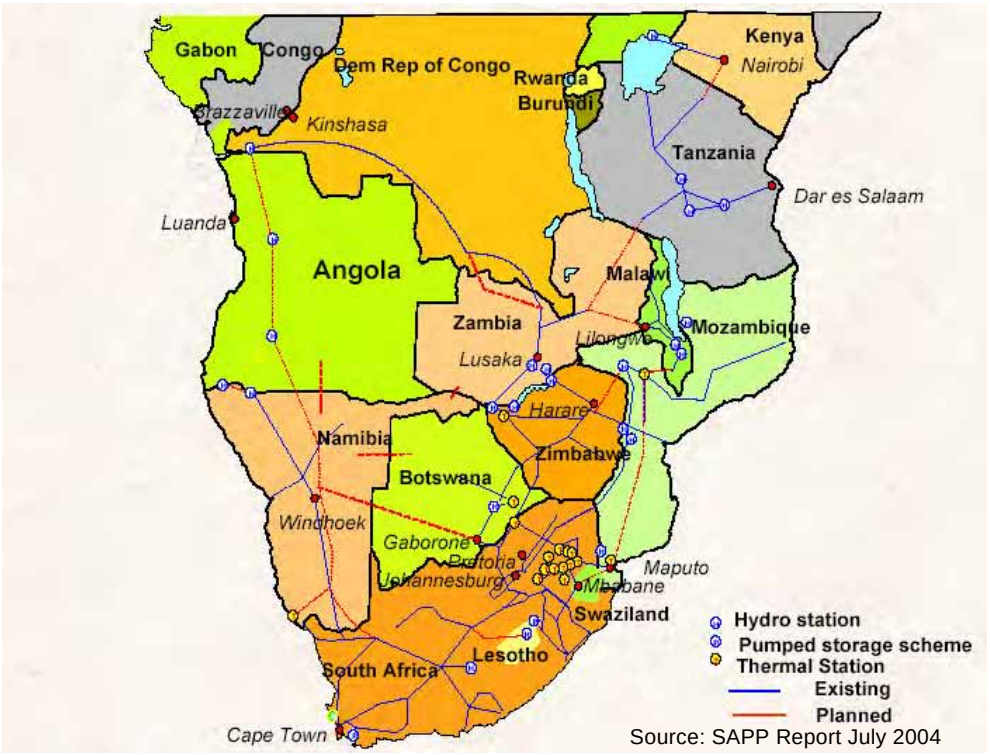



**Figure 3-22 Southern African Power Pool Interconnection**

[8] According to ZESCO's financial statements of FY2005/06, the year's cost of sales is K149,487 million, which is supposed to mainly consist of electricity import and purchase because ZESCO expenses very small amount on fossil fuel. Meanwhile, ZESCO imported 195GWh and purchased 139GWh for the year, thus the unit imported and purchased price is estimated at 448 K/kWh. In the same way, the unit imported and purchased prices for FY2004/05, FY2003/04 and FY2002/03 are estimated at 262 K/kWh, 417 K/kWh and 388 K/kWh respectively.

## 3.4. Electricity Tariff

### 3.4.1. Electricity Tariff Structure

Section 7 of the Electricity Act, CAP433 of the laws of Zambia, states that charges made by "an undertaking", i.e. ZESCO or any other electricity service companies if they exist, "shall be determined in accordance with the licence governing the undertaking". Therefore, ZESCO's tariff to its customers, except those to whom ZESCO provides bulk supply, is regulated and needs the approval of the Energy Regulation Board (ERB). Section 8 of the Electricity Act states that "an undertaking" needs to give notice of any proposal to vary or alter the charges, which comes into effect 30 days after the notice unless the consumer applies to ERB to review the proposal."

Table 3-10 was ZESCO's revised tariff, proposed and implemented in October 2007. Unlike the previous tariff revision in May 2005, where 11% increase was applied to all customer categories, this time different increase rate was applied to each customer category; 45% for residential, 49-50% for commercial and social services, and 70-75% for large customers, thus the impact of tariff increase is slightly mitigated for households compared to other categories.

**Table 3-10 ZESCO's Revised Tariff (implemented in October 2007)**

| **1. UNMETERED RESIDENTIAL TARIFFS** | | | **Current Tariff** | Old Tariff |
|---|---|---|---|---|
| **Consumption up to 2 Amps** | | (K/month) | **7,121** | 4,911 |
| **Consumption between 2-15 Amps** | | (K/month) | **25,767** | 17,770 |
| **2. METERED RESIDENTIAL TARIFFS** (Capacity up to 15kVA) | | | **Current Tariff** | Old Tariff |
| Energy charge | up to 300kWh | (K/kWh) | **102** | 70 |
| | 301 to 700kWh | (K/kWh) | **145** | 100 |
| | above 700kWh | (K/kWh) | **236** | 163 |
| Fixed monthly charge | | (K/month) | **8,475** | 5,845 |
| Pre-paid (Energy charge) | | (K/kWh) | **161** | 111 |
| **3. COMMERCIAL TARIFFS**[9] (Capacity up to 15kVA) | | | **Current Tariff** | Old Tariff |
| Energy charge | | (K/kWh) | **245** | 163 |
| Fixed monthly charge | | (K/month) | **43,841** | 29,227 |
| **4. SOCIAL SERVICES TARIFFS**[10] | | | **Current Tariff** | Old Tariff |
| Energy charge | | (K/kWh) | **201** | 135 |
| Fixed monthly charge | | (K/month) | **34,839** | 23,382 |
| **5. MAXIMUM DEMAND TARIFFS** | | | **Current Tariff** | Old Tariff |
| **MD1: Capacity between 16 - 300kVA** | | | | |
| MD charge | | (K/kVA/month) | 11,803 | 6,943 |
| Energy charge | | (K/kWh) | 170 | 100 |
| Fixed monthly charge | | (K/month) | 115,603 | 68,200 |
| **MD2: Capacity between 300-2,000kVA** | | | | |
| MD charge | | (K/kVA/month) | 22,083 | 12,990 |
| Energy charge | | (K/kWh) | 145 | 85 |
| Fixed monthly charge | | (K/month) | 231,205 | 136,003 |
| **MD3: Capacity between 2,00-7,500kVA** | | | | |
| MD charge | | (K/kVA/month) | 34,277 | 19,587 |
| Energy charge | | (K/kWh) | 110 | 63 |
| Fixed monthly charge | | (K/month) | 476,011 | 272,006 |
| **MD4: Capacity above 7,500kVA** | | | | |
| MD charge | | (K/kVA/month) | 34,468 | 19,696 |
| Energy charge | | (K/kWh) | 91 | 52 |
| Fixed monthly charge | | (K/month) | 952,021 | 544,012 |

9 "Commercial" here includes industrial and agricultural energy usage.

10 Schools, hospitals, orphanages, churches, water pumping, street lighting etc.

Customers who were not metered were charged monthly fixed tariff. According to ZESCO, Northern Regional Office, about 30% of customers of its service area in Northern Province[11] were not metered.

For metered customers whose capacity did not exceed 15kVA, ZESCO offered three different tariffs depending on customer class, that is, residential, commercial, and social services. The tariff for each of these consists of monthly fixed charge (K/month) and energy charge (K/kWh). The same fixed charge applies to all three classes. The unit energy price for residential customers increases progressively with three steps, that is, 70 K/kWh for the first 300kWh consumption, 100 K/kWh for the next 400kWh consumption (301-700kWh), and 163 K/kWh for the consumption above 700kWh. This progressive unit price system for residential customers is commonly adopted in many countries, for the following reasons:

- To mitigate the burden of poor households
- To encourage energy conservation and to restrain waste (in some countries where energy conservation is a policy priority issue)

Thus the first threshold (between the first and the second lowest steps) is usually set at a level that is considered to be the minimum monthly electricity consumption for a household's subsistence. Typically this is between 20 kWh and 50 kWh per month in developing countries. In Japan where the assumed "lowest level of lifestyle for subsistence" is higher than in developing countries, this first threshold is 120 kWh/month. In the ZESCO's tariff system, the first threshold was set at 300 kWh/month, which is higher than generally adopted in other countries. This is equivalent to the second threshold in Japan[12], where "300kWh/month" approximately corresponds to an average electricity consumption of a household. ZESCO referred to the low unit price for the first 300 kWh "Life-line Tariff", justified on the basis that, "the 300 units are enough to use in a 2 to 3 roomed house. The units can be used for cooking on a 2 plate cooker, radio and lighting"[13]. For "Commercial" and "Social Services" customer types, only a single unit energy price is applied respectively regardless of monthly consumption.

ZESCO's tariff for large customers, whose capacity is more than 15kVA, is called "Maximum Demand Tariff (MD)", and consists of three parts, that is, fixed monthly charge (K/month, for each customer), MD charge (K/kVA/month), and energy charge (K/kWh). MD Tariff has four sub-categories depending on the capacity, namely MD1 (capacity 16-300kVA), MD2 (301-2,000kVA), MD3 (2,001-7,500kVA) and MD4 (above 7,500kVA), and different tariff is applied to each category.

Since in Zambia the source of energy supply is almost entirely from hydropower, there is no automatic adjustment of the unit energy price with fluctuations of fuel costs.

In addition to the price in the electricity tariff, customers were also charged a Government Excise Duty, which was 5% of every electricity bill, and 17.5% VAT. Of the Government Excise Duty, 3% was appropriated for the Rural Electrification Fund (REF, also refer to Section 3.2.

The graphs in Figure 3-23 show ZESCO's average selling price to different customer categories[14], such as "Residential", "Non-residential (ZESCO retail)", "Bulk Sales to Mining Industry (CEC etc.)", and "Export", together with the average cost of electricity supply[15] as bar chart in background. As

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[11] The service area of ZESCO's Northern Regional Office is not exactly the same as the area of Northern Province. A part of the province is covered by Luapula Regional Office.

[12] 9 out of Japan's 10 power utilities set this second threshold at "300kWh/month", while the Hokkaido Electric Power Company, the only exception, set this threshold at "280kWh/month" that also used to be the standard for other 9 utilities until 1990s. "120kWh/month" has been uniformly adopted by all Japanese utilities since the three-steps progressive unit price was applied in Japan in mid-1970s.

[13] Source: ZESCO Website http://www.zesco.co.zm/why-pay-for-elec.html

[14] ZESCO's "Statistics Yearbook of Electric Energy" changed the classification of power consumption from its "2005/06" edition. For this reason, data of average selling price for FY2005/06 may not be consistent with those in the past.

[15] Definition of "Cost of Electricity Supply" is same as that of Figure 3-27 to be discussed in Section 3.5.1.

observed in the Figure, average selling price for residential customers is relatively low, even lower than the average cost of electricity supply. On the other hand, average selling price to customers other than residential, such as commercial, industrial and agricultural customers, is far higher than that of residential customers and the average cost of electricity supply. A significant gap between residential and non-residential selling prices is also confirmed in the tariff table (Table 3-10), according to which "Commercial Tariffs" must always be higher than "Metered Residential Tariffs" with same electricity consumption. Taking into consideration that the average unit selling price of residential customers would be by nature a little higher than that of non-residential customers if the tariffs were set strictly reflecting the marginal unit cost of supply[16], we can observe the existence of cross-subsidization from non-residential tariff to residential tariff to benefit residential customers while total revenue balances with total cost of supply. This cross-subsidization, however, should be evaluated taking into account the residential customers' affordability to pay for electricity.

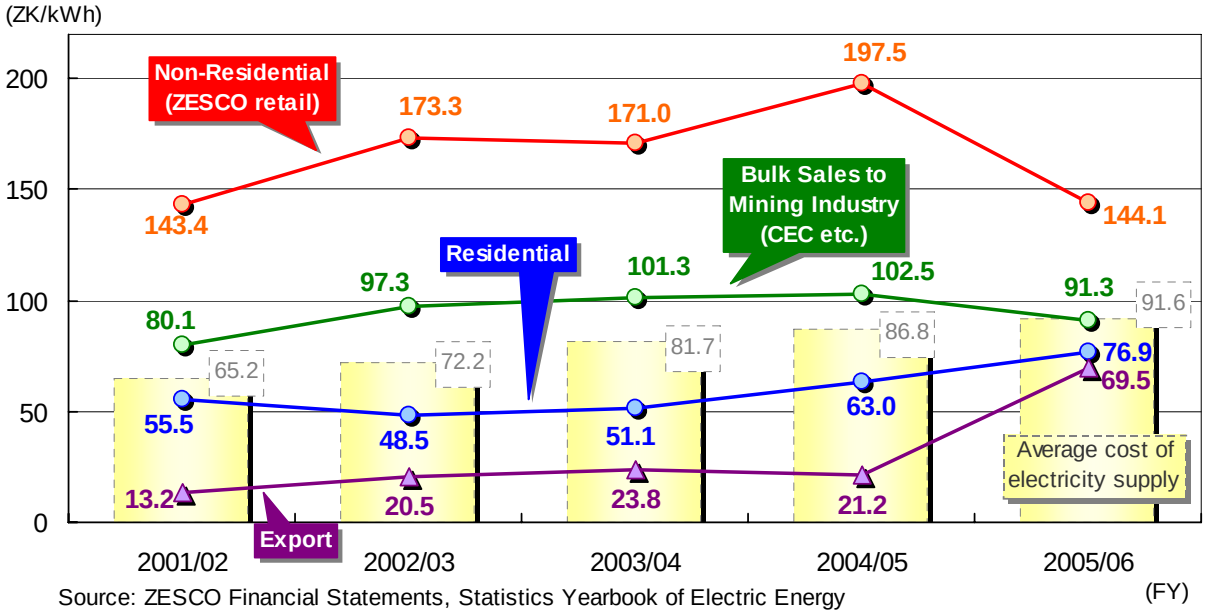



**Figure 3-23 Average Selling Price**

[16] Almost all residential customers are supplied with low-voltage (400/230V) and thus have to pay the cost of using low-voltage distribution lines while many non-residential customers do not need to share the cost of low-voltage lines because they are supplied electricity from 11kV distribution lines. In addition, load factor of non-residential customers, especially industrial, is generally apt to be higher than that of residential customers, and high load factor helps reduce average fixed cost (= fixed cost divided by electricity consumption).

### 3.4.2. Metering and Billing

In common with the practice in other countries, electricity consumption of ZESCO's metered customers have their meters read at regular intervals, and a bill is issued to each customer monthly. ZESCO's meter readers, called "Client Service Accounts Assistants (CSAA)" off-load the metered data to ZESCO's customer database at District Office, which is linked to the company's billing system. According to ZESCO, this "metering – billing" process takes a few days to complete. In some regions, especially in urban area, ZESCO started using a handheld metering terminal so that the collected readings are easily off-loaded to the customer database.

Electricity bills may be paid either in cash or by cheque at ZESCO's Customer Service Centres or it is also possible to debit the amount automatically from a customers' bank account. ZESCO is encouraging the customers to make use of this Direct Debit and Credit Clearing (DDACC) service, offering incentives that include a 5% discount on the bill.

ZESCO's power cut policy against customers who fail to pay electricity bills is generally the same as the one adopted by power utilities of other countries. Customers that fail to pay bills for more than two months receive a notice of disconnection. Another notice to urge the payment may be issued again 48 hours prior to the disconnection in some cases. Disconnected customers have to pay at least 75% of the total bill, together with some penalties, for reconnection. The remaining 25% of the bill has to be paid within 3 months for supply to be maintained. Figure 3-24 illustrates a workflow of ZESCO's Power Cut Policy[17], though actual implementation of the policy might be more flexible case by case.

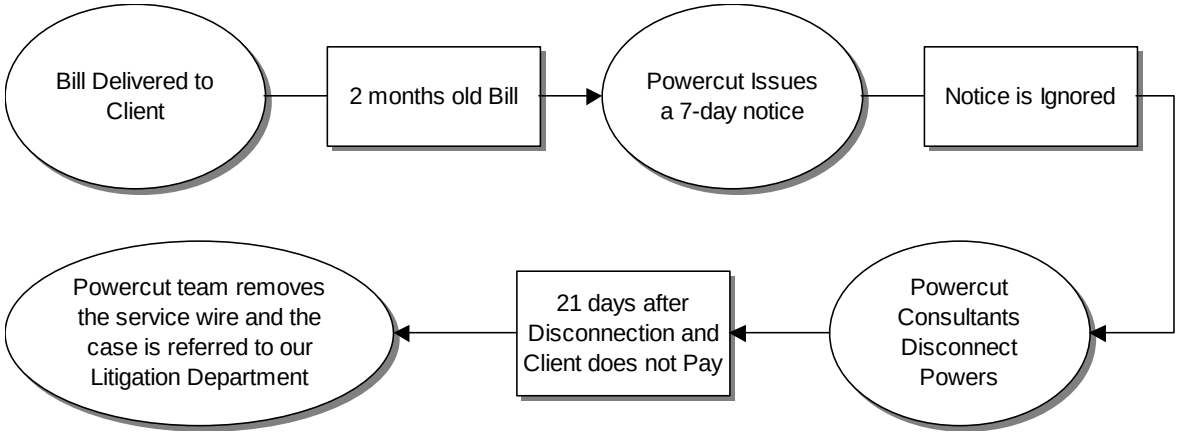



**Figure 3-24 ZESCO's Powercut Workflow**

Figure 3-25 shows ZESCO's trade receivables, i.e. uncollected revenue that is accounted for as current assets in balance sheet, for the past 5 years, and its annual increase or decrease. In FY 2001/02 the trade receivables increased by K175 billion (about +50%) and the remaining balance reached K524 billion, which reached almost the same amount as ZESCO's revenue of that year (K537 billion). In other words, about one third of ZESCO's revenue of that year was not collected. It was not until then that ZESCO seriously took on managing non-performing trade receivables.

There are two factors that affect the increase and decrease of trade receivables:

- Failure to collect revenue of the year (= increase) or collection of trade receivables in the past (= decrease)
- Writing-off of a part of trade receivables as "provisions for doubtful debt", which is accounted for as "loss" in income statement (= decrease)

ZESCO continuously needs to write off a part of its trade receivables that it does not expect to be able

[17] Source: ZECSO Website http://www.zesco.co.zm/p-cut.html

to collect in the future by offsetting this with the profit, in order to prevent the swelling of non-performing assets.

The bar chart in the lower half of Figure 3-25 is the breakdown of increase/decrease of trade receivables by abovementioned factors. During FY2002/03 ZESCO's trade receivables decreased by K183 billion, which is mostly due to ZESCO's writing-off of K180 billion trade receivables. This K180 billion is equal to 28% of ZESCO's total revenue of the year and roughly corresponds to the huge increase of trade receivables in the previous fiscal year (K175 billion). ZESCO wrote off K140 billion out of K180 billion through "Debt Swap" with GRZ, by which ZESCO's receivables from GRZ were offset with the interest-bearing borrowings that the company owed to GRZ. Improvement of revenue collection also helped the decrease of trade receivables in FY2002/03: this -K3 billion appears modest compared to the remaining amount, but is a remarkable improvement taking into account the rapidly worsened revenue collection in the past. Since then, outstanding trade receivables have been kept relatively stable.

In order to enhance revenue collection and thus to reduce trade receivables, ZESCO embarked on a project to install prepayment meters. The pilot scheme started in 2002 with 1,000 customers in Lusaka, and in March 2006 the project moved on to Phase 1, in which 24,000 prepaid meters were installed.

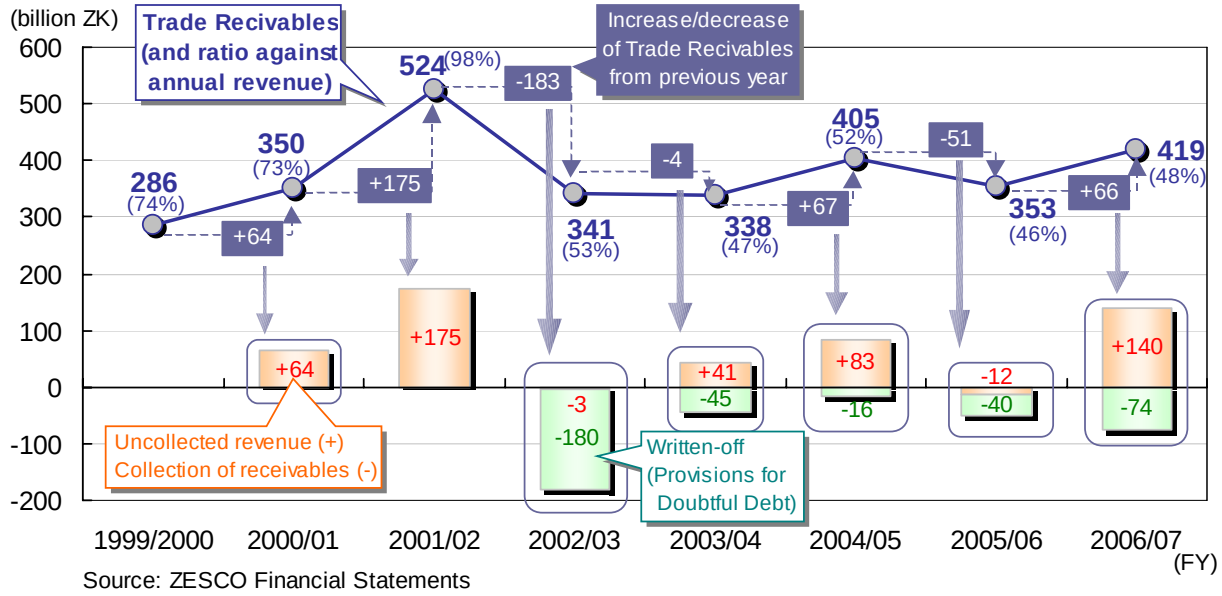


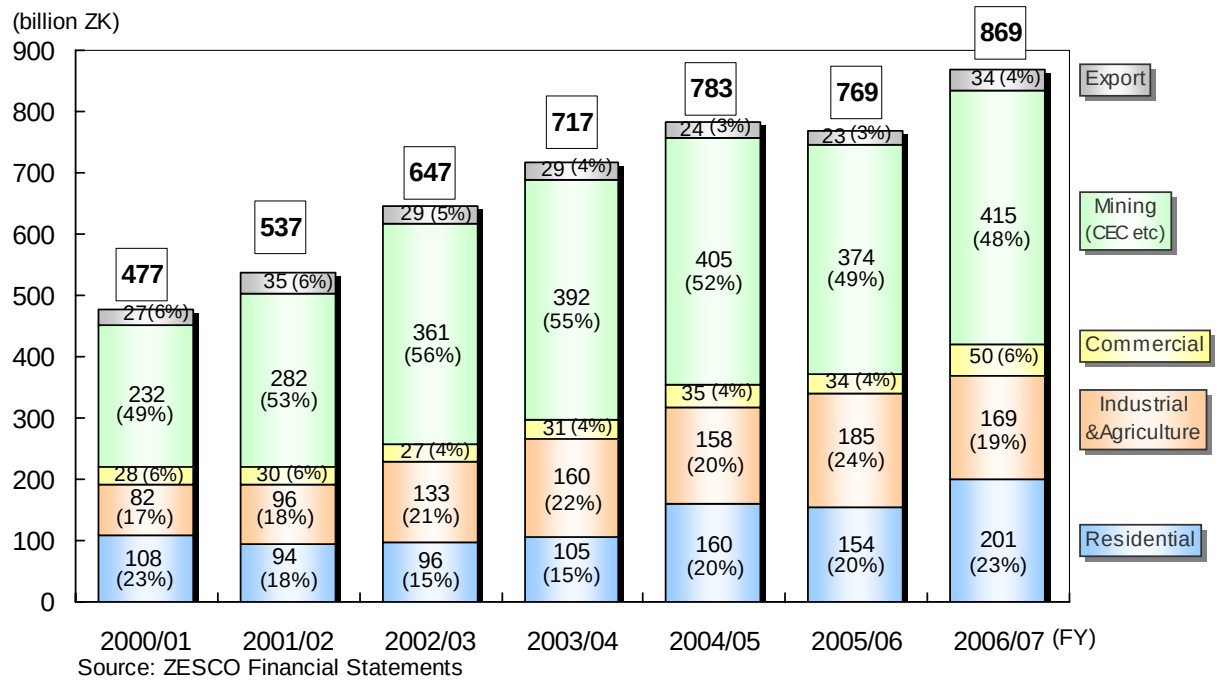

**Figure 3-25 Increase / Decrease of ZESCO's Trade Receivables**

## 3.5. Financial Status of the Power Sector

### 3.5.1. Financial Status of ZESCO

#### (1) Electricity Revenue and Cost

In line with the growth of electricity demand, ZESCO's annual revenue has seen a rapid increase, with 82% growth from K477 billion in FY2000/01 to K869 billion in FY2006/07. The increase in revenue owes considerably to the mining sector (mostly CEC), which accounts for about half of ZESCO's total revenue. The dip of total revenue in FY2005/06, decreasing from K783 billion in the previous year, is mainly due to the -8% drop in the revenue from mining sector (K374 billion). The revenue from mining sector decreased despite the steady increase of the sector's electricity consumption (3.5% increase from 3,952GWh in FY2004/05 to 4,091GWh in FY2005/06: refer to Figure 3-14). The dip was caused by the fact that the CEC tariff was denominated in US$ and for that year the Zambia Kwacha appreciated against US$, thus decreasing the Kwacha revenues. Similarly, the Kwacha's depreciation against US$ in FY2006/07 raised ZESCO's revenue from mining sector of the year, as well as its total revenue. Revenue from ZESCO's retail customers, i.e. revenue excluding export and mining, continued increasing as a whole, though there has been some fluctuation for each customer category.



Source: ZESCO Financial Statements

**Figure 3-26 ZESCO's Annual Revenue**

ZESCO's total cost of electricity supply, which comprises not only direct costs (e.g. power purchase, import, fuel cost) but also indirect costs (e.g. staff costs, depreciation, financial costs) and taxation, is shown in Figure 3-27. A conspicuous increase can be seen in staff costs, swelling about 3.8 times from K115 billion in FY 2000/01 to K430 billion in FY2006/07, despite that the number of employees decreased from 3,963 as at end of FY 2000/01 to 3,603 as at end of FY2006/07. According to ZESCO, the growth of staff cost is due to the increase of temporary employees who are not counted in the "number of employees", and to the rise in their unit cost following the Government's instruction. The financial cost decreased from K49 billion in FY 2001/02 to K21 billion in FY2006/07, which is due to the company's reduced dependence on bridging loans such as bank overdraft and short-term borrowings that have high interest rates. The total cost of supply is also affected by foreign exchange gains/losses (changed from K183 gain in FY2005/06 to K173 loss in FY2006/07), which mainly derives from the fluctuation in Kwacha value of long-term loans.

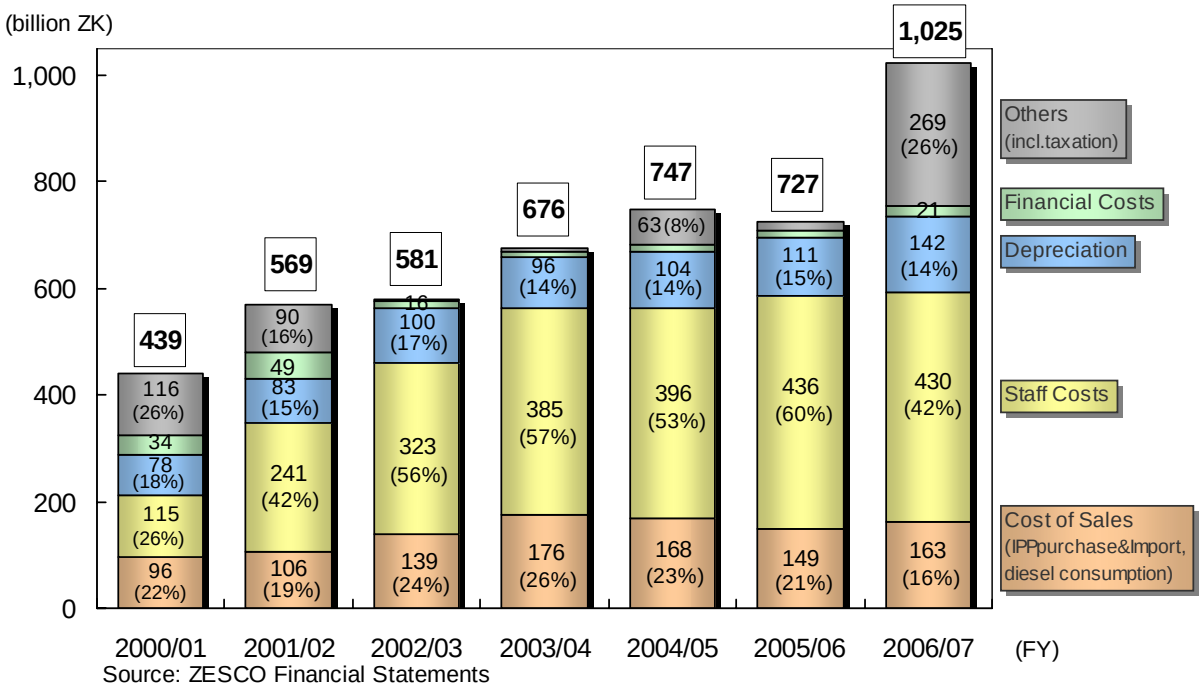



**Figure 3-27 Total Cost of Electricity Supply**

The difference between annual revenue (Figure 3-26) and total cost (Figure 3-27) is equal to "profit after taxation". In FY 2006/07, ZESCO made the loss of K156 billion, which is mainly due to the abovementioned huge foreign exchange loss, but it should be noted that ZESCO's profitability fundamentals have been weak even without foreign exchange effects considering that the operating profit/loss subtracting foreign exchange gain/loss was negative in FY2005/06 and FY2006/07.

ZESCO's financial statements are summarized in Table 3-11.

**Table 3-11 Summary of ZESCO's Financial Statements**

(K million)

| | 2000/01 | 2001/02 | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 |
|---|---|---|---|---|---|---|---|
| **Turnover (A)** | **477,398** | **536,583** | **646,515** | **717,373** | **782,641** | **768,915** | **868,725** |
| Cost of Sales (B) | 96,359 | 106,355 | 138,954 | 176,362 | -168,384 | 149,487 | 163,011 |
| **Gross Profit (C) = (A) - (B)** | **381,039** | **430,228** | **507,561** | **541,011** | **614,257** | **619,428** | **705,714** |
| Other Operating Costs (D) * | 267,644 | 358,182 | 388,852 | 452,444 | 563,141 | 489,207 | 902,650 |
| **Operating Profit (E) = (C) - (D)** | **113,395** | **72,046** | **118,709** | **88,567** | **51,116** | **130,221** | **-196,936** |
| Financial Cost (F) | 33,870 | 49,277 | 15,764 | 12,063 | 15,412 | 11,070 | 21,276 |
| Exceptional Items (G) | – | 8,395 | – | – | – | – | – |
| **Profit before Tax (H)=(E)-(F)-(G)** | **79,525** | **14,374** | **102,945** | **76,504** | **35,704** | **119,151** | **-218,212** |
| Taxation (I) | 41,420 | 47,151 | 37,732 | 34,828 | 71 | 76,812 | -62,117 |
| **Profit after Tax (J) = (H) - (I)** | **38,105** | **-32,777** | **65,213** | **41,676** | **35,633** | **42,339** | **-156,095** |
| | | | | | | | |
| **Assets (K)** | **1,831,680** | **2,133,633** | **2,271,147** | **2,636,002** | **3,499,240** | **3,693,644** | **3,979,596** |
| ROA = (E) / average(K) ** | 6.4% | 3.6% | 5.4% | 3.6% | 1.7% | 3.6% | -5.1% |
| **Equities** | **1,271,965** | **1,239,188** | **1,276,535** | **1,303,211** | **1,688,291** | **1,730,630** | **1,574,535** |
| **Liabilities** | **559,715** | **894,445** | **994,612** | **1,332,791** | **1,810,949** | **1,963,014** | **2,405,061** |

Source: ZESCO Financial Statements

Note: Miscellaneous incomes (e.g. interest income) are subtracted in "Other Operating Costs"
ROA = Operating profit / {(this year's total asset + previous year's total assets) / 2}

### (2) Capital Structure

ZESCO spent heavily on capital projects such as rehabilitation of hydropower stations, which led to the rapid growth of total assets (more than twice from K1,832 billin in FY2000/01 to K3,980 billion in FY2006/07). Little of the capital expenditure was covered by ZESCO's own funds[18], as shown in Figure 3-28., The company's financing has been dependent on liabilities, such as borrowings, capital grants and customers' contribution, than equities, which is evidenced as a gradually worsening Debt/Equity ratio seen in Figure 3-29.

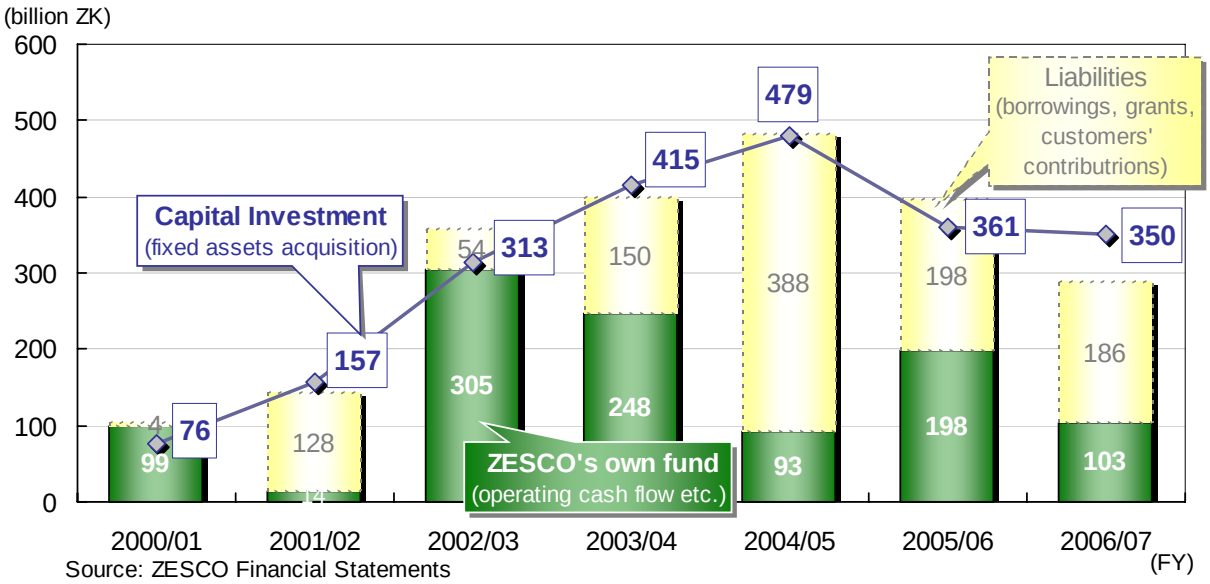



**Figure 3-28 Capital Investment Financing**

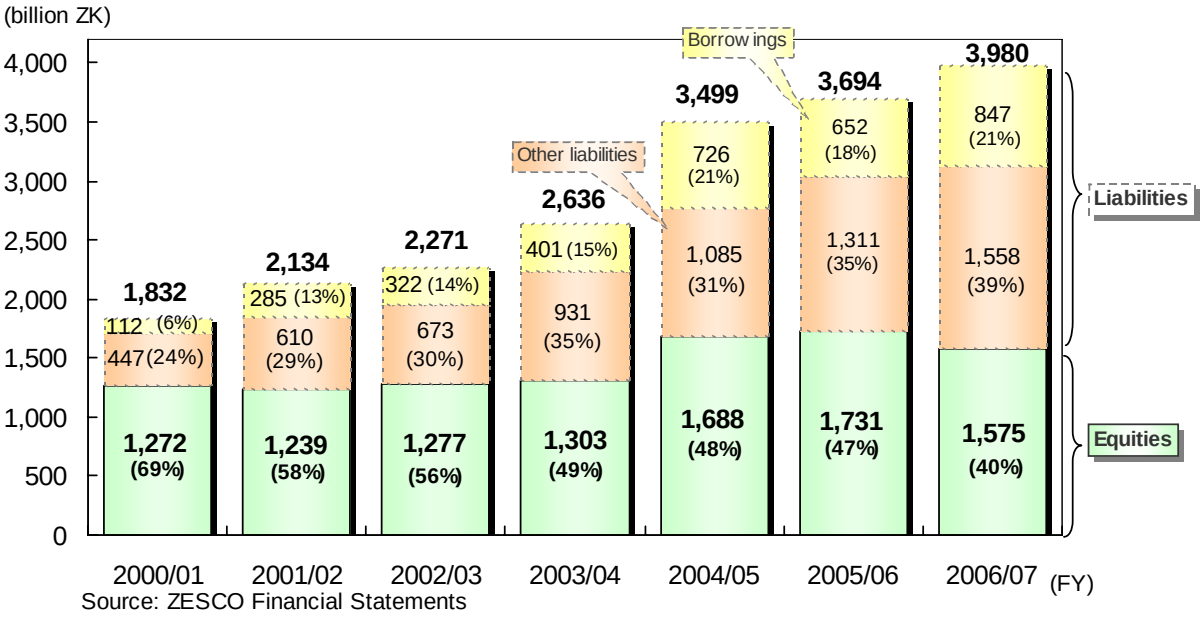
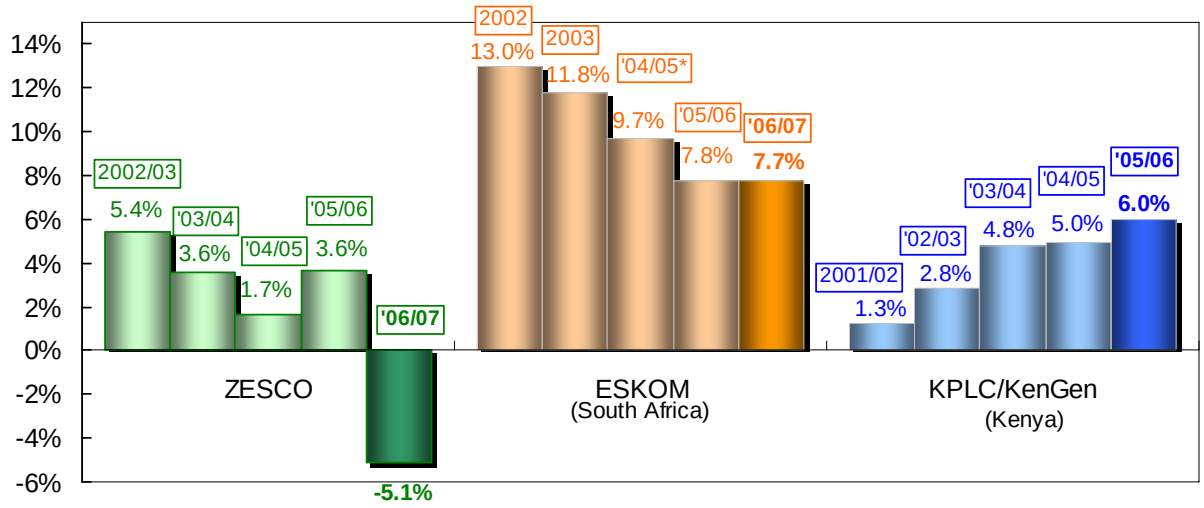



**Figure 3-29 ZESCO's Capital Structure (Equities & Liabilities)**

[18] Here defined as "Operating cash flow + Disposal of tangible assets + Interest received" in the cash flow statement

### (3) International Comparison (Profitability Indicator)

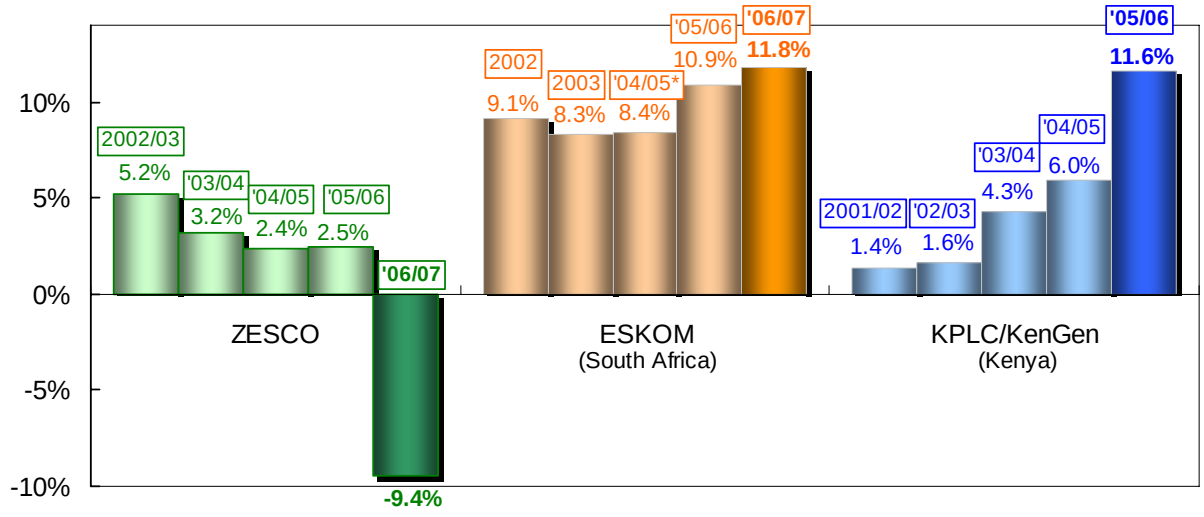
Figure 3-30 and Figure 3-31 show ZESCO's return on assets (ROA) and return on equity (ROE) for the past 4 years, in comparison with that of ESKOM (South Africa)[19] and KPLC/KenGen (Kenya)[20], who have relatively advanced management in the region and disclose their financial statements to the public. Both ROA and ROE show a similar trend. ESKOM, the largest power utility in Africa, keeps around 8-12% of ROA and ROE, and has the highest profitability among these three countries. The profitability of Kenyan sector is at close level to that of ZESCO's, but while Kenya's electricity sector has steadily improved profitability, ZESCO's profitability has seen a decreasing trend.




Source: Financial Statements of each company

**Figure 3-30 Return on Assets (ROA) – International Comparison**

Note: ROA = Operating profit / {(this year's total asset + previous year's total assets) / 2}




Source: Financial Statements of each company

**Figure 3-31 Return on Equity (ROE) – International Comparison**

Note: ROE = Profit after tax / {(this year's shareholders' equities + previous year's shareholders' equities) / 2}

[19] ESKOM shifted its fiscal year from "January-December" to "April-March" in 2004, and FY2004/05 as transition period lasted irregularly 15-months long (Jan 2004-Mar 2005). ESKOM's indicators of FY2004/05 were amended to 12-months base for comparison.

[20] Kenya's electricity sector has two major utilities, KPLC (transmission/distribution) and KenGen (generation). For evaluating the performance of power sector as a "vertically integrated utility", financial statements of these two utilities are consolidated by offsetting transactions between them. Kenya's fiscal year starts 1st July and ends 30th June.

### 3.5.2. Financial Status of Other Players in the Sector

#### (1) Copperbelt Energy Corporation (CEC)

Copperbelt Energy Corporation Plc (CEC) also publicizes its financial statements annually like ZESCO. CEC, which used to be a division of the defunct Zambia Consolidated Copper Mines (ZCCM), the Government-led company, and whose revenue mostly depends on the mining industry, the largest export industry of Zambia, records its financial statements in US$. The unit prices of power purchase from ZESCO and sales to its customers are also set in US$, which means that mining companies, whose cost of production depends a lot on electricity, hedges the risk of exchange rate fluctuation regarding electricity cost in US$ value, and so does CEC the cost of power purchase from ZESCO, and as a result the risk is borne by ZESCO in the end, which is evidenced as the dip in ZESCO's revenue in FY2005/06 (refer to Section 3.5.1). CEC's unit selling price to its customers was around 3US¢/kWh for some years in the past.

**Table 3-12 CEC's Electricity Demand and Sales**

| | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|
| Maximum Demand (MW) | 451.70 | 475.86 | 491.31 | 505.08 | 503.89 |
| Electricity Sales to Customers (GWh) | 3,354 | 3,578 | 3,689 | 3,818 | 3,734 |
| Unit Selling Price (US¢/kWh) | 3.15 | 3.08 | 3.11 | 3.15 | 3.27 |

Source: CEC Financial Statements

Table 3-13 is the summary of CEC's financial statements for the past 5 years. The gross profit margin, i.e. the ratio of gross profit against revenue, has been stable at around 30%. This fact indicates that CEC's selling price to its customers is linked to the purchase price from ZESCO, which accounts for most of CEC's cost of sales, so that CEC receives 30% gross profit margin.

**Table 3-13 Summary of CEC's Financial Statements**

(1,000 US$)

| | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|
| Revenue (A) | 105,624 | 110,128 | 114,874 | 120,348 | 122,164 |
| Cost of Sales (B) | 73,217 | 78,506 | 82,097 | 85,239 | 85,797 |
| **Gross Profit (C) = (A)–(B)** | **32,407** | **31,622** | **32,777** | **35,109** | **36,367** |
| Gross Profit Margin (C) / (A) | 30.7% | 28.7% | 28.5% | 29.2% | 29.8% |
| Other Operating Costs (D) | 17,397 | 7,469 | 17,551 | 16,444 | 21,127 |
| **Operating Profit (E) = (C)–(D)** | **15,010** | **24,153** | **15,226** | **18,665** | **15,240** |
| **Profit after Tax (F)** | **8,547** | **15,012** | **10,069** | **11,842** | **8,241** |
| **Dividends (G)** | **18,000** | **25,000** | **20,000** | **20,500** | **9,900** |
| Payout Ratio = (G) / (F) | 211% | 167% | 199% | 173% | 120% |
| **Assets (H)** | **168,574** | **157,123** | **148,566** | **142,361** | **136,505** |
| ROA = (E) / average(H)* | N.A. | 14.8% | 10.0% | 12.8% | 10.9% |

Source: CEC Financial Statements

Another issue to be noted regarding the financial statements is that CEC's payout ratio, which is the ratio of dividends for shareholders against profit after tax, has been higher than 100%, which means that CEC has paid higher dividends than a year's profit retained for shareholders. The additional source of high dividends derives from the following:

- Depreciation of fixed assets: CEC's annual capital investment has been almost below the depreciation of the year
- Collection of trade receivables in the past

Return on Assets (ROA) of CEC for the past 4 years has been above 10%, which is by far higher than that of ZESCO during the same period (1.7%–5.4%).

CEC plays an important role in Zambia's electricity sector, not only because CEC purchases about half of ZESCO's electricity sales but also it owns a part of transmission lines interconnected with DR Congo to wheel electricity from DR Congo to Zimbabwe and South Africa and, in part, Zambia. In February 2006, Zambian Energy Corporation (Zam-En), a consortium of Zambian and foreign investors, acquired 77% stake in CEC from National Grid of the United Kingdom and Cinergy Global Power of the United States. The remaining shares are owned by the Zambian Government through. ZCCM-Investment Holdings Plc (20%) and Local Technical Team of Power Division (3%).

### (2) Others

Other players in Zambia's electricity sector, such as Lunsemfwa Hydro Power Company, an IPP in which ESKOM of South Africa has 51% stake, and some small ESCOs that installs solar home system on customers' premises, do no disclose their financial statements. According to an interview that the Study Team had with some ESCOs operating in Eastern Province, their financial performance has been worsening due to the sluggish revenue collection.

# Chapter 4

# Current Situation of Rural Society

# Chapter 4. Current Situation of Rural Society

## 4.1. Functions of Rural Growth Centres and Local Communities

Villages in Zambia are in general located along the roads and rivers. A typical rural village consists of group of houses and in many cases does not include core facilities, such as schools, clinics, churches, and market. The style of these villages reflects cultural factors especially the long-established tradition by which relatives tend to live together. Government has defined a Rural Growth Centres (RGC) as a rural locality with a high concentration of residential settlements and which is the centre of rural economic activities. An RGC provides services to residents of the RGC and those in the catchment area (CA) that surrounds the RGC. Typically people go to an RGC in order to sell their agricultural produce and handicrafts, to purchase daily necessities and to access public services (refer to Figure 4-1).

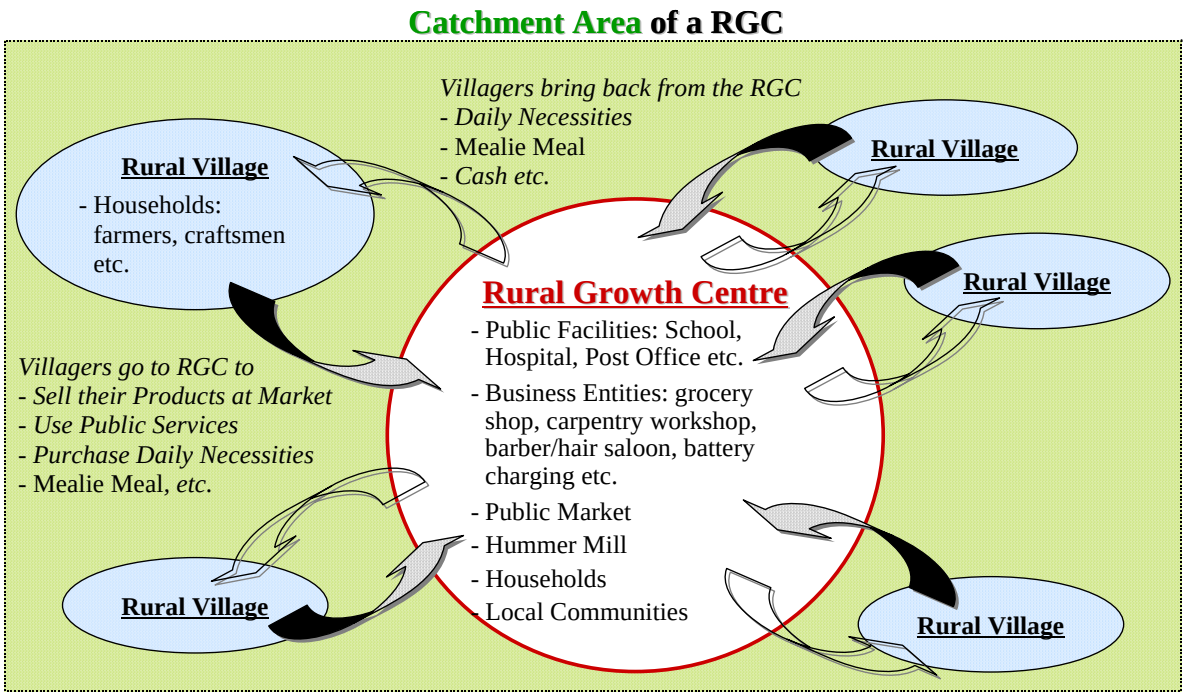



**Figure 4-1 Concept of Rural Growth Centre and Catchment Area**

In addition to the grocery shops and markets found at RGCs, there are also electrified hammer mills, which are used to produce maize meal for making "Nsima", the Zambian staple. In larger RGCs, there are also small factories, restaurants, bars and other social services. The RGCs function as a centre of daily life and activities in rural areas. Among the residents of the RGC are to be found public workers like doctors, nurses, teachers and police officers.

Local community groups have been established and they operate from public places like community halls or recreation centres within RGCs. In many cases, there are also local community groups that contribute to the development of infrastructure and public facilities, acting as recipient organizations of funds from NGOs and international donors.

For example, the Zambia Social Investment Fund (ZAMSIF), established with the assistance of the World Bank, supports the development of infrastructure like schools, clinics, boreholes, roads and bridges. In order to receive funds from ZAMSIF, the resident community establishes a committee for each project, known as the ZAMSIF Project Management Committee. Besides receiving

construction materials from ZAMSIF, the Committee is required to provide a construction labour force drawn from the villages and to contribute any necessary additional materials. On completion, the maintenance of the facility is primarily the responsibility of the Committee; however the Zambian government dispatches salaried doctors for newly constructed clinics and teachers for newly constructed schools. This model could be adapted for rural electrification projects by entrusting a village cooperative with the operation and maintenance works of electric facilities and/or tariff collection.

The size of the CA seems to vary from one district to another: for example, in the North-Western Province a CA is within approximately 8 km radius of the RGC, while that in Eastern Province is within 10 to 16 km radius of the RGC. In addition, for the Eastern Province, a kind of sub-RGC is observed within the CA. This is a much smaller and less developed unit than the main RGC and typically consists of grocery shops only.

## 4.2. Economic Activity in Rural Areas and Expected Effects after Electrification

Villagers wishing to sell their crops and products at the RGC market pay a fee. They purchase miscellaneous goods at grocery shops, or have their maize ground at electrified hammer mills in the RGCs. It can be expected therefore that there is potential demand in the unelectrified RGCs, from economic activities such as refrigeration in grocery shops and the addition of electric hammer mills.

In unelectrified RGCs, paraffin is utilized as fuel for refrigerators in grocery shops. Supply of stable electricity is expected to provide a strong possibility that paraffin refrigerator users will shift to electric refrigerators. Clinics and dairy farmers in unelectrified RGCs, that store vaccines (for human and livestock respectively) in refrigerators powered by unstable SHS, will also be the beneficiaries of electrification.

In unelectrified RGCs, hammer/maize mills with capacity of about 15kW are driven by privately owned diesel generators, and the owners charge K800 to K3,000 as the fee for grinding a bucket of maize. An increase of hammer/maize mill businesses may be expected if electricity is supplied through by extending the distribution lines at reasonable costs. Price reduction of milling fees, as a result of market competition, may also occur with entrance of mill owners, which is also expected to trigger other secondary impacts.

## 4.3. Rural Electrification and Energy Consumption

As shown in Table 4-1, the electrification rate for households is 20.3% in Zambia as of 2004. Of the 61% of the population that live in rural areas, only 3.1% currently has access to electricity. Broken down regionally, electrification rate in each Province is as follows in the descending order: 46.1% in Lusaka, 44.3% in Copperbelt, 15.7% in Southern, 12.4% in Central, 11.1% in North Western, 9.6% in Northern, 8.2% in Eastern, 4.4% in Luapula, and 4.2% in Western (refer to Figure 4-2).

Households using kerosene/paraffin as a major source of lighting are 45.7% of total households countrywide. Candle is used by 18.1 % of the households. The remaining are the households using diesel at 7.4%, wood fire at 6.1% and other energy sources at 1.4% for lighting. In rural area, kerosene/paraffin is the most commonly used source of lighting energy with 62.3% of households (especially high in Luapula Province by 80.9% and Northern Province by 70.4%), and diesel is the secondary major source of it. Since fossil fuel is expensive, especially in rural area, kerosene/paraffin and diesel users for their lighting energy are likely to be able to pay for the electricity tariff, once it has become available.

In order to receive electricity supply from ZESCO, however, expensive down payment is charged as the connection fee: Single-phase overhead for K2,873,000 and three-phase overhead for

K4,887,000 in rural area as of 2005. This initial cost is one of the big hurdles for the promotion of rural electrification.

According to the "*Living Conditions Monitoring Survey 2004*" conducted by the Central Statistics Office (CSO), the majority of Zambians (84.9% in rural area and 54.2% in whole country) use collected firewood and only 1.7 % of households in rural area use electricity as their main source of energy for cooking (refer to Table 4-2).

**Table 4-1 Percentage Distribution of Households by Main Source of Energy for Lighting**

| | | Kerosene / Paraffin | Electricity | Candle | Diesel | Wood Fire | Others | None | Total | Total No. of Households | % of Total Population |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Zambia Total** | **Total** | **45.7%** | **20.3%** | **18.1%** | **7.4%** | **6.1%** | **1.4%** | **0.9%** | **100.0%** | **2,110,640** | **100.0%** |
| | Rural | 62.3% | 3.1% | 9.7% | 11.6% | 9.9% | 2.0% | 1.5% | 100.0% | 1,288,065 | 61.0% |
| | Urban | 19.5% | 47.6% | 31.5% | 0.9% | 0.2% | 0.3% | 0.1% | 100.0% | 822,575 | 39.0% |
| **Provinces** | Central | 53.8% | 12.4% | 16.8% | 13.3% | 1.9% | 1.3% | 0.6% | 100.0% | 207,197 | 9.8% |
| | Copperbelt | 29.2% | 44.3% | 20.7% | 4.2% | 0.9% | 0.6% | 0.1% | 100.0% | 311,712 | 14.8% |
| | Eastern | 61.3% | 8.2% | 13.3% | 8.7% | 5.4% | 1.6% | 1.5% | 100.0% | 290,224 | 13.8% |
| | Luapula | 80.9% | 4.4% | 4.1% | 0.4% | 9.5% | 0.4% | 0.4% | 100.0% | 171,659 | 8.1% |
| | Lusaka | 12.6% | 46.1% | 39.8% | 0.5% | 0.2% | 0.6% | 0.2% | 100.0% | 309,949 | 14.7% |
| | Northern | 70.4% | 9.6% | 5.3% | 5.3% | 7.4% | 1.2% | 0.9% | 100.0% | 275,266 | 13.0% |
| | North-Western | 36.7% | 11.1% | 14.3% | 22.0% | 13.7% | 1.4% | 0.8% | 100.0% | 125,814 | 6.0% |
| | Southern | 41.4% | 15.7% | 19.5% | 15.5% | 5.3% | 1.1% | 1.4% | 100.0% | 252,423 | 12.0% |
| | Western | 39.2% | 4.2% | 19.3% | 4.5% | 23.9% | 5.5% | 3.4% | 100.0% | 166,219 | 7.9% |

Source: Living Conditions Monitoring Survey Report 2004
(Central Statistical Office, December 2006)

**Table 4-2 Percentage Distribution of Households by Main Source of Energy for Cooking**

| | | Collected Firewood | Purchased Firewood | Own Produced Charcoal | Purchased Charcoal | Coal | Kerosene / Paraffin / Gas | Electricity | Others | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Zambia Total** | **Total** | **54.2%** | **1.9%** | **3.5%** | **23.8%** | **0.0%** | **0.2%** | **16.2%** | **0.1%** | **100.0%** |
| | Rural | 84.9% | 1.7% | 4.7% | 6.6% | 0.0% | 0.2% | 1.7% | 0.2% | 100.0% |
| | Urban | 5.6% | 2.2% | 1.5% | 51.1% | 0.0% | 0.2% | 39.3% | 0.0% | 100.0% |
| **Provinces** | Central | 68.2% | 1.8% | 1.0% | 19.4% | 0.0% | 0.2% | 9.3% | 0.1% | 100.0% |
| | Copperbelt | 16.0% | 1.4% | 3.6% | 41.7% | – | 0.2% | 37.0% | 0.1% | 100.0% |
| | Eastern | 76.9% | 2.7% | 0.5% | 14.6% | – | 0.3% | 4.9% | 0.3% | 100.0% |
| | Luapula | 45.8% | 3.1% | 24.0% | 24.4% | – | 0.1% | 2.4% | 0.2% | 100.0% |
| | Lusaka | 10.7% | 0.8% | 0.8% | 47.3% | 0.0% | 0.2% | 40.2% | 0.0% | 100.0% |
| | Northern | 75.2% | 1.0% | 3.2% | 14.0% | 0.1% | 0.2% | 6.4% | 0.0% | 100.0% |
| | North-Western | 71.7% | 1.5% | 2.3% | 15.9% | 0.1% | 0.5% | 7.7% | 0.2% | 100.0% |
| | Southern | 71.1% | 2.5% | 0.7% | 13.4% | 0.1% | 0.2% | 12.0% | 0.1% | 100.0% |
| | Western | 88.3% | 3.8% | 0.6% | 3.6% | – | 0.2% | 3.2% | 0.4% | 100.0% |

Source: Living Conditions Monitoring Survey Report 2004
(Central Statistical Office, December 2006)

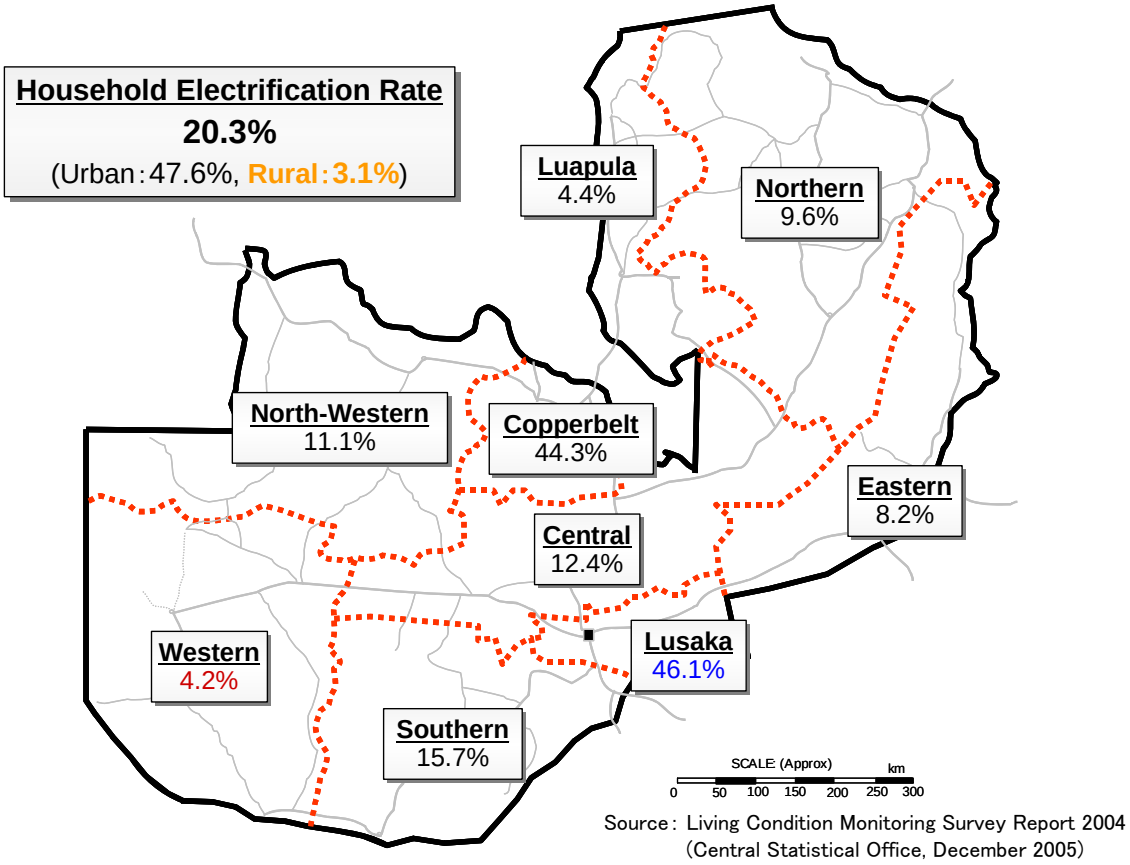



**Figure 4-2 Electrification Rate (for Lighting) by Province**

## 4.4. Rural Development Plan

The Fifth National Development Plan 2006 - 2010 (FNDP) states that the overall goal of the energy sector is "To ensure availability and accessibility to adequate and reliable supply of energy from various sources at the lowest total economic, social and environmental cost consistent with national development goals of sustained growth, employment generation and poverty reduction."

Rural development plans, however, tend to be drafted by each District in accordance with the decentralization policy. Thus, all information regarding rural development plans is neither aggregated in the Central Government nor shared among related Ministries/Organizations, such as Ministry of Local Government and Housing, Ministry of Health, Ministry of Education, Ministry of Agriculture and Cooperatives, Ministry of Energy and Water Development, and Rural Electrification Authority. These Ministries involved with the development of rural areas do not possess even basic information, such as number, names, location, and electrification status of RGCs in each District, population and number of households/business entities/public facilities in each RGC, etc. Although the Ministry of Education and the Ministry of Health have plans for the improvement of schools and hospitals/clinics, there is no centralized information regarding rural development plans and very little information is shared among Ministries. In addition, sharing of information regarding rural electrification and arrangements among DoE, REA and ZESCO have not been satisfactorily.

## 4.5. Selection of Electrification Target

Household access to electricity in the rural areas of Zambia is very low and was estimated as 3.1% in 2004. Even RGCs, which are the centers for rural economic activities and where public facilities such as schools and clinics are in place, are mostly not electrified. Electrification of a RGC

contributes to the growth of the community market and improves the quality of public services such as education and health care that the Zambian government accords high priority. In other words, electrification of an RGC will benefit residents not only in the RGC but also in its CA. In addition, business entities generally have sufficient income to afford the connection fee and the monthly electricity tariff, resulting in a boost to the local economy. Therefore, the first REMP Workshop held in Lusaka in June 2006 resolved that the RGCs shall be the main targets of the Rural Electrification Master Plan.

Three basic strategies, listed below, were defined for executing the Rural Electrification Master Plan Study. The goals were 1) maintaining transparency in the selection of electrification targets, 2) providing equal framework for the electrification of the whole country, and 3) being consistent with national policies of decentralized planning.

- Make a long list of all unelectrified RGCs in the country based on the data submitted from each District
- Verify the electrification priority of RGCs in each district submitted by District planners
- Finalize the electrification priority of all RGCs based on the size of potential demand, economical efficiency, and socio-economical consideration

To compile a comprehensive list of all unelectrified RGCs nation-wide, it was necessary to collect the data of all the existing unelectrified RGCs in each of the 72 Districts. As stated in the previous section, this information is not available anywhere in the Government structure. Therefore, as an important task of this Study, basic demographic data and locations of both electrified and unelectrified RGCs in each District were investigated and compiled in a systematic uniformed format. At the First REMP Workshop held in Lusaka, Data Collection Sheets and Topographic Maps were distributed to each Provincial representative, who then forwarded them to District Planners to fill in the information of unelectrified RGCs that district planners consider should be given priority for electrification. These data sheets were submitted by District Planners during the Second REMP Workshop held at each of 9 Provincial Centres in November 2006 (except the one in Northern Province that was held in August 2006). The location, demographical data and their electrification status, as well as the priority of RGCs for electrification in each District, are specified in the Data Collection Sheets. Among the long list of all 1,217 unelectrified RGCs, the first prioritised RGCs to be electrified in each District, together with their reasons for selection, are short listed in Table 4-3.

The first ranked RGC in each District (except Lusaka District, which is 100% urban area and thus shall be excluded from the Study's target) were also selected as the target of socio-economic survey executed as part of this Study: The seventy-one (71) unelectrified RGCs from each District, together with 19 electrified RGCs, were selected for the field survey. The selection of 19 electrified RGCs, summarized in Table 4-4, was based on the information (such as locations and duration after electrification) provided by ZESCO Regional Offices in parallel with the Provincial Workshops. Information of these electrified RGCs also needed to be checked thoroughly in order to develop profiles of electricity consumption from which estimates of potential electricity demand of unelectrified RGCs would be derived. Through the said processes, 90 RGCs in total were selected as survey targets. The main informants interviewed and the sample RGCs are summarized in Table 4-5.

## Table 4-3 Unelectrified Rural Growth Centres with the Highest Priority in Each District

| | | District | Ward | Rural Growth Centre | Reasons for Selection |
|---|---|---|---|---|---|
| ***Central Province*** | 1 | Chibombo | Kakoma | Shimukuni | Population, schools, health, trading, farming (food reserve & tobacco Scheme), access road, distance from existing distribution line |
| | 2 | Kabwe | Mpima | Mpima | Schools, health, social services, farming (food reserve, irrigation), access road, distance from existing distribution line |
| | 3 | Kapiri Mposhi | Luanchele | Chipepo | School, chief palace, local court, rural health, agricultural activities |
| | 4 | Mkushi | Kamimbya | Old Mkushi | Population, schools, health, gem stone mining, shops/social services, farming (food reserve & tobacco Scheme), police post, access road, distance from existing distribution line |
| | 5 | Mumbwa | Kalwanyembe | Mumbwa Big Concession | Farming, mining, population, schools, rural health centres, tourism |
| | 6 | Serenje | Chibale | Chibale | Population, schools, health, shops/social services, farming (food reserve & tobacco Scheme) |
| ***Copperbelt Province*** | 7 | Chiliabombwe | Anoya Zulu | Mungomba | Population, schools, health, community centre, Farming/farming (food reserve), access road, distance from existing distribution line |
| | 8 | Chingola | Kapisha | Kamiteta | Population, schools, Farm Block/farming, Cooperative, access road |
| | 9 | Kalulushi | Ichimpe | Kameme | Schools, health, Farm Block, agriculture, access road |
| | 10 | Kitwe | Limaposa | Kakolo | Schools, health, community centre, orphanage, NGO cooperative for farmers, access road, distance from existing distribution line |
| | 11 | Luanshya | Chitwi | Kafubu | Population, schools, health, community centre, Farming Block/farming, Farmers Union |
| | 12 | Lufwanyama | (N.A.) | Emerald Mining Area | Mining emerald, schools, health, clubs cooperative, access road, shops/social services |
| | 13 | Masaiti | Mutaba | Mutaba | Population, schools, health, shops/social services, farmers cooperative (women's) access road |
| | 14 | Mpongwe | Mikata | Mikata | Schools, health, shops/social services, farming/cooperatives, distance from existing distribution line |
| | 15 | Mufulira | Mutundu | Mutundu North | Schools, health, shops/business, cooperative Farm Block, access road |
| | 16 | Ndola | Kavu | Kanglonga | Schools, health, shops/businesses, Farm Block/farming cooperative, access road, distance from existing distribution line |
| ***Eastern Province*** | 17 | Chadiza | Kamini | Mlolo | Population, schools, health, shops/businesses, resettlement scheme, farming cooperative, access road |
| | 18 | Chama | Kalinkhu | Kalinkhu | Population, schools, health, shops/businesses, hammer mill, farmers cooperative |
| | 19 | Chipata | (N.A.) | Chiparamba | Population, schools, health, social services, farming (food reserve & tobacco scheme), access road, distance from existing distribution line |
| | 20 | Katete | Kapangulula | Kagoro | Population, schools, health, shops/businesses, farm block, farmers union, food reserve, tobacco scheme, access road |
| | 21 | Lundazi | Chimaliro | Mwase | Population, schools, health, shops/businesses, hammer mills, NGO farmers cooperative, |
| | 22 | Mambwe | Mphomwa | Mphomwa Tse-tse | Schools, shops/businesses, farmers cooperative, access road distribution line |
| | 23 | Nyimba | Ngozi | Chipembe | Population, secondary schools, shops/businesses, restaurants, small factories, farmers cooperative, access road, distance from existing distribution line |
| | 24 | Petauke | Matambazi | Kapungwe | Population, schools, shops, farm block, farmers cooperative, access road from existing distribution line |
| ***Luapula Province*** | 25 | Chienge | Lunchinda | Lupiya | Schools, shops/businesses, hammer mills, farm blocks, farmers cooperatives, access road, |
| | 26 | Kawambwa | Mulunda | Chama | Population, schools/health, shops/businesses, hammer mill, farm block, access road, |
| | 27 | Mansa | Chibeleka | Kasongwa Sub Boma | Population, schools/health, shops/businesses, hammer mill, farmers cooperatives, access road |
| | 28 | Milenge | Mikula | Tayali | Population, schools/health, shops/businesses, hammer mill, farmers cooperatives, access road |
| | 29 | Mwense | Mpasa | Katuta | Schools/health, shops, hammer mill, farm block, farmers cooperatives, access road |
| | 30 | Nchelenge | Chilongo | Chilongo | Population, schools, small factory, hammer mill, access road |
| | 31 | Samfya | Kapata | Chinsanka | Population, primary schools, shops/businesses/market, hammer mill, farm block, farmers cooperatives, access road distribution line |
| ***Lusaka Province*** | 32 | Chongwe | Bunda Bunda | Chinyunyu | Schools/health, shops/businesses, market, hammer mill, farm block, farmers cooperatives, access road, distance from existing distribution line |
| | 33 | Kafue | Malundu | Chipapa | Population, schools/health, shops/businesses, market, hammer mill, farm block, farmers cooperatives, access road, distance from existing distribution line |
| | 34 | Luangwa | Dzalo | Luangwa Boma | Population, schools/health, shops/businesses, hammer mill, farm block, farmers cooperatives, access road, distance from existing distribution line |
| | - | *Lusaka* | - | - | ** No candidate RGC was selected from Lusaka District, where 100% of the population lives in "urban" area.* |
| ***Northern Province*** | 35 | Chilubi | Santa Maria | Kambashi | Schools/health, shops/businesses, fishing, small industries, hammer mill, distance from existing distribution line |
| | 36 | Chinsali | Mukumbi | Shiwangandu | Micro-hydro potential, population, schools/health, shops/businesses/small industries, tourism, hammer mill, farmers cooperative, access road, distance from existing distribution line |
| | 37 | Isoka | Kalansa | Muyombe | Schools/health, shops/businesses/markets, hammer mill, access road |
| | 38 | Kaputa | (N.A.) | Nsama Sub Boma | (No info available) |
| | 39 | Kasama | Musowa | Kachuma | Population, schools, shops, hammer mill, farm block, farmers cooperatives, access road |
| | 40 | Luwingu | (N.A.) | Masonde | (No info available) |
| | 41 | Mbala | Lapisha | Chimula | Population, schools/health, shops/businesses, hammer mill, farm block, farmers cooperatives, access road |
| | 42 | Mpika | Chibwa | Kanchibiya | Schools/health, shops/businesses, hammer mill, farm block, farmers cooperatives, access road |
| | 43 | Mporokoso | Kalungwishi | Mukupakaoma | Micro-hydro potential, population, schools/health, shops/businesses/markets, hammer mill, farm block, farmers cooperatives |
| | 44 | Mpulungu | Kapembwa | Kasaba Bay | (No info available) |
| | 45 | Mungwi | Mpanda | Makasa | Schools/health, shops/businesses, farmers cooperatives, (food reserve & tobacco Scheme), access road, distance from existing distribution line |
| | 46 | Nakonde | Isunda | Wulongo | Population, schools/health, shops/businesses, hammer mill, farm block, farmers cooperatives, access road, distance from existing distribution line |
| ***North-Western Province*** | 47 | Chavuma | Chivombo | Chivombo | Micro-hydro potential, Population, schools/health, shops, hammer mill, farm block, farmers cooperatives, access road, distance from existing distribution line |
| | 48 | Kabompo | Kashinakazhi | Kashinakazhi | Population, schools/health, shops/market, farmers cooperatives, access road |
| | 49 | Kasempa | Nselauke | Nselauke | Population, schools/health, shops/businesses/market, hammer mill, farmers cooperatives, access road, distance from existing distribution line |
| | 50 | Mufumbwe | Matushi | Matushi | Population, schools/health, shops/market, hammer mill, farm block, farmers cooperatives, access road, distance from existing distribution line |
| | 51 | Mwinilunga | Ntambu | Ntambu | Micro-hydro potential, population, schools/health, shops/businesses/markets, hammer mill, farmers cooperatives, access road |
| | 52 | Solwezi | Mumena | Mumena | Population, schools/health, shops/businesses/market, hammer mill |
| | 53 | Zambezi | Chitokoloki | Chitokoloki | Micro-hydro potential, population, schools/health, shops/businesses/market/small factory, hammer mill, farm block, farmers cooperatives, access road |
| ***Southern Province*** | 54 | Choma | Hamaundu | Kachomba | Population, schools, Courts, health, community centre, farming (food reserve), access road |
| | 55 | Gwembe | Chibuwe | Siabwengo | Fishing camp, schools, health, social services, distance from existing distribution line |
| | 56 | Itezhi-tezhi | Lubanda | Lubanda | Schools, health, social services, Farm Block/farming, food reserve, agric camp, Vet Camp, groceries/shops, hammer mills |
| | 57 | Kalomo | Mbwiko | Napatizya | Schools, health, social services, Farm Block/farming, food reserve, agric camp, Vet Camp, groceries/shops, hammer mills |
| | 58 | Kazungula | Sekute | Mambova | Schools, health, community centre, Agric depot |
| | 59 | Livingstone | Kasiya | Kasiya | Population, schools, health, social services, farm Block/farming (food reserve & tobacco Scheme), access road, distance from existing distribution line |
| | 60 | Mazabuka | Magoye | Ngwezi | Population, schools, health, social services, farming (food reserve & tobacco Scheme), access road, distance from existing distribution line |
| | 61 | Monze | Choongo East | Kamuzya East | Agriculture, population, social amenities, schools, health, food reserve, distance from existing distribution line |
| | 62 | Namwala | Bambwe | Bambwe | Cattle faring, palaces, population, schools, health, (food reserve & tobacco Scheme), access road, distance from existing distribution line |
| | 63 | Siavonga | Nanyanga | Namoomba | Population, schools, health, social services, farming (food reserve & tobacco Scheme), access road, distance from existing distribution line |
| | 64 | Sinazongwe | Malima | Sinakaimbi | Farmers Training Centre, Population, schools, health, business facilities, farming, access road, distance from existing distribution line |
| ***Western Province*** | 65 | Kalabo | Maala | Sikongo | Population, schools/health, shops/businesses, hammer mill, farm block, farmers cooperatives, access road |
| | 66 | Kaoma | Nkeyama | Nkeyama | Population, schools/health, shops/businesses, hammer mills, farm block, farmers cooperatives, (tobacco Scheme), access road |
| | 67 | Lukulu | (N.A.) | Lukulu Boma | Population, schools/health, shops/businesses, markets, hammer mill, farm block, access road |
| | 68 | Mongu | Nangula | Nangula | Population, schools/health, shops/businesses/small industries, hammer mill, food reserve, access road |
| | 69 | Senanga | Muoyo | Sianda | Schools, shops/businesses, market, small factories, hammer mill, farmers cooperatives, access road, distance from existing distribution line |
| | 70 | Sesheke | Sichili | Sichili | Schools/health, shops/businesses/small industries, hammer mill, farmers cooperatives, access road |
| | 71 | Shang'ombo | Simu | Shang'ombo | Population, schools/health, shops/businesses/small industries, hammer mill, farm block, NGO farmers cooperatives, access road, distance from |

**Table 4-4 Electrified Rural Growth Centres for Socio-Economic Survey**

| | | District | Ward | Rural Growth Centre |
|---|---|---|---|---|
| ***Central Province*** | 1 | Kapiri Mposhi | (N.A) | Mpula |
| | 2 | Kabwe | Mpunde | Mpunde |
| ***Copperbelt Province*** | 3 | Ndola | Kafulafuta | Mishikishi |
| | 4 | Ndola | Kafulafuta | Chiwala |
| ***Luapula Province*** | 5 | Nchelenge | Kasamba | Kambwali |
| | 6 | Mansa | Luapula | Chembe |
| | 7 | Kawambwa | (N.A) | Munkanta |
| | 8 | Mansa | (N.A) | Luamfumu |
| ***Lusaka Province*** | 9 | Chongwe | Nakatindi | Nchute |
| | 10 | Kafue | Chiawa | Chiawa |
| ***Northern Province*** | 11 | Kasama | Chamfubu | Nseluka |
| ***North-Western Province*** | 12 | Mwinilunga | (N.A) | Kabanda |
| | 13 | Solwezi | (N.A) | Kapinjimpanga |
| ***Southern Province*** | 14 | Livingstone | Mukuni | Mukuni Village |
| | 15 | Choma | Singani | Mochipapa |
| | 16 | Livingstone | Musokotwane | Musokotwane Village |
| | 17 | Livingstone | (N.A) | Mwandi Village |
| ***Western Province*** | 18 | Senanga | Imatonga | Senanga |
| | 19 | Mongu | Sefula | Sefula |

**Table 4-5 Sampling Targets and Numbers for Socioeconomic Survey**

| Type of RGCs | Sampling Items | Sampling Target & Number | Sampling Method |
|---|---|---|---|
| All RGCs | Characteristics of each RGC | 90 RGCs<br>(71 Unelectrified<br>+19 Electrified) | - Data collection at Central Statistical Office (CSO)<br>- Measurement by enumerators<br>- Interview with key informants (any of the following institutions), using the prepared questionnaire:<br>1) District Commissioners<br>2) District ZESCO Managers<br>3) Local Institutions of Local Government and Housing officials in the RGC (Councils)<br>4) Local Ministry of Heath officials in the RGC<br>5) Local Ministry of Education officials in the RGC<br>6) Local Ministry of Agriculture officials in the RGC<br>7) Local Community Development Officials in the RGC<br>8) Representatives of Business Associations in the RGC<br>9) Representatives of Farmers' Associations in the RGC<br>10) Representatives of Residents in the RGC<br>11) Ministry of Community Development and Social Services |
| Unelectrified RGCs | Characteristics of unelectrified public facilities, households, and business entities, such as potential power demand | All public facilities in 71 Unelectrified RGCs | - Individual interview with representatives of all public facilities, such as hospitals, clinics, schools, police post, post office, immigration office and so on, using prepared questionnaires. |
| | | 13 interviewees<br>(7 households<br>+ 6 business owners) per RGC<br><br>Total sampling number: 923<br>(= 13 x 71RGCs) | - Individual interview with randomly selected unelectrified households and business owners in each RGC, using prepared questionnaires. |
| Electrified RGCs | Characteristics of electrified public facilities, households, and business entities, such as consumption record and demand growth | All public facilities in 19 Electrified RGCs | - Individual interview with representatives of all public facilities, such as hospital, clinic, school, police, post office, immigration office and so on, using prepared questionnaires |
| | | 20 interviewees<br>(14 households<br>+ 6 business owners) per RGC<br><br>Total sampling number: 380<br>(= 20 x 19RGCs) | - Individual interview with randomly selected electrified households and business owners in each RGC, using prepared questionnaires. |
| | Characteristics of unelectrified households and business entities, such as seasons why still not electrified | 10 interviewees<br>(6 households<br>+ 4 business owners) per RGC<br><br>Total sampling number: 190<br>(= 10 x 19RGCs) | - Individual interview with randomly selected households and business owners in each RGC, who have not received electricity, using prepared questionnaires. |

## 4.6. Collected Sample Sizes

In the socio-economic survey, data necessary for the analysis in both the technical and social aspects of the 90 RGCs – 71 unelectrified and 19 electrified – were collected from four different types of interviewees: 1) household representatives, 2) business owners, 3) representatives of each public facility, and 4) key-informants of each RGC. The socio-economic survey took place from December 2006 to February 2007. Among 71 targeted unelectrified RGCs, 11 RGCs were not accessible due to the heavy rains that made it impossible to use access roads. For these 11 unelectrified RGCs, 8 RGCs were replaced by other unelectrified RGCs in the same District of the originally targeted RGCs; 1 RGC was substituted by an electrified RGC; and 2 RGCs (Kalinku in Eastern Province and Ntambu in North Western Province, were unaccessible) were unable to be replaced at all, as shown in Table 4-6. In addition, 4 RGCs (Mpima in Central Province, Kangonga in Copperbelt Province, Luangwa Boma in Lusaka Province, and Lukulu Boma in Western Province) considered as unelectrified were found to be electrified, while 1 RGC (Nchute in Lusaka Province) considered as electrified were detected as unelectrified in the survey. As a result, data was collected from 23 electrified and 65 unelectrified RGCs: 4 more electrified and 6 less unelectrified RGCs than the targeted numbers. The number of surveyed RGCs by Province is summarised in Table 4-7.

Out of these 88 RGCs, socio-economic data were collected from 681 households, 379 business entities, 267 public facilities and 88 key-informants as summarized in Table 4-8. The actual collected data were less than the targeted numbers: 78% for households and 62% for business entities. The situations above arose because the connected households in electrified RGCs and the business entities existing in the surveyed RGCs were less than the targeted numbers.

Although the sample sizes were smaller than the targeted numbers, the analysis used these data as they were the only primary data available, no secondary data were substitutable, and they were the most reliable information collected using the questionnaire designed by the Study Team. No secondary data were available.

## Table 4-6 Inaccessible RGCs and Diffirent Electrificatoin Status

| | | District | Ward | Rural Growth Centre | Note | Replacement | Elec. Status |
|---|---|---|---|---|---|---|---|
| ***Central Province*** | 1 | Chibombo | Kakoma | Shimukuni | | | |
| | 2 | Kabwe | Mpima | Mpima | Electrified | | |
| | 3 | Kapiri Mposhi | Luanchele | Chipepo | | | |
| | 4 | Mkushi | Kamimbya | Old Mkushi | | | |
| | 5 | Mumbwa | Kalwanyembe | Mumbwa Big Concession | | | |
| | 6 | Serenje | Chibale | Chibale | | | |
| ***Copperbelt Province*** | 7 | Chiliabombwe | Anoya Zulu | Mungomba | | | |
| | 8 | Chingola | Kapisha | Kamiteta | | | |
| | 9 | Kalulushi | Ichimpe | Kameme | | | |
| | 10 | Kitwe | Limaposa | Kakolo | | | |
| | 11 | Luanshya | Chitwi | Kafubu | | | |
| | 12 | Lufwanyama | (N.A.) | Emerald Mining Area | | | |
| | 13 | Masaiti | Mutaba | Mutaba | | | |
| | 14 | Mpongwe | Mikata | Mikata | | | |
| | 15 | Mufulira | Mutundu | Mutundu North | | | |
| | 16 | Ndola | Kavu | Kanglonga | Electrified | | |
| ***Eastern Province*** | 17 | Chadiza | Kamini | Mlolo | | | |
| | 18 | Chama | Kalinkhu | Kalinkhu | Inaccessible | No Place | - |
| | 19 | Chipata | (N.A.) | Chiparamba | | | |
| | 20 | Katete | Kapangulula | Kagoro | | | |
| | 21 | Lundazi | Chimaliro | Mwase | | | |
| | 22 | Mambwe | Mphomwa | Mphomwa Tse-tse | | | |
| | 23 | Nyimba | Ngozi | Chipembe | | | |
| | 24 | Petauke | Matambazi | Kapungwe | | | |
| ***Luapula Province*** | 25 | Chienge | Lunchinda | Lupiya | Inaccessible | Kalobwa | Electrified |
| | 26 | Kawambwa | Mulunda | Chama | Inaccessible | Mushota | Unelectrified |
| | 27 | Mansa | Chibeleka | Kasongwa Sub Boma | | | |
| | 28 | Milenge | Mikula | Tayali | | | |
| | 29 | Mwense | Mpasa | Katuta | | | |
| | 30 | Nchelenge | Chilongo | Chilongo | | | |
| | 31 | Samfya | Kapata | Chinsanka | | | |
| ***Lusaka Province*** | 32 | Chongwe | Bunda Bunda | Chinyunyu | | | |
| | 33 | Kafue | Malundu | Chipapa | | | |
| | 34 | Luangwa | Dzalo | Luangwa Boma | Electrified | | |
| | - | Lusaka | - | - | | | |
| ***Northern Province*** | 35 | Chilubi | Santa Maria | Kambashi | Inaccessible | Matipa | Unelectrified |
| | 36 | Chinsali | Mukumbi | Shiwangandu | | | |
| | 37 | Isoka | Kalansa | Muyombe | | | |
| | 38 | Kaputa | (N.A.) | Nsama Sub Boma | | | |
| | 39 | Kasama | Musowa | Kachuma | | | |
| | 40 | Luwingu | (N.A.) | Masonde | | | |
| | 41 | Mbala | Lapisha | Chimula | | | |
| | 42 | Mpika | Chibwa | Kanchibiya | | | |
| | 43 | Mporokoso | Kalungwishi | Mukupakaoma | | | |
| | 44 | Mpulungu | Kapembwa | Kasaba Bay | Inaccessible | Chitimbwa | Unelectrified |
| | 45 | Mungwi | Mpanda | Makasa | Inaccessible | Rosa | Unelectrified |
| | 46 | Nakonde | Isunda | Wulongo | | | |
| ***North-Western Province*** | 47 | Chavuma | Chivombo | Chivombo | | | |
| | 48 | Kabompo | Kashinakazhi | Kashinakazhi | | | |
| | 49 | Kasempa | Nselauke | Nselauke | | | |
| | 50 | Mufumbwe | Matushi | Matushi | | | |
| | 51 | Mwinilunga | Ntambu | Ntambu | Inaccessible | No Place | - |
| | 52 | Solwezi | Mumena | Mumena | | | |
| | 53 | Zambezi | Chitokoloki | Chitokoloki | | | |
| ***Southern Province*** | 54 | Choma | Hamaundu | Kachomba | | | |
| | 55 | Gwembe | Chibuwe | Siabwengo | | | |
| | 56 | Itezhi-tezhi | Lubanda | Lubanda | | | |
| | 57 | Kalomo | Mbwiko | Napatizya | Inaccessible | Kabanga | Unelectrified |
| | 58 | Kazungula | Sekute | Mambova | | | |
| | 59 | Livingstone | Kasiya | Kasiya | | | |
| | 60 | Mazabuka | Magoye | Ngwezi | | | |
| | 61 | Monze | Choongo East | Kamuzya East | | | |
| | 62 | Namwala | Bambwe | Bambwe | | | |
| | 63 | Siavonga | Nanyanga | Namoomba | | | |
| | 64 | Sinazongwe | Malima | Sinakaimbi | | | |
| ***Western Province*** | 65 | Kalabo | Maala | Sikongo | Inaccessible | Nangweshi | Unelectrified |
| | 66 | Kaoma | Nkeyama | Nkeyama | | | |
| | 67 | Lukulu | (N.A.) | Lukulu Boma | Electrified | | |
| | 68 | Mongu | Nangula | Nangula | | | |
| | 69 | Senanga | Muoyo | Sianda | | | |
| | 70 | Sesheke | Sichili | Sichili | | | |
| | 71 | Shang'ombo | Simu | Shang'ombo | Inaccessible | Sioma | Unelectrified |

**Table 4-7 Number of Surveyed RGCs by Province**

| Province | Electrified | Unelectrified | Total |
|---|---|---|---|
| Central | 3 | 5 | 8 |
| Copperbelt | 3 | 9 | 12 |
| Eastern | 0 | 7 | 7 |
| Luapula | 5 | 6 | 11 |
| Lusaka | 2 | 2 | 5 |
| Northern | 1 | 12 | 13 |
| North Western | 2 | 6 | 8 |
| Southern | 4 | 11 | 15 |
| Western | 3 | 7 | 9 |
| Total | 23 | 65 | 88 |

**Table 4-8 Collected Sample Sizes in Socio-economic Survey**

| | TARGET | | | ACHIEVEMENT | | | |
|---|---|---|---|---|---|---|---|
| | Electrified | Unelectrified | Total | Electrified | Unelectrified | Total | % |
| RGCs | 19 | 71 | 90 | 23 | 65 | 88 | 98 |
| 1) Households | 380 | 497 | 877 | 246 | 435 | 681 | 78 |
| 2) Business Entities | 190 | 426 | 616 | 124 | 255 | 379 | 62 |
| *Sub-total* | *570* | *923* | *1,493* | *370* | *690* | *1,060* | *71* |
| 3) Public Facility | All | All | - | 149 | 118 | 267 | - |

## 4.7. Ability and Willingness to Pay

In order to analyse the connection costs and the monthly electricity tariff, this socio-economic survey investigates the amount that customers pay in electrified RGCs. The ability to pay for a monthly tariff is estimated from the current expenditures by the interviewed households on alternative energy forms in unelectrified RGCs including firewood, paraffin, charcoal and storage batteries. To determine the amount that villagers in unelectrified RGCs are willing to pay for the initial connection cost and the monthly tariff, a randomly selected sample was interviewed applying the Contingent Valuation Method (CVM). To estimate how the interviewees value the initial cost and monthly tariff, in comparison with urgency (years that they are ready to wait until receiving electricity) and daily consumable duration, Conjoint Analysis was applied in the socio-economic survey. The technique was mainly developed as a widely used factor analysis method in the field of marketing research, to identify a product with the best combination of factors/attributes for consumers.

### 4.7.1. Methodology to Assess Ability to Pay for Monthly Tariff

In the socio-economic survey, data (or balance sheet) of a monthly income and expenditure was collected from households and business entities to assess income, energy cost, ZESCO tariff (only for electrified households), ratio of energy cost to income, ratio of ZESCO tariff to income (only for electrified households), and ratio of ZESCO tariff to energy cost (only for electrified households). The analysis was carried out by classifying respondents into 8 categories: 1) electrified households, 2) electrified business entities, 3) unconnected households, 4) unconnected business entities in electrified RGCs; and 5) unelectrified households, 6) unelectrified business entities, 7) households with stand alone generator, 8) business entities with stand alone generator in unelectrified RGCs. Unconnected households and business entities are those who are not connected to a ZESCO distribution line even though they live in electrified RGCs. Stand alone generator is either solar home system or diesel generator. Among all collected data, only reliable data, whose total income and total expenditures were balanced, were used in the analysis. Therefore, only 301 effective data out of 1,060 collected data were used for the analysis.

### 4.7.2. Evaluation of Ability to Pay for Monthly Tariff

The analysis results and significance different test results by non-parametric test (Mann-Whitney U) for all the possible combination of 8 respondent categories are summarized in Table 4-9. Key findings focusing on unelectrified households and business entities in unelectrified RGCs are as follows.

(A) Monthly Income (Section (A) in Table 4-9)

The average monthly income (AMI) for unelectrified households in unelectrified RGCs was determined as K910,757. This is significantly lower than the corresponding figures in electrified RGCs, which are K1,163,721 for electrified households and K1,299,833 for households with stand alone generator (with 5% level), but higher than for unconnected households in electrified RGCs at K640,000 (with 10% level). Thus, the average incomes in unelectrified households in unelectrified RGCs is better than those for unconnected ones in electrified RGCs, but not as good as the electrified ones in electrified RGCs. [Note: Average monthly household income as of 2004 is K334,308 in rural areas, K760,629 in urban areas, and K502,030 for the whole country. *Living Condition Monitoring Survey Report 2004, Central Statistical Office, December 2005*]

The AMI for business entities in unelectrified RGCs was K4,456,118, and this value is higher than that for electrified business entities in electrified RGCs at K2,805,067, for unconnected business entities in electrified RGCs at 2,403,667, and for business entities with stand alone generator at K2,800,000. These differences, however, are not significant even with 10% level. Therefore, income level for surveyed business entities in unelectrified RGCs is as good as that for electrified ones in electrified RGCs. As expected, the AMI for business entities was generally higher than that for households.

(B) Monthly Energy Cost (Section (B) in Table 4-9)

The Average Monthly Energy Cost (AMEC) for unelectrified households in unelectrified RGCs is K59,141, and this is significantly lower than that for electrified households in electrified RGCs at K87,118 (with 1% level), but is significantly different from neither that for households with stand alone generator at K63,025 nor that for unconnected households in electrified RGCs at K53,525 (even with 10% level). Since monthly income for unelectrified households is lower than electrified households, it is not surprising that AMEC for unelectrified households are also lower than electrified households.

The AMEC for business entities in unelectrified RGCs is K75,315, and this is significantly lower than that for electrified business entities in electrified RGCs at K308,653. While monthly income between electrified and unelectrified business entities are not significantly different (in fact, the value for unelectrified business entities are larger than unelectrified ones), it seems that surveyed unelectrified business entities are affordable to pay more for energy cost.

(C) Monthly ZESCO Tariff (Section (C) in Table 4-9)

Average Monthly ZESCO Tariff (AMZT) paid by households is K52,286, while that by business entities is K201,600: business entities expense approximately 4 times on monthly ZESCO tariffs compared to households. They are significantly different with 5% significance level.

(D) Ratio of Energy Cost to Income (Section (D) in Table 4-9)

The average Ratio of monthly Energy Cost to monthly Income (RECI) for unelectrified households in unelectrified RGCs is 0.108, and this is significantly larger than that for households with stand alone generator at 0.048 (with 1% significance level), but is not different from electrified households at 0.118 and unconnected ones at 0.134, even with 10% significance level. Thus, RECI is approximately 11% for both electrified households by ZESCO and unelectrified households.

RECI for business entities in unelectrified RGCs is 0.057, and this is significantly lower than that for electrified business entities in electrified RGCs at 0.165.

(E) Ratio of ZESCO Tariff to Income (Section (E) in Table 4-9)

The average Rate of monthly ZESCO Tariff to monthly Income (RZTI) for households is 0.066, while that for business entities is 0.081. They are not significantly different even with 10% significance level, and thus approximately 6 to 8% of income is consumed by ZESCO customers no matter whether they are households or business entities.

(F) Ratio of ZESCO Tariff to Energy Cost (Section (F) in Table 4-9)

The average Rate of monthly ZESCO Tariff to monthly Energy Cost (RZTEC) for households is 0.623, while that for business entities is 0.819. They are significantly different with 1% significance level. Therefore, both business entities and households still use energy other than electricity even after electrification, but business entities seem to shift from alternative energy to electricity more remarkably than households: business entities consume less than 20% of energy cost for alternative energy after the electrification, while households still spend approximately 40% of energy cost for it.

Based on the key findings above, it is estimated that unelectrified business entities are more likely to afford monthly electricity tariff than households. By assuming that 60% of the current monthly energy expenditure could be switched to the electricity consumption for unelectrified households and 80% for unelectrified business entities after the electrification, estimated ability to pay for monthly electricity tariffs are at least K35,485 (=K59,141*0.6) for households and K60,252 (=K75,315*0.8) for business entities respectively.

## Table 4-9 Analysis Results of Monthly Balance Sheet (1/2)

**(A) Monthly Income [= Monthly Expenditure]**

| | | Sample # | Average | St. Dev. | Median | LB of 95% CI | UB of 95% CI | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| Electrified RGC | 1. Electrified HH | 28 | 1,163,721 | 705,739 | 970,000 | 890,065 | 1,437,378 | 0.408 | -0.631 |
| | 2. Electrified BE | 15 | 2,805,067 | 2,649,242 | 2,600,000 | 1,337,965 | 4,272,168 | 1.326 | 1.414 |
| | 3. Unconnected HH | 20 | 640,000 | 816,488 | 350,000 | 257,872 | 1,022,128 | 2.747 | 8.158 |
| | 4. Unconnected BE | 9 | 2,403,667 | 1,981,515 | 1,600,000 | 880,539 | 3,926,794 | 1.883 | 3.535 |
| Unelectrified RGC | 5. Unelectrified HH | 129 | 910,757 | 1,228,944 | 680,000 | 696,660 | 1,124,854 | 4.673 | 27.841 |
| | 6. Unelectrified BE | 81 | 4,456,118 | 7,255,342 | 2,100,000 | 2,851,830 | 6,060,406 | 3.330 | 12.207 |
| | 7. HH with Stand Alone Generator | 12 | 1,299,833 | 572,480 | 1,180,000 | 936,097 | 1,663,570 | 0.966 | 0.260 |
| | 8. BE with Stand Alone Generator | 7 | 2,800,000 | 1,802,776 | 2,800,000 | 1,132,711 | 4,467,289 | 0.484 | -1.146 |

| | | Electrified RGC | | | | Unelectrified RGC | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1. Electrified HH | 2. Electrified BE | 3. Unconnected HH | 4. Unconnectedd BE | 5. Unelectrified HH | 6. Unelectrified BE | 7. HH with Generator | 8. BE with Generator |
| Electrified RGC | 1. Electrified HH | | 133.0 (0.050)** | 135.0 (0.002)* | 68.0 (0.040)** | 1218.5 (0.007)* | 662.5 (0.001)* | 144.0 (0.479) | 43.5 (0.025)** |
| | 2. Electrified BE | 133.0 (0.050)** | | 57.5 (0.002)* | 64.0 (0.835) | 476.0 (0.001)* | 566.5 (0.679) | 63.5 (0.196) | 45.5 (0.622) |
| | 3. Unconnected HH | 135.0 (0.002)* | 57.5 (0.002)* | | 15.5 (0.000)* | 983.0 (0.087)*** | 222.0 (0.000)* | 31.0 (0.001)* | 10.0 (0.001)* |
| | 4. Unconnected BE | 68.0 (0.040)** | 64.0 (0.835) | 15.5 (0.000)* | | 170.0 (0.000)* | 350.5 (0.851) | 32.0 (0.117) | 27.0 (0.633) |
| Unelectrified RGC | 5. Unelectrified HH | 1218.5 (0.007)* | 476.0 (0.001)* | 983.0 (0.087)*** | 170.0 (0.000)* | | 2143.5 (0.000)* | 375.0 (0.003)* | 113.5 (0.001)* |
| | 6. Unelectrified BE | 662.5 (0.001)* | 566.5 (0.679) | 222.0 (0.000)* | 350.5 (0.851) | 2143.5 (0.000)* | | 339.5 (0.093) | 259.5 (0.711) |
| | 7. HH with Generator | 144.0 (0.479) | 63.5 (0.196) | 31.0 (0.001)* | 32.0 (0.117) | 375.0 (0.003)* | 339.5 (0.093) | | 19.0 (0.052)*** |
| | 8. BE with Generator | 43.5 (0.025)** | 45.5 (0.622) | 10.0 (0.001)* | 27.0 (0.633) | 113.5 (0.001)* | 259.5 (0.711) | 19.0 (0.052)*** | |

**(B) Monthly Energy Cost**

| | | Sample # | Average | St. Dev. | Median | LB of 95% CI | UB of 95% CI | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| Electrified RGC | 1. Electrified HH | 28 | 87,118 | 37,728 | 80,750 | 72,489 | 101,747 | 0.334 | -0.586 |
| | 2. Electrified BE | 15 | 308,653 | 501,705 | 116,000 | 30,819 | 586,488 | 2.408 | 5.335 |
| | 3. Unconnected HH | 20 | 53,525 | 47,270 | 34,500 | 31,402 | 75,648 | 1.045 | -0.309 |
| | 4. Unconnected BE | 9 | 101,267 | 107,891 | 60,000 | 18,334 | 184,199 | 1.387 | 1.192 |
| Unelectrified RGC | 5. Unelectrified HH | 129 | 59,141 | 49,182 | 50,600 | 50,573 | 67,709 | 2.395 | 10.373 |
| | 6. Unelectrified BE | 81 | 75,315 | 70,731 | 53,000 | 59,675 | 90,955 | 1.887 | 4.311 |
| | 7. HH with Stand Alone Generator | 12 | 63,025 | 63,909 | 51,500 | 22,419 | 103,631 | 2.024 | 4.909 |
| | 8. BE with Stand Alone Generator | 7 | 736,000 | 1,460,099 | 100,000 | -614,366 | 2,086,366 | 2.499 | 6.355 |

| | | Electrified RGC | | | | Unelectrified RGC | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1. Electrified HH | 2. Electrified BE | 3. Unconnected HH | 4. Unconnectedd BE | 5. Unelectrified HH | 6. Unelectrified BE | 7. HH with Generator | 8. BE with Generator |
| Electrified RGC | 1. Electrified HH | | 159.0 (0.194) | 142.0 (0.004)* | 105.0 (0.457) | 1003.5 (0.000)* | 801.5 (0.021)** | 96.0 (0.034)** | 92.5 (0.821) |
| | 2. Electrified BE | 159.0 (0.194) | | 67.5 (0.006)* | 46.0 (0.199) | 474.0 (0.001)* | 356.5 (0.011)** | 41.0 (0.017)** | 50.5 (0.888) |
| | 3. Unconnected HH | 142.0 (0.004)* | 67.5 (0.006)* | | 67.0 (0.278) | 1145.0 (0.419) | 660.5 (0.202) | 115.0 (0.846) | 45.5 (0.175) |
| | 4. Unconnected BE | 105.0 (0.457) | 46.0 (0.199) | 67.0 (0.278) | | 496.0 (0.466) | 342.0 (0.762) | 43.5 (0.454) | 24.0 (0.427) |
| Unelectrified RGC | 5. Unelectrified HH | 1003.5 (0.000)* | 474.0 (0.001)* | 1145.0 (0.419) | 496.0 (0.466) | | 4749.0 (0.267) | 768.0 (0.965) | 324.0 (0.209) |
| | 6. Unelectrified BE | 801.5 (0.021)** | 356.5 (0.011)** | 660.5 (0.202) | 342.0 (0.762) | 4749.0 (0.267) | | 426.0 (0.491) | 212.0 (0.270) |
| | 7. HH with Generator | 96.0 (0.034)** | 41.0 (0.017)** | 115.0 (0.846) | 43.5 (0.454) | 768.0 (0.965) | 426.0 (0.491) | | 29.0 (0.271) |
| | 8. BE with Generator | 92.5 (0.821) | 50.5 (0.888) | 45.5 (0.175) | 24.0 (0.427) | 324.0 (0.209) | 212.0 (0.270) | 29.0 (0.271) | |

**(C) Monthly ZESCO Tariff**

| | | Sample # | Average | St. Dev. | Median | LB of 95% CI | UB of 95% CI | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| Electrified RGC | 1. Electrified HH | 28 | 52,286 | 31,061 | 46,500 | 40,241 | 64,330 | 1.407 | 2.465 |
| | 2. Electrified BE | 15 | 201,600 | 419,889 | 87,000 | -30,927 | 434,127 | 3.710 | 14.070 |
| | 3. Unconnected HH | - | - | - | - | - | - | - | - |
| | 4. Unconnected BE | - | - | - | - | - | - | - | - |
| Unelectrified RGC | 5. Unelectrified HH | - | - | - | - | - | - | - | - |
| | 6. Unelectrified BE | - | - | - | - | - | - | - | - |
| | 7. HH with Stand Alone Generator | - | - | - | - | - | - | - | - |
| | 8. BE with Stand Alone Generator | - | - | - | - | - | - | - | - |

| | | Electrified RGC | | | | Unelectrified RGC | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1. Electrified HH | 2. Electrified BE | 3. Unconnected HH | 4. Unconnectedd BE | 5. Unelectrified HH | 6. Unelectrified BE | 7. HH with Generator | 8. BE with Generator |
| Electrified RGC | 1. Electrified HH | | 113.5 (0.014)** | | | | | | |
| | 2. Electrified BE | 113.5 (0.014)** | | | | | | | |
| | 3. Unconnected HH | | | | | | | | |
| | 4. Unconnected BE | | | | | | | | |
| Unelectrified RGC | 5. Unelectrified HH | | | | | | | | |
| | 6. Unelectrified BE | | | | | | | | |
| | 7. HH with Generator | | | | | | | | |
| | 8. BE with Generator | | | | | | | | |

[Note]
Upper: Mann-Whitney's U Value
Lower: (P-Value)

* : Significantly different with 1% level
** : Significantly different with 5% level
***: Significantly different with 10% level

## Table 4-9 Analysis Results of Monthly Balance Sheet (2/2)

**(D) Energy Cost/Income Rate [= (B) / (A)]**

| | | Sample # | Average | St. Dev. | Median | LB of 95% CI | UB of 95% CI | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| Electrified RGC | 1. Electrified HH | 28 | 0.118 | 0.105 | 0.078 | 0.077 | 0.159 | 1.888 | 3.093 |
| | 2. Electrified BE | 15 | 0.165 | 0.246 | 0.057 | 0.029 | 0.302 | 2.830 | 8.919 |
| | 3. Unconnected HH | 20 | 0.134 | 0.115 | 0.089 | 0.080 | 0.188 | 1.689 | 3.196 |
| | 4. Unconnected BE | 9 | 0.056 | 0.069 | 0.029 | 0.003 | 0.109 | 2.012 | 3.982 |
| Unelectrified RGC | 5. Unelectrified HH | 129 | 0.108 | 0.091 | 0.083 | 0.092 | 0.124 | 2.208 | 6.274 |
| | 6. Unelectrified BE | 81 | 0.057 | 0.092 | 0.023 | 0.036 | 0.077 | 2.852 | 8.252 |
| | 7. HH with Stand Alone Generator | 12 | 0.048 | 0.035 | 0.045 | 0.026 | 0.071 | 0.307 | -1.608 |
| | 8. BE with Stand Alone Generator | 7 | 0.167 | 0.251 | 0.083 | -0.065 | 0.399 | 2.255 | 5.292 |

| | | Electrified RGC | | | | Unelectrified RGC | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1. Electrified HH | 2. Electrified BE | 3. Unconnected HH | 4. Unconnectedd BE | 5. Unelectrified HH | 6. Unelectrified BE | 7. HH with Generator | 8. BE with Generator |
| Electrified RGC | 1. Electrified HH | | 183.5<br>(0.499) | 244.5<br>(0.458) | 52.5<br>(0.009)* | 1760.5<br>(0.835) | 423.0<br>(0.000)* | 84.0<br>(0.013)** | 86.5<br>(0.635) |
| | 2. Electrified BE | 183.5<br>(0.499) | | 129.0<br>(0.484) | 40.5<br>(0.107) | 901.5<br>(0.666) | 316.0<br>(0.003)* | 60.0<br>(0.143) | 49.0<br>(0.805) |
| | 3. Unconnected HH | 244.5<br>(0.458) | 129.0<br>(0.484) | | 38.0<br>(0.014)** | 1123.5<br>(0.354) | 307.0<br>(0.000)* | 55.0<br>(0.011)** | 58.5<br>(0.524) |
| | 4. Unconnected BE | 52.5<br>(0.009)* | 40.5<br>(0.107) | 38.0<br>(0.014)** | | 289.0<br>(0.012)** | 325.0<br>(0.595) | 51.5<br>(0.859) | 22.0<br>(0.315) |
| Unelectrified RGC | 5. Unelectrified HH | 1760.5<br>(0.835) | 901.5<br>(0.666) | 1123.5<br>(0.354) | 289.0<br>(0.012)** | | 2175.5<br>(0.000)* | 387.0<br>(0.004)* | 418.5<br>(0.745) |
| | 6. Unelectrified BE | 423.0<br>(0.000)* | 316.0<br>(0.003)* | 307.0<br>(0.000)* | 325.0<br>(0.595) | 2175.5<br>(0.000)* | | 388.0<br>(0.261) | 181.0<br>(0.114) |
| | 7. HH with Generator | 84.0<br>(0.013)** | 60.0<br>(0.143) | 55.0<br>(0.011)** | 51.5<br>(0.859) | 387.0<br>(0.004)* | 388.0<br>(0.261) | | 29.0<br>(0.272) |
| | 8. BE with Generator | 86.5<br>(0.635) | 49.0<br>(0.805) | 58.5<br>(0.524) | 22.0<br>(0.315) | 418.5<br>(0.745) | 181.0<br>(0.114) | 29.0<br>(0.272) | |

**(E) ZESCO Tariff/Income Rate [= (C) / (A)]**

| | | Sample # | Average | St. Dev. | Median | LB of 95% CI | UB of 95% CI | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| Electrified RGC | 1. Electrified HH | 28 | 0.066 | 0.058 | 0.053 | 0.044 | 0.088 | 2.878 | 10.900 |
| | 2. Electrified BE | 15 | 0.081 | 0.069 | 0.054 | 0.043 | 0.119 | 0.974 | -0.480 |
| | 3. Unconnected HH | - | - | - | - | - | - | - | - |
| | 4. Unconnected BE | - | - | - | - | - | - | - | - |
| Unelectrified RGC | 5. Unelectrified HH | - | - | - | - | - | - | - | - |
| | 6. Unelectrified BE | - | - | - | - | - | - | - | - |
| | 7. HH with Stand Alone Generator | - | - | - | - | - | - | - | - |
| | 8. BE with Stand Alone Generator | - | - | - | - | - | - | - | - |

| | | Electrified RGC | | | | Unelectrified RGC | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1. Electrified HH | 2. Electrified BE | 3. Unconnected HH | 4. Unconnectedd BE | 5. Unelectrified HH | 6. Unelectrified BE | 7. HH with Generator | 8. BE with Generator |
| Electrified RGC | 1. Electrified HH | | 198.0<br>(0.760) | | | | | | |
| | 2. Electrified BE | 198.0<br>(0.760) | | | | | | | |
| | 3. Unconnected HH | | | | | | | | |
| | 4. Unconnected BE | | | | | | | | |
| Unelectrified RGC | 5. Unelectrified HH | | | | | | | | |
| | 6. Unelectrified BE | | | | | | | | |
| | 7. HH with Generator | | | | | | | | |
| | 8. BE with Generator | | | | | | | | |

**(F) ZESCO Tariff/Energy Cost Rate [= (C) / (B)]**

| | | Sample # | Average | St. Dev. | Median | LB of 95% CI | UB of 95% CI | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| Electrified RGC | 1. Electrified HH | 28 | 0.623 | 0.235 | 0.686 | 0.532 | 0.714 | -0.481 | -0.751 |
| | 2. Electrified BE | 15 | 0.819 | 0.296 | 0.958 | 0.655 | 0.983 | -1.932 | 2.782 |
| | 3. Unconnected HH | - | - | - | - | - | - | - | - |
| | 4. Unconnected BE | - | - | - | - | - | - | - | - |
| Unelectrified RGC | 5. Unelectrified HH | - | - | - | - | - | - | - | - |
| | 6. Unelectrified BE | - | - | - | - | - | - | - | - |
| | 7. HH with Stand Alone Generator | - | - | - | - | - | - | - | - |
| | 8. BE with Stand Alone Generator | - | - | - | - | - | - | - | - |

| | | Electrified RGC | | | | Unelectrified RGC | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1. Electrified HH | 2. Electrified BE | 3. Unconnected HH | 4. Unconnectedd BE | 5. Unelectrified HH | 6. Unelectrified BE | 7. HH with Generator | 8. BE with Generator |
| Electrified RGC | 1. Electrified HH | | 96.0<br>(0.004)* | | | | | | |
| | 2. Electrified BE | 96.0<br>(0.004)* | | | | | | | |
| | 3. Unconnected HH | | | | | | | | |
| | 4. Unconnected BE | | | | | | | | |
| Unelectrified RGC | 5. Unelectrified HH | | | | | | | | |
| | 6. Unelectrified BE | | | | | | | | |
| | 7. HH with Generator | | | | | | | | |
| | 8. BE with Generator | | | | | | | | |

[Note]
Upper: Mann-Whitney's U Value
Lower: (P-Value)

* : Significantly different with 1% level
** : Significantly different with 5% level
***: Significantly different with 10% level

### 4.7.3. Methodology to Assess Willingness to Pay

To analyze residents' willingness to pay for initial cost (such as ZESCO line connection fee, contribution for micro/mini hydropower plant, and solar home system installation) and monthly tariff in unelectrified RGCs, Contingent Valuation Method (CVM) was adopted. Regarding the energy consumption mode, four (4) scenarios were prepared:

Scenario 1: No electricity

Scenario 2: Electricity supplied by Solar Home System (SHS)

Scenario 3: Electricity supplied by micro/mini hydropower plant with isolated distribution network

Scenario 4: Electricity supplied by ZESCO distribution line

Details of each scenario were explained to interviewees from enumerators, and by comparing Scenario 1 to each of Scenario 2, 3, and 4, their willingness to pay for initial cost and monthly tariff were asked by the double bound method. In the double bound method, the firstly asked prices were randomly selected either K1,000,000, K1,500,000, K2,000,000, K3,000,000, or K4,000,000 for initial cost; and either K10,000, K15,000, K20,000, K30,000, or K40,000 for monthly tariff. When an interviewee was willing to pay for the first asked price, one step higher price was asked; while when an interviewee was not willing to pay for the first asked price, one step lower price was asked. For example, if an interviewee was asked K4,000,000 for the initial cost in the first question and expressed the willingness to pay (or answered "yes") for the price, whether the interviewee is willing to pay at K5,000,000 for the initial cost is asked as the second question. Another example is that if an interviewee disagreed on the monthly tariff at K10,000, the interviewee is asked K5,000 in the second question (refer to Table 4-10). Data was collected from 784 households and business entities in total.

**Table 4-10 Price Categories Used in Double Bound Method for CVM**

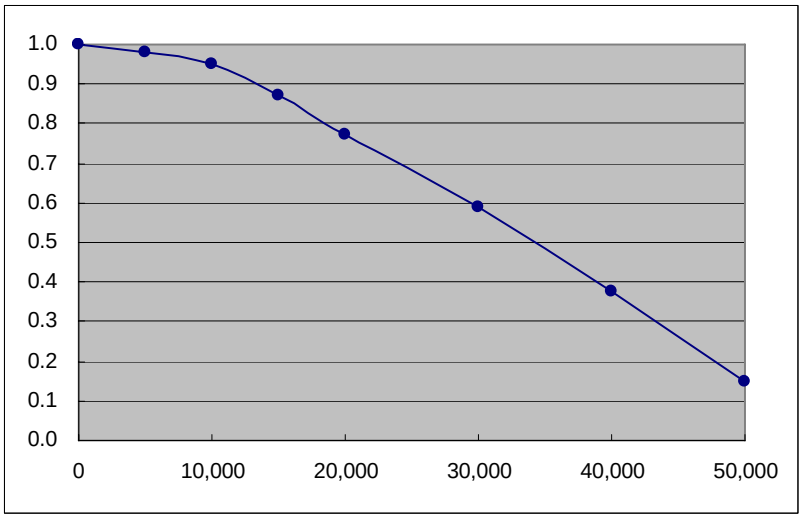
| | |
|---|---|
| Initial Cost | K500,000, K1,000,000, K1,500,000, K2,000,000, K3,000,000, K4,000,000, K5,000,000 |
| Monthly Tariff | K5,000, K10,000, K15,000, K20,000, K30,000, K40,000, K50,000 |

### 4.7.4. Willingness to Pay for Monthly Tariff

Analysis results regarding willingness to pay for monthly tariff for each of electrification methods (SHS, micro/mini hydro, and ZESCO distribution line) are summarized in Figure 4-3. By comparing the middle average values obtained by Turnbull method (non-parametric method) for each method, SHS at K32,634 is the lowest, micro/mini hydropower at K33,227 is the middle, and ZESCO distribution line at K37,194 is the highest. These results indicate that the willingness to pay for monthly tariff becomes higher as convenience (such as usable duration and amount) and reliability of supplied electricity are better. The willingness to pay for monthly tariff for ZESCO service shows quite close value to the estimated households' ability to pay at K35,485 in the section 4.7.2.

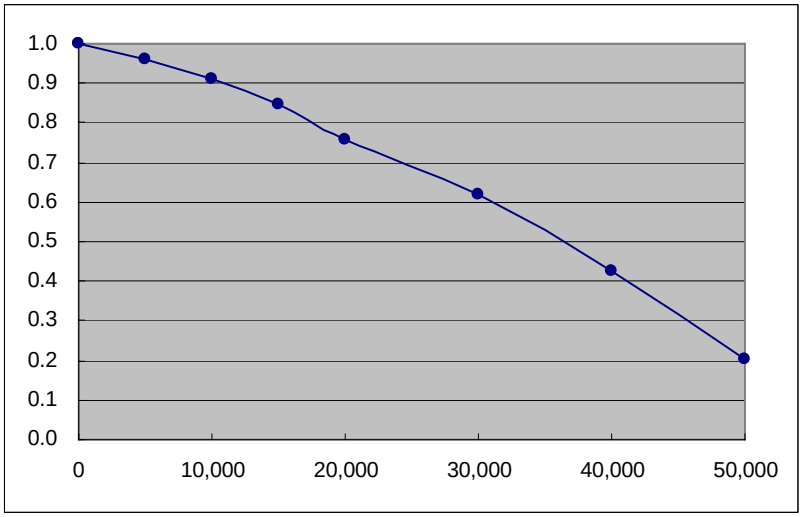
These values, however, could be underestimated as more than 30% of interviewees still expressed the willingness to pay at K50,000 for ZESCO service: price categories selected in double bound method for monthly tariff was low.

(A) Solar Home System



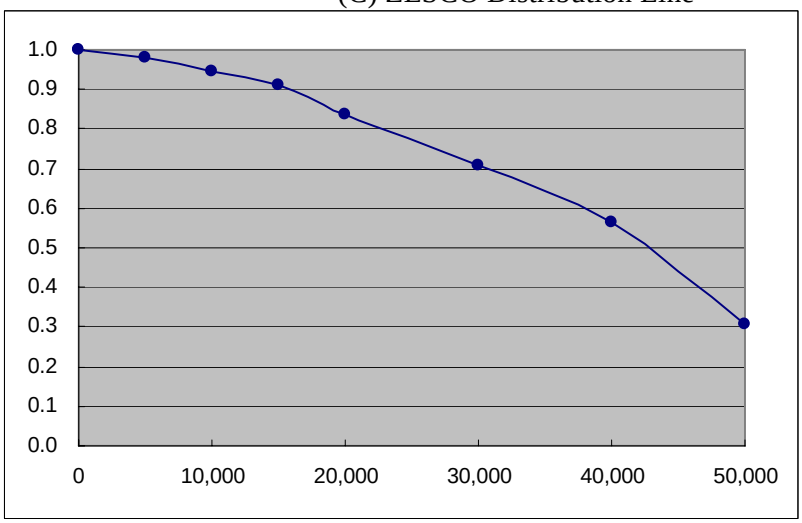

| | Average |
|---|---|
| Lower Bound | 28,949 |
| Middle | 32,634 |
| Upper Bound | 36,320 |

(B) Micro/Mini Hydropower Plant




| | Average |
|---|---|
| Lower Bound | 29,840 |
| Middle | 33,227 |
| Upper Bound | 36,615 |

(C) ZESCO Distribution Line




| | Average |
|---|---|
| Lower Bound | 34,131 |
| Middle | 37,197 |
| Upper Bound | 40,263 |

**Figure 4-3 Willingness to Pay for Monthly Tariff**

### 4.7.5. Willingness to Pay for Initial Cost

Analysis results regarding willingness to pay for initial cost for each of electrification methods (SHS, micro/mini hydro, and ZESCO distribution line) are summarized in Figure 4-4 (on the next page). By comparing the middle average values obtained by Turnbull method (non-parametric method) for each method, initial cost for SHS at K2,105,556 and that for micro/mini hydropower at K2,118,646 are similar, while that for ZESCO distribution line at K2,508,483 is much higher than the others. These results indicate that unelectrified residents wish to receive electricity from ZESCO distribution line, even if they need to pay more initial cost than SHS or micro/mini hydropower with isolated grid.

Figure 4-5 shows actual connection fee for both 1 phase and 3 phase charged by ZESCO in each of urban, peri-urban, and rural areas. ZESCO charges higher connection fee in rural areas (K4,887,000 for 3 phase and K2,873,000 for 1 phase) than urban and peri-urban. The connection fee for 1 phase in rural area is slightly more expensive than the average willingness to pay for ZESCO connection by the socio-economic surveyed residents in unelectrified RGCs. Since the average monthly household income in unelectrified RGCs is K910,757 (refer to section 4.7.2.), connection fee for 1 phase is about 3 times and that for 3 phase is more than 5 times of it. The average monthly business entity income in unelectrified RGCs (K4,456,118) is close to the 3 phase connection fee, and thus business entities seem to reasonably afford it.

As a socio-economic survey result, it was found that approximately 20% of households have connected to ZESCO in the electrified RGCs (details are shown in Table 5-1). In Figure 4-4, the willingness to pay for 20% of residents in unelectrified RGCs is approximately K3,800,000, which is coincidently similar to the average connection fee of 1 phase and 3 phase in rural areas.

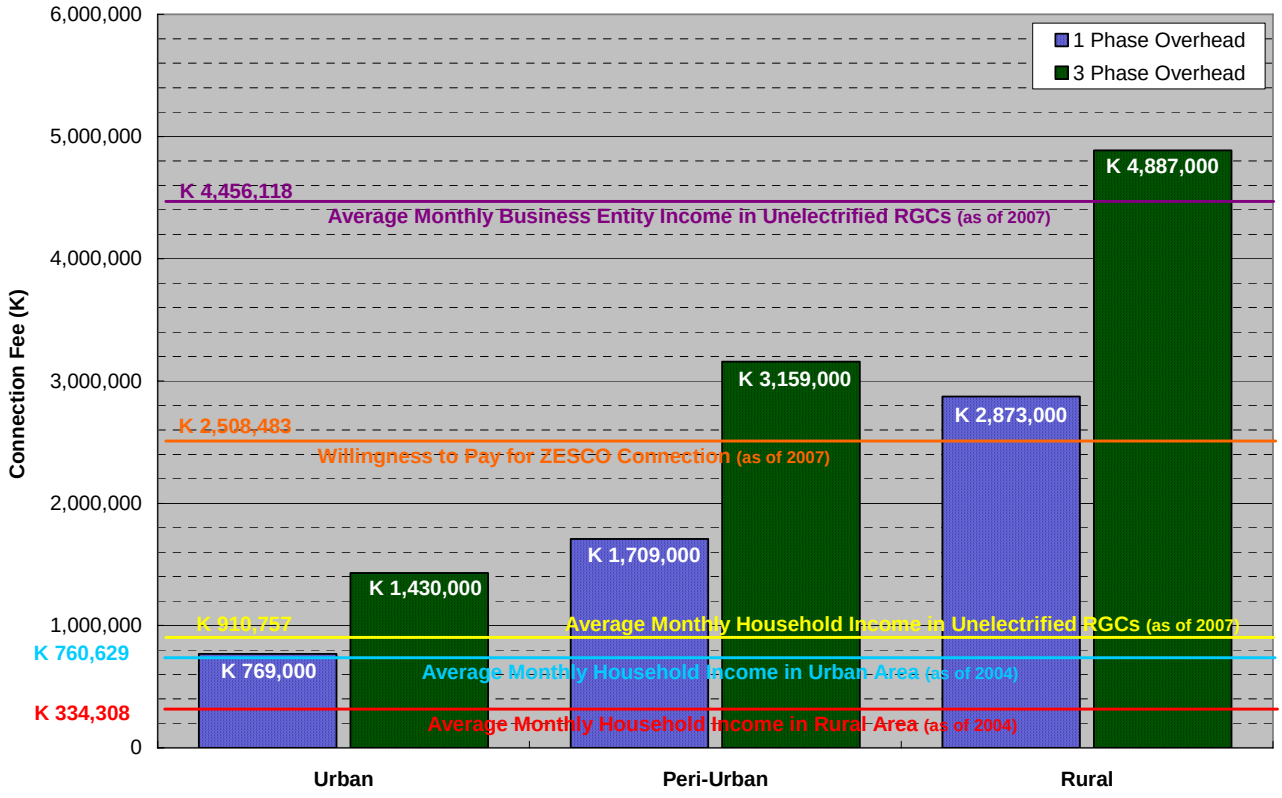
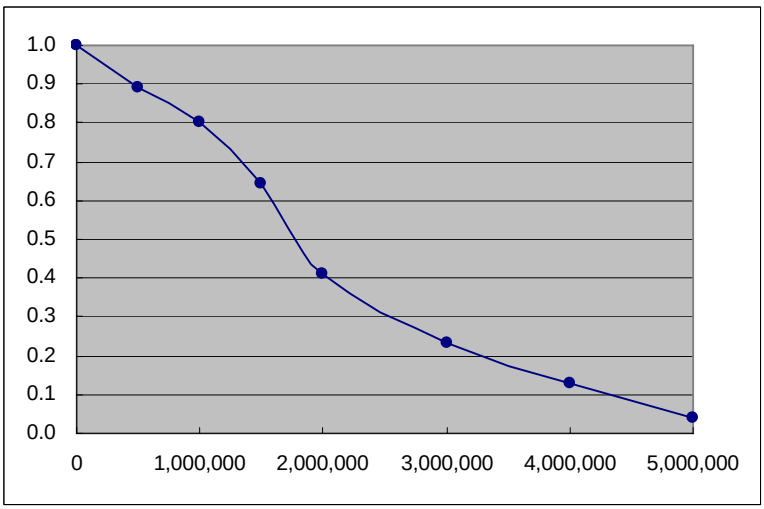


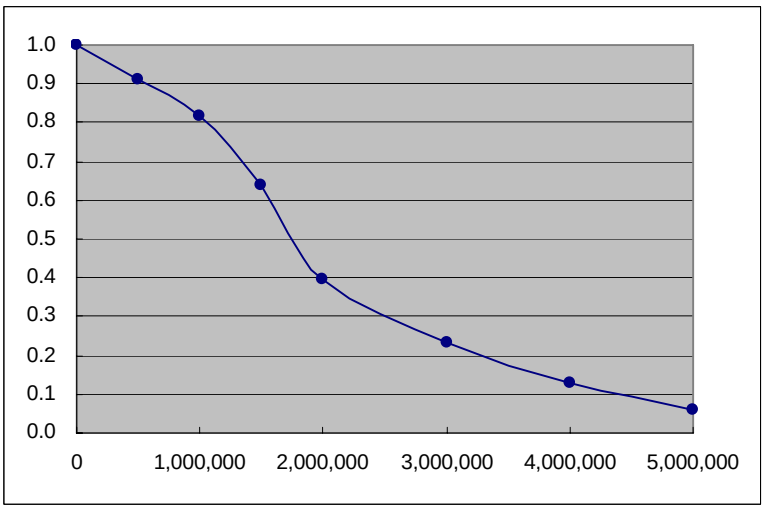

**Figure 4-5 ZESCO Connection Fee, Average Income, and Willingness to Pay**

(A) Solar Home System



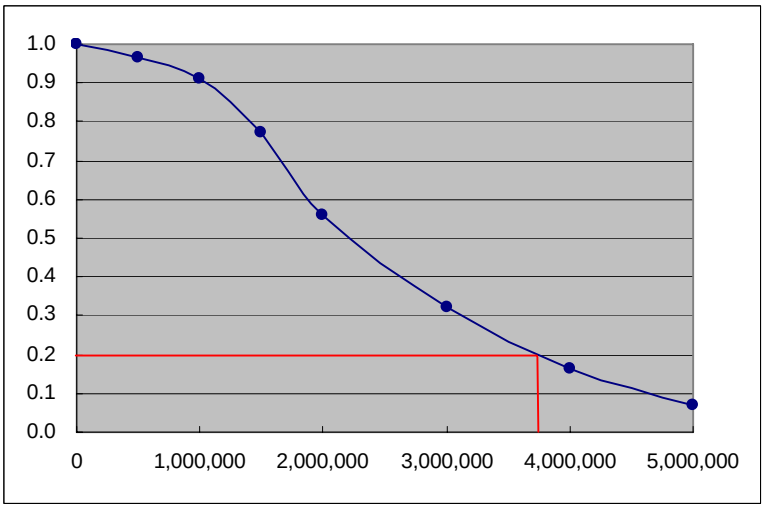

| | Average |
|---|---|
| Lower Bound | 1,771,541 |
| Middle | 2,105,566 |
| Upper Bound | 2,439,591 |

(B) Micro/Mini Hydropower Plant




| | Average |
|---|---|
| Lower Bound | 1,798,665 |
| Middle | 2,118,646 |
| Upper Bound | 2,438,627 |

(C) ZESCO Distribution Line




| | Average |
|---|---|
| Lower Bound | 2,153,636 |
| Middle | 2,508,483 |
| Upper Bound | 2,863,331 |

**Figure 4-4 Willingness to Pay for Initial Cost**

## 4.8. Prioritized Property for Electrification Perceived by Unelectrified Residents

The Study sought to establish for unconnected residents, which factors among the following they perceived to be most important for the future electrification: 1) urgency, 2) duration, 3) initial cost, and 4) monthly tariff. The information obtained was analyzed to provide a background for designing the necessary political interventions and measures to promote rural electrification. Conjoint Analysis, explained earlier in this report was applied to the collected data.

### 4.8.1. Conjoint Analysis Method

As shown in Table 4-11, three levels were used for each of the four selected factors. Among 81 ($=3^4$) possible combinations for 4 factors with each 3 levels, 11 combinations (including 2 hold out combinations to be used to confirm the accuracy of the data analysis) are selected by orthogonal design method (to minimize the number of combination necessary to the analysis) to create conjoint cards. Interviewees are asked to make a ranking order for these 11 cards based on their preference for the combinations shown in each card.

**Table 4-11 Properties and Levels for Conjoint Analysis**

| Property | Definition | Levels |
|---|---|---|
| 1) Urgency | How soon does an interviewee wish to receive electricity. | 2, 5, 15 years |
| 2) Duration | How many hours does an interviewee wish to use electricity per day. | 5, 10, 24 hours/day |
| 3) Initial Cost | One time cost, such as ZESCO line connection fee, contribution for micro/mini hydropower plant, and solar home system installation, required to commence using electricity. | K1,700,000, K3,200,000, K4,700,000 |
| 4) Monthly Tariff | Monthly electricity cost charged by electricity supplier or savings for the future maintenance of electrification facilities. | K8,000/month, K24,000/month, K40,000/month |

### 4.8.2. Conjoint Analysis Results

Data from 761 interviewees were analyzed using statistical analysis package SPSS. As shown in Figure 4-6, Duration was the most important property (35%), followed by Urgency (26%), Monthly Tariff (20%), and Initial Cost (19%). Regarding Duration, usage of 24 hours per day was the most preferable (as shown in (B) in Figure 4-7). Interesting finding, however, was that the second favorable Duration was not 10 hours, but 5 hours. This result might be caused as most of interviewees live in place where is no hydro potential, and thus electrification by micro/mini hydro for 10 hours per day seems difficult to imagine. Other than Duration, analysis results are ordinary: unelectrified residents want to be electrified in short waiting time, with minimum initial cost and monthly tariff.

Among all the possible 81 combination, the most favourable one selected by the interviewees is "receive electricity within 2 years for 24 hours usage by K1,700,000 initial cost and K24,000 monthly tariff" based on BTL (Bradley-Terry-Luce) utility evaluation rate (refer to Table 4-12). The second preference is "receive electricity within 2 years for 5 hours usage by K1,700,000 initial cost and K24,000 monthly tariff." Therefore, it could be said that even limited usage by SHS, unelectrified residents wish to be electrified soon by the minimum initial cost but reasonable monthly tariff.

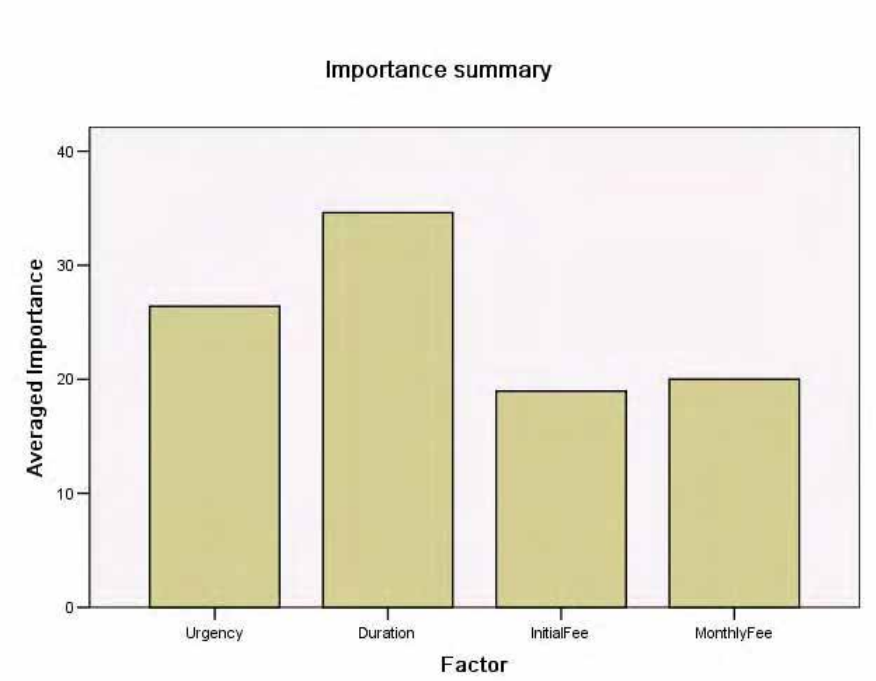
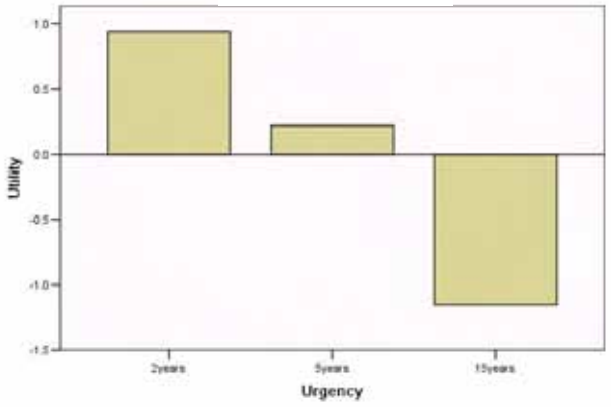
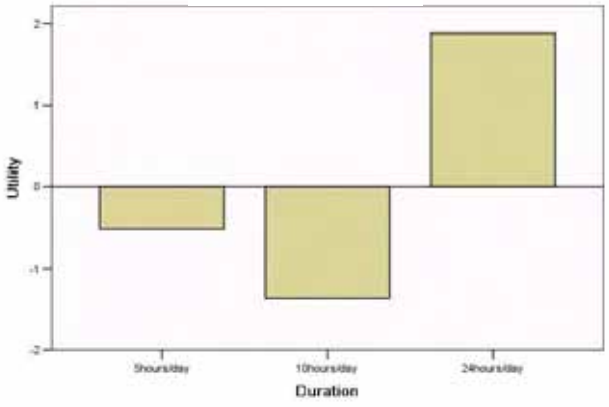



**Figure 4-6 Importance of 4 Properties for Rural Electrification**

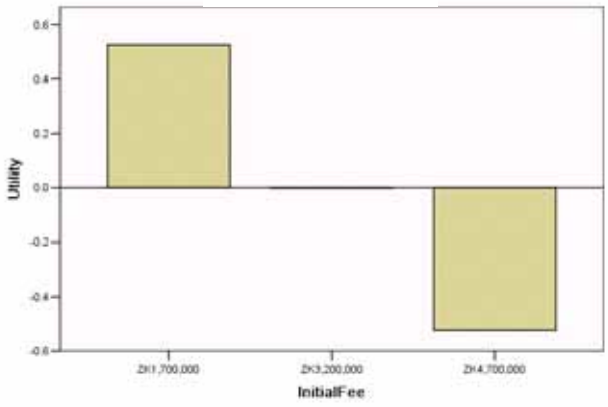
(A) Urgency




(B) Duration




(C) Initial Cost




(D) Monthly Tariff

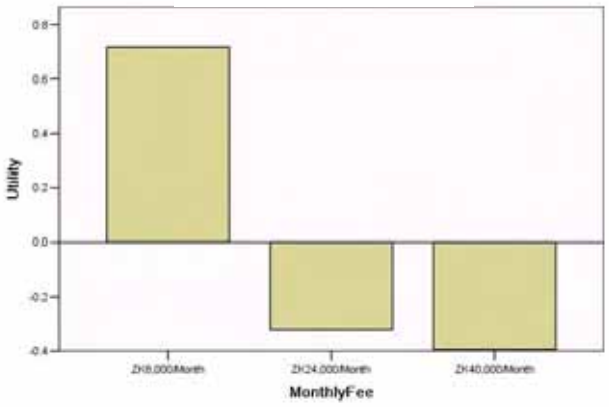



**Figure 4-7 Summary of Utilities for Each Property**

**Table 4-12 Combination of Properties in Preference Order**

| Urgency | Duration | Initial Fee | Monthly Fee | BTL |
|---|---|---|---|---|
| 2years | 24hours | K 1,700,000 | K 24,000/month | 19.26% |
| 2years | 5hours | K 1,700,000 | K 24,000/month | 18.66% |
| 5years | 24hours | K 1,700,000 | K 24,000/month | 17.80% |
| 5years | 5hours | K 1,700,000 | K 24,000/month | 17.20% |
| 15years | 24hours | K 1,700,000 | K 24,000/month | 13.84% |
| 15years | 5hours | K 1,700,000 | K 24,000/month | 13.24% |

# Chapter 5

# Potential Power Demand of Unelectrified RGCs

# Chapter 5. Potential Power Demand of Unelectrified RGCs

## 5.1. Purposes of Potential Demand Forecast and Data Analysis Flow

To determine the required specifications of the electrification equipment and facilities, and to select the economically optimal electrification method for each unelectrified RGC, it was necessary to forecast the potential power demand for each unelectrified RGC. The potential demand would also be among the criteria for prioritizing the unelectrified RGCs: the greater the potential demand, the higher the priority accorded to an RGC.

In this study, the potential demand for each unelectrified RGC was forecasted based on the current consumption trends in electrified RGCs as captured by the socio-economic survey. A flow chart of data analysis for the potential demand forecast is shown in Figure 5-1. The first step of the analysis consisted of estimation of an average Daily Load Curve per unit of facility for each of the following four different types of consumers in electrified RGCs: 1) Public Facilities, 2) Business Entities, 3) Hammer Mills and 4) Households. By multiplying the unitary average daily load curve by the number of existing facilities in a RGC for each type and then adding them all together, the daily load curves and daily peak demands were estimated for all electrified RGCs participating in the survey. The second step of the analysis was the selection of a "Peak Demand Forecast Method". Adaptability of a linear regression model to estimate the daily peak demand in electrified RGCs, derived from the relationship between the number of households and the estimated peak demands in electrified RGCs (calculated in the first step), was tested. The third step of the analysis was to forecast the potential demand for each of 1,217 unelectrified RGCs based on the selected method in the second step. Details of each step are explained in the following sections.

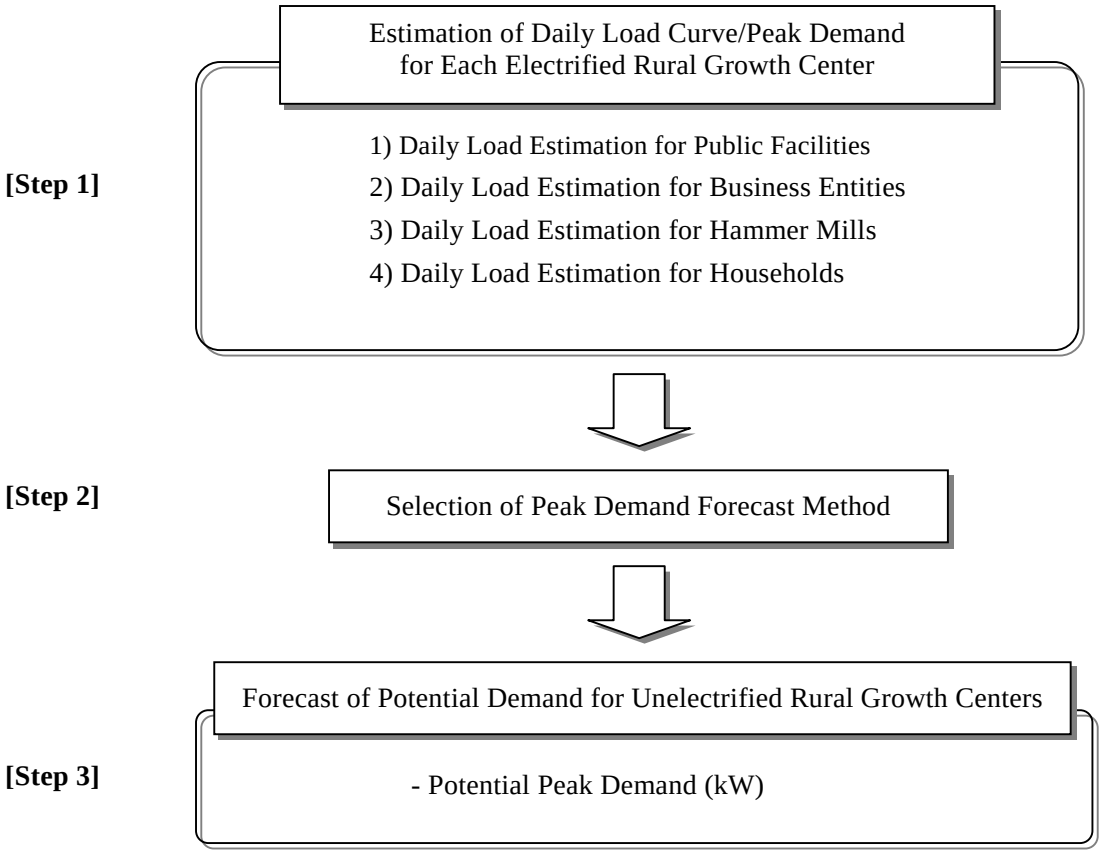



**Figure 5-1 Flow Chart of Data Analysis for Potential Demand Forecast**

## 5.2. Estimation of Daily Load Curve/Peak Demand for Each Electrified RGC [Step 1]

From the socio-economic survey results and the national census data, statistics regarding the number of existing facilities and the number of these facilities already electrified were obtained for each electrified RGC and for each type of consumer (Public Facilities, Business Entities, Hammer Mills and Households), as shown in Table 5-1 (on the next page). Firstly, an average daily load curve per unit for each type of customer was obtained. Then, the total daily demand of electrified RGCs studied in this survey was found by multiplying the curve data by the existing number of each type of facility in a RGC and adding them altogether.

## 5.3. Estimation of Daily Demand for Public Facilities

The socio-economic survey results showed that there are 249 public facilities in the investigated 23 electrified RGCs. Among the total of 249 facilities, 107 have been electrified. Data collected from 49 electrified public facilities were used to create the electricity demand curves. Table 5-2 summarizes the results of the investigation regarding public facilities.

On the data collection sheet used in the survey, public facilities were categorized in 18 types as indicated in Table 5-2. Significant data was collected from the following 14 types of public facilities: Basic/Primary School, Secondary School, Hospital, Health Center/Clinic, Police Post/Station, Post Office, Church, Community Center, Agriculture Depot, Orphanage, Central Government Office, District Government Office, and others. Data from four other types of public facilities – Mosque, Provincial Government Office, Local Administration Office and Court – could not be collected. Therefore a daily load curve per unit was created for each of the 14 specific types of public facilities. The average daily demand of these 14 types was applied to the four public facility types from which no data could be collected. Figure 5-1 shows the daily load curve for each of the 14 public facility types as well as an average curve representative for all these facility types except Hospital of which indicates much different (larger) power demand from others.

The daily load curve data per unit multiplied by the number of electrified units for each type in a RGC (shown in Table 8-2) resulted in the daily load curves of public facilities for electrified RGCs.

**Table 5-2 Summary Table of Surveyed Public Facilities**

| Public Facility | Existing | Electrified | Elec. Rate | Available Load Data |
|---|---|---|---|---|
| 1) Basic/Primary School | 26 | 16 | 61.5% | 13 |
| 2) Secondary School | 13 | 12 | 92.3% | 1 |
| 3) Tertiary School | 5 | 3 | 60.0% | 2 |
| 4) Hospital | 2 | 2 | 100.0% | 1 |
| 5) Health Center/Clinic | 16 | 16 | 100.0% | 14 |
| 6) Police Post/Station | 8 | 8 | 100.0% | 3 |
| 7) Post Office | 4 | 3 | 75.0% | 2 |
| 8) Church | 113 | 13 | 11.5% | 4 |
| 9) Mosque | 1 | 0 | 0.0% | 0 |
| 10) Community Center | 5 | 2 | 40.0% | 1 |
| 11) Agriculture Depot | 10 | 5 | 50.0% | 2 |
| 12) Orphanage | 6 | 1 | 16.7% | 1 |
| 13) Central Government Office | 1 | 1 | 100.0% | 1 |
| 14) Provincial Government Office | 2 | 2 | 100.0% | 0 |
| 15) District Government Office | 15 | 14 | 93.3% | 1 |
| 16) Local Administration Office | 2 | 1 | 50.0% | 0 |
| 17) Court | 10 | 2 | 20.0% | 0 |
| 18) Other | 10 | 6 | 60.0% | 3 |
| Total | 249 | 107 | 43.0% | 49 |

## Table 5-1 Summary of Surveyed Electrified Rural Growth Centers

| RGC | Province | RGC Electrification Year | Public Facility | | | Business Entity | | | Maize Mill | | | Household | | | Year After Elec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Existing in RGC | Electrified | Elec. Rate | Existing in RGC | Electrified | Elec. Rate | Existing in RGC | Electrified | Elec. Rate | Existing in RGC | Electrified | Elec. Rate | |
| MPIMA | CENTRAL | 2006 | 8 | 2 | 25.0% | 1 | 0 | 0.0% | 4 | 0 | 0.0% | 1 | 1 | 100.0% | 1 |
| MPULA | CENTRAL | 1994 | 10 | 2 | 20.0% | 729 | 434 | 59.5% | 3 | 3 | 100.0% | 70 | 0 | 0.0% | 13 |
| MPUNDE | CENTRAL | 2003 | 1 | 0 | 0.0% | 12 | 5 | 41.7% | 2 | 0 | 0.0% | 500 | 20 | 4.0% | 4 |
| MISHIKISHI | COPPERBELT | 2002 | 11 | 3 | 27.3% | 24 | 14 | 58.3% | 4 | 3 | 75.0% | 350 | 5 | 1.4% | 5 |
| CHIWALA | COPPERBELT | 2005 | 20 | 4 | 20.0% | 14 | 5 | 35.7% | 2 | 2 | 100.0% | 225 | 6 | 2.7% | 2 |
| KANGONGA | COPPERBELT | 1996 | 7 | 7 | 100.0% | 17 | 3 | 17.6% | 1 | 1 | 100.0% | 140 | 2 | 1.4% | 11 |
| CHEMBE | LUAPULA | 2006 | 25 | 9 | 36.0% | 18 | 3 | 16.7% | 2 | 0 | 0.0% | 215 | 27 | 12.6% | 1 |
| LUAMFUMU | LUAPULA | 1973 | 3 | 2 | 66.7% | 3 | 3 | 100.0% | 1 | 0 | 0.0% | 200 | 200 | 100.0% | 34 |
| KALOBWA | LUAPULA | 2002 | 3 | 1 | 33.3% | 5 | 4 | 80.0% | 1 | 1 | 100.0% | 50 | 6 | 12.0% | 5 |
| KAMBWALI | LUAPULA | 1987 | 7 | 1 | 14.3% | 4 | 3 | 75.0% | 3 | 2 | 66.7% | 400 | 12 | 3.0% | 20 |
| MUNKANTA | LUAPULA | 2006 | 14 | 5 | 35.7% | 27 | 15 | 55.6% | 2 | 2 | 100.0% | 777 | 59 | 7.6% | 1 |
| CHIAWA | LUSAKA | 2001 | 14 | 5 | 35.7% | 12 | 5 | 41.7% | 1 | 1 | 100.0% | 1,120 | 15 | 1.3% | 6 |
| LUANGWA BOMA | LUSAKA | 1970 | 13 | 10 | 76.9% | 95 | 40 | 42.1% | 3 | 3 | 100.0% | 580 | 214 | 36.9% | 37 |
| KAPIJIMPANGA | NORTH WESTERN | 2004 | 10 | 4 | 40.0% | 2 | 1 | 50.0% | 1 | 1 | 100.0% | 250 | 0 | 0.0% | 3 |
| KABANDA | NORTH WESTERN | - | 14 | 2 | 14.3% | 108 | 30 | 27.8% | 15 | 5 | 33.3% | 500 | 8 | 1.6% | - |
| NSELUKA | NORTHERN | 2003 | 8 | 3 | 37.5% | 28 | 7 | 25.0% | 4 | 4 | 100.0% | 486 | 20 | 4.1% | 4 |
| MOCHIPAPA | SOUTHERN | 1966 | 8 | 3 | 37.5% | 6 | 2 | 33.3% | 1 | 1 | 100.0% | 47 | 30 | 63.8% | 41 |
| MUSOKOTWANE | SOUTHERN | 1970 | 10 | 3 | 30.0% | 6 | 2 | 33.3% | 1 | 1 | 100.0% | 500 | 25 | 5.0% | 37 |
| MUKUNI VILLAGE | SOUTHERN | 1996 | 10 | 3 | 30.0% | 54 | 22 | 40.7% | 2 | 2 | 100.0% | 639 | 26 | 4.1% | 11 |
| MWANDI | SOUTHERN | - | 11 | 5 | 45.5% | 68 | 66 | 97.1% | 2 | 2 | 100.0% | 410 | 110 | 26.8% | - |
| LUKULU BOMA | WESTERN | 1988 | 26 | 24 | 92.3% | 43 | 33 | 76.7% | 17 | 7 | 41.2% | 323 | 100 | 31.0% | 19 |
| SEFULA | WESTERN | 1989 | 8 | 7 | 87.5% | 31 | 14 | 45.2% | 3 | 3 | 100.0% | 170 | 130 | 76.5% | 18 |
| SENANGA | WESTERN | 1976 | 8 | 2 | 25.0% | 12 | 1 | 8.3% | 2 | 0 | 0.0% | 800 | 26 | 3.3% | 31 |
| Total | | | 249 | 107 | - | 1,319 | 712 | - | 77 | 44 | - | 8,753 | 1,042 | - | - |
| Average | | | 10.8 | 4.7 | 40.5% | 57.3 | 31.0 | 46.1% | 3.3 | 1.9 | 70.3% | 380.6 | 45.3 | 21.7% | - |

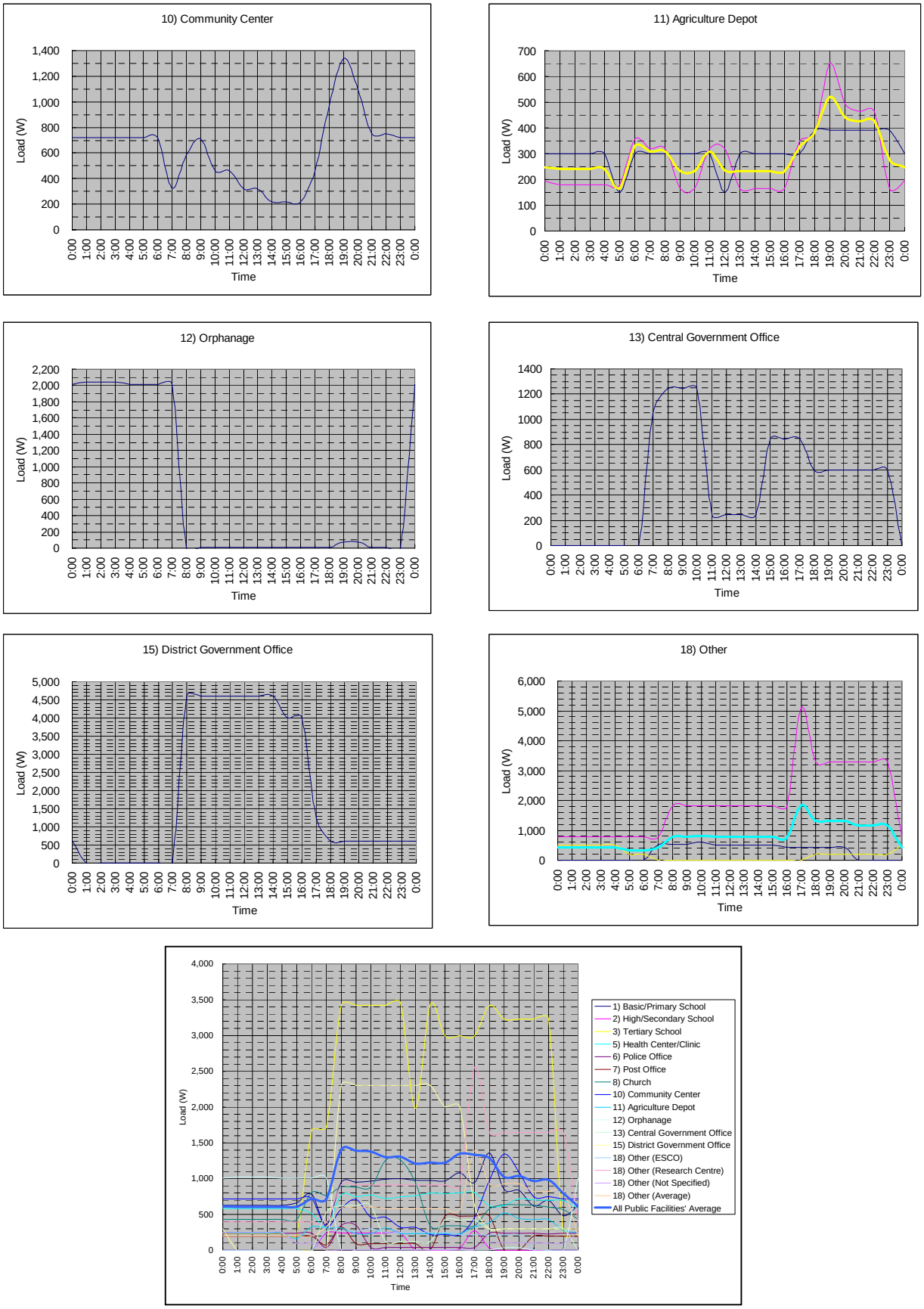



**Figure 5-2 Public Facilities' Daily Load Curves for Electrified RGC (2/2)**

## 5.4. Estimation of Daily Demand for Business Entities

Survey results indicated that there are 1,319 business entities operating in the electrified RGCs investigated in this survey. Among them, 712 have been electrified. Data utilized for the calculation of electricity demand curves was collected from 32 of these electrified business entities. Table 5-3 summarizes the investigation results regarding business entities.

Figure 5-3 shows the average daily load curves per business entity in each of the 8 electrified RGCs (from a total of 23 surveyed RGCs). Data from these average daily load curves multiplied by the number of electrified business entities in a RGC (indicated in Table 5-3) resulted in the daily load curves of business entities for electrified RGCs.

**Table 5-3 Summary Table of Surveyed Business Entities**

| RGC | Province | Business Entity | | | Available Load Data |
|---|---|---|---|---|---|
| | | Existing in RGC | Electrified | Elec. Rate | |
| MPIMA | CENTRAL | 1 | 0 | 0.0% | - |
| MPULA | CENTRAL | 729 | 434 | 59.5% | - |
| MPUNDE | CENTRAL | 12 | 5 | 41.7% | - |
| MISHIKISHI | COPPERBELT | 24 | 14 | 58.3% | 5 |
| CHIWALA | COPPERBELT | 14 | 5 | 35.7% | - |
| KANGONGA | COPPERBELT | 17 | 3 | 17.6% | - |
| CHEMBE | LUAPULA | 18 | 3 | 16.7% | 3 |
| LUAMFUMU | LUAPULA | 3 | 3 | 100.0% | 2 |
| KALOBWA | LUAPULA | 5 | 4 | 80.0% | 3 |
| KAMBWALI | LUAPULA | 4 | 3 | 75.0% | 3 |
| MUNKANTA | LUAPULA | 27 | 15 | 55.6% | 4 |
| CHIAWA | LUSAKA | 12 | 5 | 41.7% | 5 |
| LUANGWA BOMA | LUSAKA | 95 | 40 | 42.1% | - |
| KAPIJIMPANGA | NORTH WESTERN | 2 | 1 | 50.0% | - |
| KABANDA | NORTH WESTERN | 108 | 30 | 27.8% | - |
| NSELUKA | NORTHERN | 28 | 7 | 25.0% | 7 |
| MOCHIPAPA | SOUTHERN | 6 | 2 | 33.3% | - |
| MUSOKOTWANE | SOUTHERN | 6 | 2 | 33.3% | - |
| MUKUNI VILLAGE | SOUTHERN | 54 | 22 | 40.7% | - |
| MWANDI | SOUTHERN | 68 | 66 | 97.1% | - |
| LUKULU BOMA | WESTERN | 43 | 33 | 76.7% | - |
| SEFULA | WESTERN | 31 | 14 | 45.2% | - |
| SENANGA | WESTERN | 12 | 1 | 8.3% | - |
| Total | | 1,319 | 712 | - | 32 |
| Average | | 57.3 | 31.0 | 46.1% | 4.0 |

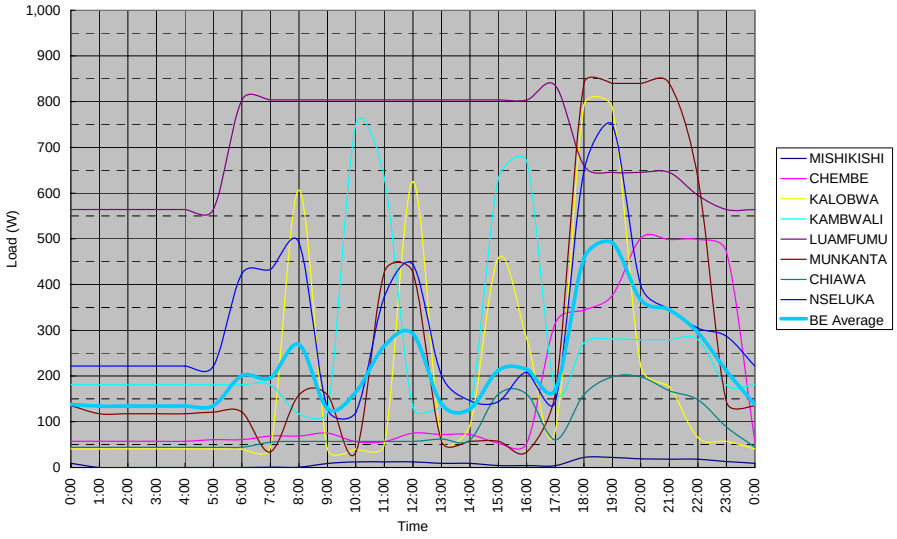



**Figure 5-3 Business Entity's Unit Average Daily Load Curve for Each Electrified RGC**

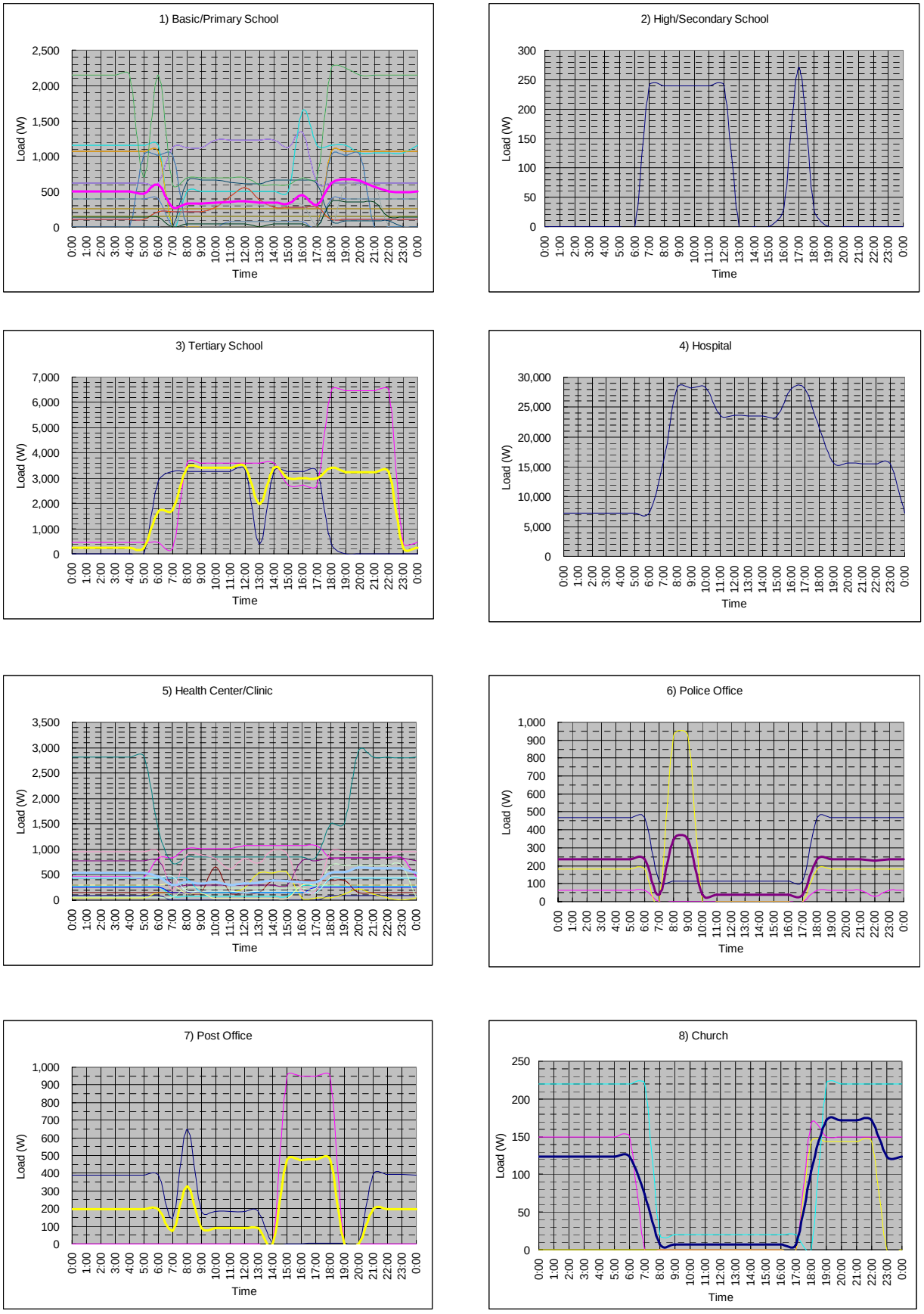



**Figure 5-2 Public Facilities' Daily Load Curves for Electrified RGC (1/2)**

## 5.5. Estimation of Daily Demand for Hammer Mills

Results showed that there are 77 hammer mills in the electrified RGCs surveyed, and 44 of them were electrified. The average electrification rate is 70.3%, which is relatively high compared to the rate of 46.1% for business entities (refer to Table 5-3). The unitary capacity of 15 kW/unit for hammer mills is large, and 3.3 units are installed in each RGC on average. Therefore, hammer mills are considered to be one of the major electricity users, probably the largest consumers, in a RGC, thus necessitating distinction from other business entities in this study. Table 5-4 summarizes the study results on hammer mills.

The unit capacity of hammer mills – 15 kW – multiplied by the number of electrified hammer mills in a RGC (shown in Table 5-4) and by the operation hours – generally from 7:00 to 19:00 – resulted in the daily load curves of hammer mills for the electrified RGCs.

**Table 5-4 Summary Table of Surveyed Hammer Mills**

| RGC | Province | Business Entity | | | Available Load Data |
|---|---|---|---|---|---|
| | | Existing in RGC | Electrified | Elec. Rate | |
| MPIMA | CENTRAL | 4 | 0 | 0.0% | - |
| MPULA | CENTRAL | 3 | 3 | 100.0% | - |
| MPUNDE | CENTRAL | 2 | 0 | 0.0% | - |
| MISHIKISHI | COPPERBELT | 4 | 3 | 75.0% | 1 |
| CHIWALA | COPPERBELT | 2 | 2 | 100.0% | - |
| KANGONGA | COPPERBELT | 1 | 1 | 100.0% | - |
| CHEMBE | LUAPULA | 2 | 0 | 0.0% | - |
| LUAMFUMU | LUAPULA | 1 | 0 | 0.0% | - |
| KALOBWA | LUAPULA | 1 | 1 | 100.0% | 1 |
| KAMBWALI | LUAPULA | 3 | 2 | 66.7% | 2 |
| MUNKANTA | LUAPULA | 2 | 2 | 100.0% | - |
| CHIAWA | LUSAKA | 1 | 1 | 100.0% | 1 |
| LUANGWA BOMA | LUSAKA | 3 | 3 | 100.0% | - |
| KAPIJIMPANGA | NORTH WESTERN | 1 | 1 | 100.0% | - |
| KABANDA | NORTH WESTERN | 15 | 5 | 33.3% | - |
| NSELUKA | NORTHERN | 4 | 4 | 100.0% | - |
| MOCHIPAPA | SOUTHERN | 1 | 1 | 100.0% | - |
| MUSOKOTWANE | SOUTHERN | 1 | 1 | 100.0% | - |
| MUKUNI VILLAGE | SOUTHERN | 2 | 2 | 100.0% | - |
| MWANDI | SOUTHERN | 2 | 2 | 100.0% | - |
| LUKULU BOMA | WESTERN | 17 | 7 | 41.2% | - |
| SEFULA | WESTERN | 3 | 3 | 100.0% | - |
| SENANGA | WESTERN | 2 | 0 | 0.0% | - |
| Total | | 77 | 44 | - | 5 |
| Average | | 3.3 | 1.9 | 70.3% | 1.3 |

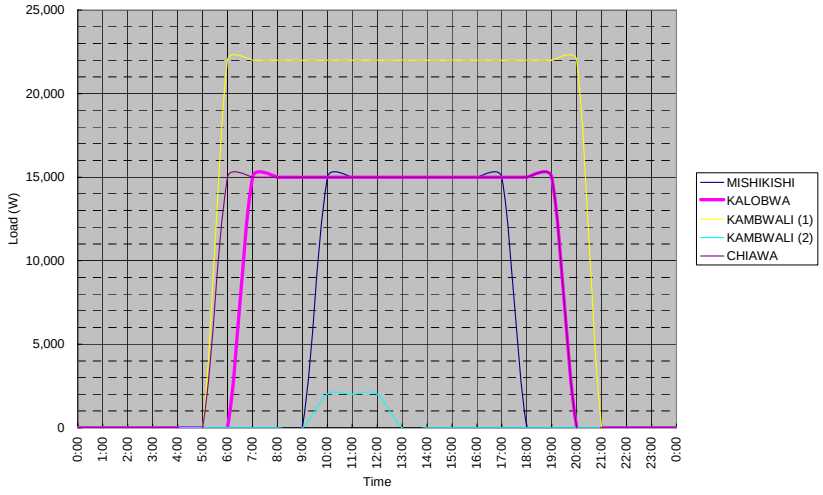



**Figure 5-4 Hammer Mill's Unit Daily Load Curve for Each Electrified RGC**

## 5.6. Estimation of Daily Demand for Households

The results showed that there were 8,753 households in the 23 electrified RGCs surveyed. Of these, 1,042 households have been electrified. The data utilized for the calculation of electricity demand curves were collected from 83 of the electrified households. Table 5-5 summarizes the study results on households.

Figure 5-5 shows the average daily load curves of households in each of the 10 electrified RGCs (from a total of 23 surveyed RGCs). Data from these average daily load curves multiplied by the number of electrified households in a RGC (shown in Table 5-5), resulted in the daily load curves of households for the electrified RGCs.

**Table 5-5 Summary Table of Surveyed Households**

| RGC | Province | Household | | | Available Load Data |
|---|---|---|---|---|---|
| | | Existing in RGC | Electrified | Elec. Rate | |
| MPIMA | CENTRAL | 1 | 1 | 100.0% | - |
| MPULA | CENTRAL | 70 | 0 | 0.0% | - |
| MPUNDE | CENTRAL | 500 | 20 | 4.0% | - |
| MISHIKISHI | COPPERBELT | 350 | 5 | 1.4% | 4 |
| CHIWALA | COPPERBELT | 225 | 6 | 2.7% | 6 |
| KANGONGA | COPPERBELT | 140 | 2 | 1.4% | 2 |
| CHEMBE | LUAPULA | 215 | 27 | 12.6% | 14 |
| LUAMFUMU | LUAPULA | 200 | 200 | 100.0% | 5 |
| KALOBWA | LUAPULA | 50 | 6 | 12.0% | 6 |
| KAMBWALI | LUAPULA | 400 | 12 | 3.0% | 12 |
| MUNKANTA | LUAPULA | 777 | 59 | 7.6% | 8 |
| CHIAWA | LUSAKA | 1,120 | 15 | 1.3% | 7 |
| LUANGWA BOMA | LUSAKA | 580 | 214 | 36.9% | - |
| KAPIJIMPANGA | NORTH WESTERN | 250 | 0 | 0.0% | - |
| KABANDA | NORTH WESTERN | 500 | 8 | 1.6% | - |
| NSELUKA | NORTHERN | 486 | 20 | 4.1% | 19 |
| MOCHIPAPA | SOUTHERN | 47 | 30 | 63.8% | - |
| MUSOKOTWANE | SOUTHERN | 500 | 25 | 5.0% | - |
| MUKUNI VILLAGE | SOUTHERN | 639 | 26 | 4.1% | - |
| MWANDI | SOUTHERN | 410 | 110 | 26.8% | - |
| LUKULU BOMA | WESTERN | 323 | 100 | 31.0% | - |
| SEFULA | WESTERN | 170 | 130 | 76.5% | - |
| SENANGA | WESTERN | 800 | 26 | 3.3% | - |
| Total | | 8,753 | 1,042 | - | 83 |
| Average | | 380.6 | 45.3 | 21.7% | 8.3 |

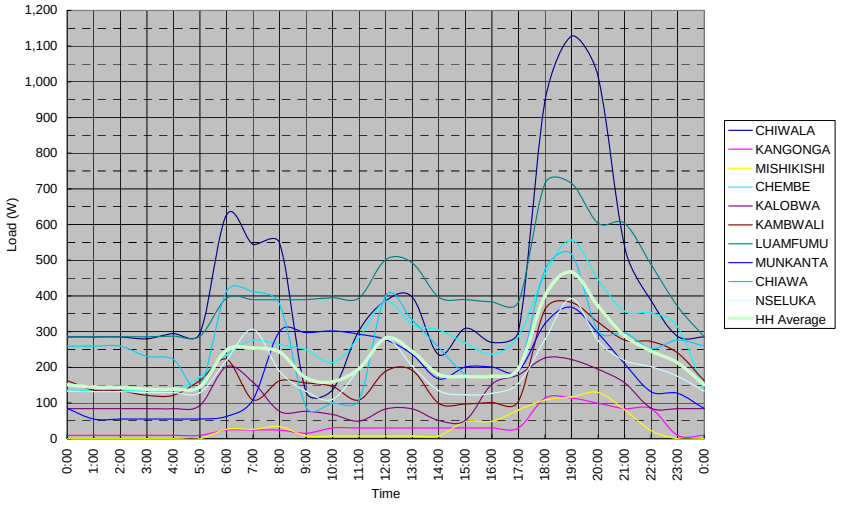



**Figure 5-5 Household's Unit Daily Load Curve for Each Electrified RGC**

## 5.7. Estimated Daily Load Curve and Peak Demand for Each Electrified RGC

A daily load curve for each electrified RGC surveyed was estimated by adding up the daily load curves of the four different types of consumer: 1) Public Facilities, 2) Business Entities, 3) Hammer Mills and 4) Households. The results of this calculation are shown in Figure 5-6, identifying the estimated daily load curves for each electrified RGC included in the survey. The daily load curves for only 8 of the 23 electrified RGCs surveyed, are plotted, since data of the 15 RGCs was insufficient to create demand curves. Hourly loads for all RGCs, which are related to the demand curves, are shown in Table5-6. In this table, the daily peak demand for each electrified RGCs is underlined.

Based on these results, features of electricity consumption of RGCs located in the rural areas of Zambia, as provided below, were delineated.

1) Of the total amount of electricity consumption in a RGC, the contribution of hammer mills is high.
2) The daily peak demand of a RGC occurs mostly in the evening from 18:00 to 19:00, coinciding with dinnertime, during which the electricity consumption for food preparation overlaps with the operation of hammer mills.

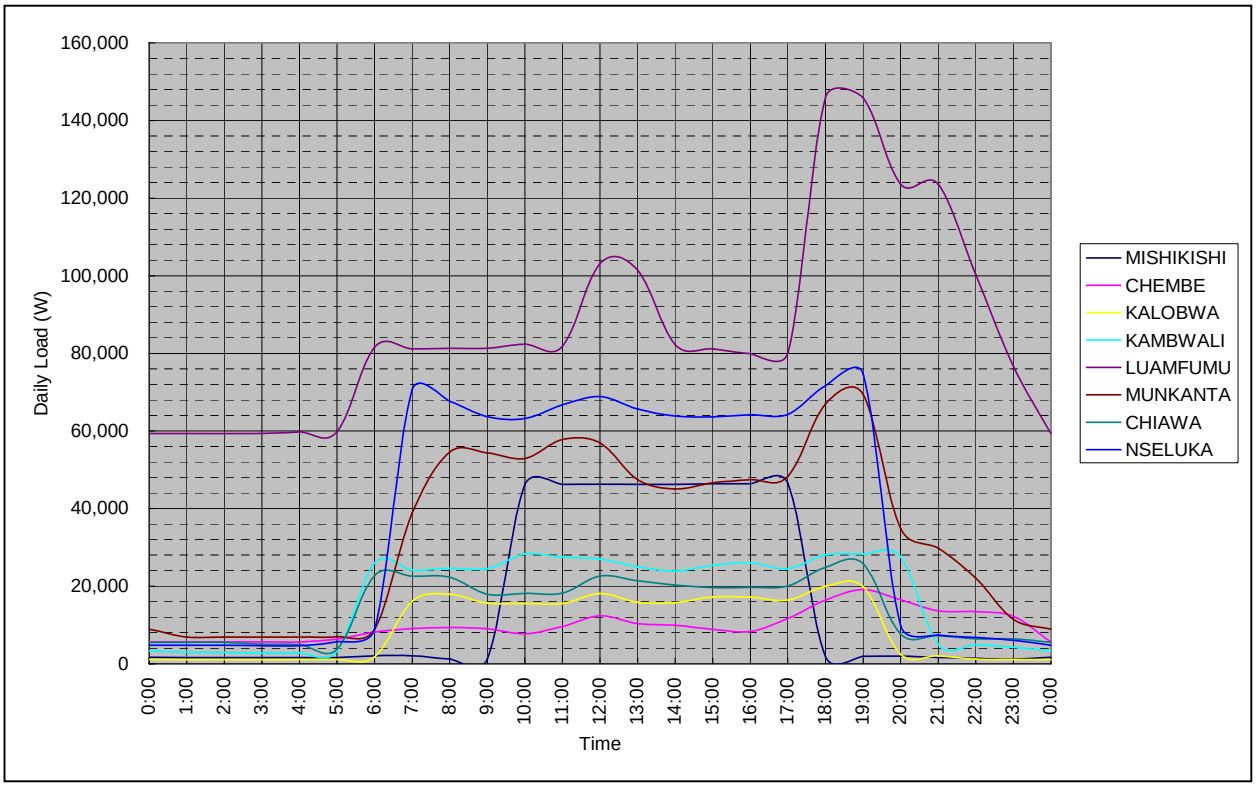



**Figure 5-6 Daily Load Curves for Electrified RGCs**

## Table 5-6 Time Table of Daily Demand in Surveyed Electrified RGCs (1/2)

| RGC (Province) | Type of Users | 0:00 | 1:00 | 2:00 | 3:00 | 4:00 | 5:00 | 6:00 | 7:00 | 8:00 | 9:00 | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 | 21:00 | 22:00 | 23:00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MISHIKISHI | Public Facility | 1,583 | 1,601 | 1,601 | 1,601 | 1,583 | 1,583 | 1,961 | 1,911 | 1,025 | 1,025 | 1,025 | 1,025 | 1,077 | 1,077 | 1,077 | 1,077 | 1,077 | 1,077 | 942 | 1,039 | 1,039 | 1,009 | 1,009 | 961 |
| (COPPERBELT) | Business Entity | 126 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 119 | 168 | 168 | 168 | 126 | 126 | 56 | 56 | 56 | 307 | 307 | 265 | 249 | 249 | 182 |
| | Hammer Mill | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Household | 0 | 0 | 0 | 0 | 0 | 0 | 131 | 131 | 169 | 38 | 38 | 38 | 38 | 38 | 38 | 240 | 240 | 401 | 542 | 586 | 647 | 407 | 114 | 0 |
| | **Daily Load** | 1,709 | 1,601 | 1,601 | 1,601 | 1,583 | 1,583 | 2,093 | 2,050 | 1,200 | 1,181 | 46,230 | 46,230 | 46,282 | 46,240 | 46,240 | 46,373 | 46,373 | 46,534 | 1,790 | 1,932 | 1,951 | 1,665 | 1,373 | 1,143 |
| | *DL exc. Hammer Mill* | *1,709* | *1,601* | *1,601* | *1,601* | *1,583* | *1,583* | *2,093* | *2,050* | *1,200* | *1,181* | *1,230* | *1,230* | *1,282* | *1,240* | *1,240* | *1,373* | *1,373* | *1,534* | *1,790* | *1,932* | *1,951* | *1,665* | *1,373* | *1,143* |
| CHEMBE | Public Facility | 1,808 | 1,808 | 1,808 | 1,808 | 1,808 | 1,523 | 1,652 | 1,412 | 2,053 | 2,054 | 1,809 | 1,742 | 1,751 | 1,486 | 1,485 | 1,476 | 1,788 | 2,964 | 2,893 | 2,965 | 2,949 | 2,506 | 2,428 | 2,383 |
| (LUAPULA) | Business Entity | 173 | 173 | 173 | 173 | 173 | 182 | 182 | 206 | 206 | 225 | 169 | 169 | 225 | 216 | 216 | 159 | 159 | 950 | 1,032 | 1,130 | 1,505 | 1,496 | 1,496 | 1,417 |
| | Hammer Mill | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Household | 3,664 | 3,664 | 3,664 | 3,664 | 3,664 | 4,677 | 6,347 | 7,457 | 7,102 | 6,719 | 5,758 | 7,681 | 10,400 | 8,657 | 8,211 | 7,245 | 6,391 | 7,748 | 12,446 | 15,024 | 12,045 | 9,628 | 9,503 | 8,462 |
| | **Daily Load** | 5,645 | 5,645 | 5,645 | 5,645 | 5,645 | 6,381 | 8,181 | 9,075 | 9,361 | 8,998 | 7,735 | 9,591 | 12,376 | 10,359 | 9,911 | 8,881 | 8,338 | 11,682 | 16,372 | 19,118 | 16,499 | 13,629 | 13,427 | 12,262 |
| | *DL exc. Hammer Mill* | *5,645* | *5,645* | *5,645* | *5,645* | *5,645* | *6,381* | *8,181* | *9,075* | *9,361* | *8,998* | *7,735* | *9,591* | *12,376* | *10,359* | *9,911* | *8,881* | *8,338* | *11,682* | *16,372* | *19,118* | *16,499* | *13,629* | *13,427* | *12,262* |
| KALOBWA | Public Facility | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 0 | 0 | 0 | 0 | 80 | 80 | 80 | 80 | 80 | 80 | 0 | 400 | 400 | 400 | 400 | 400 | 400 |
| (LUAPULA) | Business Entity | 161 | 161 | 161 | 161 | 161 | 161 | 160 | 173 | 2,427 | 160 | 160 | 200 | 2,500 | 240 | 367 | 1,833 | 1,127 | 327 | 3,169 | 3,149 | 883 | 708 | 261 | 228 |
| | Hammer Mill | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 0 | 0 | 0 | 0 |
| | Household | 504 | 504 | 504 | 504 | 504 | 559 | 1,212 | 948 | 458 | 458 | 405 | 295 | 500 | 500 | 305 | 305 | 915 | 1,073 | 1,358 | 1,332 | 1,167 | 942 | 514 | 504 |
| | **Daily Load** | 1,065 | 1,065 | 1,065 | 1,065 | 1,065 | 1,120 | 1,772 | 16,121 | 17,884 | 15,618 | 15,565 | 15,575 | 18,080 | 15,820 | 15,752 | 17,218 | 17,122 | 16,400 | 19,927 | 19,881 | 2,449 | 2,050 | 1,175 | 1,132 |
| | *DL exc. Hammer Mill* | *1,065* | *1,065* | *1,065* | *1,065* | *1,065* | *1,120* | *1,772* | *1,121* | *2,884* | *818* | *565* | *575* | *3,080* | *820* | *752* | *2,218* | *2,122* | *1,400* | *4,027* | *4,881* | *2,449* | *2,050* | *1,175* | *1,132* |
| KAMBWALI | Public Facility | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 780 | 780 | 835 | 835 | 835 | 835 | 835 | 835 |
| (LUAPULA) | Business Entity | 542 | 542 | 542 | 542 | 542 | 542 | 542 | 542 | 350 | 367 | 2,251 | 1,901 | 395 | 395 | 395 | 1,895 | 2,008 | 508 | 817 | 843 | 840 | 840 | 840 | 541 |
| | Hammer Mill | 0 | 0 | 0 | 0 | 0 | 0 | 22,000 | 22,000 | 22,000 | 22,000 | 24,000 | 24,000 | 24,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 0 | 0 | 0 |
| | Household | 1,948 | 1,628 | 1,608 | 1,458 | 1,458 | 1,958 | 2,670 | 1,305 | 1,946 | 1,873 | 1,755 | 1,300 | 2,269 | 2,299 | 1,185 | 1,165 | 1,220 | 1,256 | 4,348 | 4,583 | 3,916 | 3,318 | 3,267 | 2,879 |
| | **Daily Load** | 3,270 | 2,950 | 2,930 | 2,780 | 2,780 | 3,280 | 25,992 | 24,147 | 24,596 | 24,540 | 28,305 | 27,501 | 26,963 | 24,993 | 23,879 | 25,359 | 26,007 | 24,543 | 28,000 | 28,261 | 27,591 | 4,992 | 4,941 | 4,255 |
| | *DL exc. Hammer Mill* | *3,270* | *2,950* | *2,930* | *2,780* | *2,780* | *3,280* | *3,992* | *2,147* | *2,596* | *2,540* | *4,305* | *3,501* | *2,963* | *2,993* | *1,879* | *3,359* | *4,007* | *2,543* | *6,000* | *6,261* | *5,591* | *4,992* | *4,941* | *4,255* |
| LUAMFUMU | Public Facility | 541 | 541 | 541 | 541 | 541 | 541 | 467 | 826 | 974 | 952 | 977 | 423 | 448 | 466 | 504 | 797 | 780 | 785 | 842 | 846 | 948 | 929 | 923 | 919 |
| (LUAPULA) | Business Entity | 1,692 | 1,692 | 1,692 | 1,692 | 1,692 | 1,692 | 2,412 | 2,412 | 2,412 | 2,412 | 2,412 | 2,412 | 2,412 | 2,412 | 2,412 | 2,412 | 2,412 | 2,506 | 1,981 | 1,936 | 1,936 | 1,936 | 1,786 | 1,692 |
| | Hammer Mill | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Household | 57,120 | 57,120 | 57,120 | 57,120 | 57,520 | 57,520 | 78,720 | 77,920 | 77,920 | 77,960 | 78,960 | 78,920 | 100,320 | 98,520 | 79,320 | 77,920 | 76,720 | 76,720 | 143,120 | 143,120 | 120,720 | 120,720 | 97,520 | 74,120 |
| | **Daily Load** | 59,353 | 59,353 | 59,353 | 59,353 | 59,753 | 59,753 | 81,599 | 81,158 | 81,306 | 81,324 | 82,349 | 81,755 | 103,180 | 101,398 | 82,236 | 81,129 | 79,912 | 80,010 | 145,943 | 145,902 | 123,603 | 123,584 | 100,229 | 76,731 |
| | *DL exc. Hammer Mill* | *59,353* | *59,353* | *59,353* | *59,353* | *59,753* | *59,753* | *81,599* | *81,158* | *81,306* | *81,324* | *82,349* | *81,755* | *103,180* | *101,398* | *82,236* | *81,129* | *79,912* | *80,010* | *145,943* | *145,902* | *123,603* | *123,584* | *100,229* | *76,731* |
| MUNKANTA | Public Facility | 1,917 | 1,917 | 1,917 | 1,917 | 1,917 | 1,917 | 3,357 | 1,917 | 4,421 | 4,421 | 4,612 | 4,112 | 4,142 | 2,672 | 4,352 | 3,925 | 5,075 | 4,575 | 5,364 | 5,157 | 4,817 | 4,817 | 4,806 | 1,817 |
| (LUAPULA) | Business Entity | 2,025 | 1,763 | 1,763 | 1,763 | 1,763 | 1,819 | 1,819 | 506 | 2,381 | 2,381 | 506 | 6,416 | 6,394 | 863 | 863 | 863 | 506 | 2,456 | 12,600 | 12,600 | 12,600 | 12,600 | 9,506 | 2,156 |
| | Hammer Mill | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 0 | 0 | 0 | 0 |
| | Household | 4,986 | 3,245 | 3,245 | 3,245 | 3,245 | 3,245 | 3,688 | 6,453 | 17,755 | 17,534 | 17,803 | 17,276 | 16,361 | 13,913 | 9,857 | 11,848 | 11,848 | 11,203 | 19,020 | 21,719 | 17,423 | 12,408 | 7,762 | 7,493 |
| | **Daily Load** | 8,928 | 6,925 | 6,925 | 6,925 | 6,925 | 6,981 | 8,863 | 38,877 | 54,557 | 54,336 | 52,922 | 57,805 | 56,898 | 47,448 | 45,072 | 46,635 | 47,429 | 48,234 | 66,984 | 69,476 | 34,840 | 29,825 | 22,075 | 11,466 |
| | *DL exc. Hammer Mill* | *8,928* | *6,925* | *6,925* | *6,925* | *6,925* | *6,981* | *8,863* | *8,877* | *24,557* | *24,336* | *22,922* | *27,805* | *26,898* | *17,448* | *15,072* | *16,635* | *17,429* | *18,234* | *36,984* | *39,476* | *34,840* | *29,825* | *22,075* | *11,466* |

## Table 5-6 Time Table of Daily Demand in Surveyed Electrified RGCs (2/2)

| RGC (Province) | Type of Users | 0:00 | 1:00 | 2:00 | 3:00 | 4:00 | 5:00 | 6:00 | 7:00 | 8:00 | 9:00 | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 | 21:00 | 22:00 | 23:00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHIAWA | Public Facility | 1,383 | 1,383 | 1,383 | 1,383 | 1,383 | 1,296 | 1,353 | 1,111 | 1,320 | 1,299 | 1,348 | 1,293 | 1,328 | 1,081 | 1,118 | 1,102 | 1,225 | 1,878 | 1,951 | 2,041 | 2,127 | 1,951 | 1,879 | 1,819 |
| (LUSAKA) | Business Entity | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 275 | 285 | 285 | 285 | 285 | 285 | 310 | 301 | 801 | 800 | 300 | 795 | 990 | 990 | 840 | 740 | 445 |
| | Hammer Mill | 0 | 0 | 0 | 0 | 0 | 0 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 0 | 0 | 0 | 0 |
| | Household | 3,889 | 3,889 | 3,889 | 3,461 | 3,332 | 2,196 | 6,204 | 6,171 | 5,657 | 1,329 | 1,500 | 1,639 | 6,000 | 4,982 | 3,836 | 2,711 | 2,649 | 2,890 | 7,108 | 7,753 | 4,518 | 4,463 | 3,793 | 4,146 |
| | **Daily Load** | 5,493 | 5,493 | 5,493 | 5,064 | 4,936 | 3,714 | 22,777 | 22,558 | 22,262 | 17,913 | 18,133 | 18,218 | 22,613 | 21,373 | 20,254 | 19,614 | 19,675 | 20,068 | 24,853 | 25,784 | 7,635 | 7,254 | 6,412 | 6,411 |
| | *DL exc. Hammer Mill* | *5,493* | *5,493* | *5,493* | *5,064* | *4,936* | *3,714* | *7,777* | *7,558* | *7,262* | *2,913* | *3,133* | *3,218* | *7,613* | *6,373* | *5,254* | *4,614* | *4,675* | *5,068* | *9,853* | *10,784* | *7,635* | *7,254* | *6,412* | *6,411* |
| NSELUKA | Public Facility | 561 | 561 | 561 | 561 | 561 | 1,581 | 1,581 | 1,531 | 445 | 157 | 157 | 157 | 157 | 157 | 157 | 157 | 157 | 157 | 1,562 | 1,629 | 1,629 | 609 | 609 | 561 |
| (NORTHERN) | Business Entity | 1,552 | 1,552 | 1,552 | 1,552 | 1,552 | 1,552 | 2,967 | 3,030 | 3,442 | 897 | 844 | 2,613 | 3,105 | 1,412 | 1,023 | 1,007 | 1,457 | 1,010 | 4,541 | 5,244 | 2,782 | 2,424 | 2,131 | 2,009 |
| | Hammer Mill | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 0 | 0 | 0 | 0 |
| | Household | 2,660 | 2,639 | 2,639 | 2,577 | 2,577 | 2,574 | 4,399 | 6,119 | 3,774 | 2,648 | 2,205 | 3,918 | 5,597 | 4,071 | 2,685 | 2,453 | 2,541 | 3,098 | 5,563 | 7,860 | 5,480 | 4,385 | 4,032 | 3,498 |
| | **Daily Load** | 4,773 | 4,752 | 4,752 | 4,690 | 4,690 | 5,708 | 8,948 | 70,681 | 67,661 | 63,701 | 63,205 | 66,688 | 68,859 | 65,640 | 63,864 | 63,617 | 64,155 | 64,265 | 71,667 | 74,733 | 9,891 | 7,418 | 6,773 | 6,068 |
| | *DL exc. Hammer Mill* | *4,773* | *4,752* | *4,752* | *4,690* | *4,690* | *5,708* | *8,948* | *10,681* | *7,661* | *3,701* | *3,205* | *6,688* | *8,859* | *5,640* | *3,864* | *3,617* | *4,155* | *4,265* | *11,667* | *14,733* | *9,891* | *7,418* | *6,773* | *6,068* |

## 5.8. Selection of a Daily Peak Demand Forecast Method [Step 2]

### 5.8.1. Relationship between Number of Households and Peak Demand of RGC

One of the characteristics of hammer mills is that they consume a considerably greater amount of electricity than other types of consumers – public facilities, business entities and households, as explained in a previous section. In addition to this characteristic, there is no significant correlation between the scale of RGCs and the number of hammer mills installed in them. Therefore, adaptability of a linear regression model to a daily peak demand forecast for an unelectrified RGC was tested in two cases: daily peak demand with and without consumption of hammer mills.

The relationship between the number of households and the daily peak demand, with hammer mills and without hammer mills, for each of the RGCs are plotted in Figure 5-7 and 5-8 respectively, based on Table 5-7 developed from data shown in Table 5-6. In both cases, no relation between the number of households and the daily peak demand were observed. Neither provincial/regional nor years after electrification tendency was found. Developed linear regression model for both cases showed negative slope, meaning the larger the number of households in a RGC, the less peak demand in a RGC, and this model indication was absolutely unrealistic. In fact, the model's coefficient of determination ($R^2$) is as low as 0.0135 and 0.0376 respectively. Therefore, it was safely concluded that the linear regression model having the number of households as an explanatory variable was not applicable to forecast the peak demand in a RGC.

**Table 5-7 Peak Demand and Number of Households in Electrified RGCs**

| RGC | Province | Peak Load (W) | Peak Load Except Hammer Mills (W) | Number of Households | Year after Elec. |
|---|---|---|---|---|---|
| MISHIKISHI | COPPERBELT | 46,534 | 2,093 | 350 | 5 |
| CHEMBE | LUAPULA | 19,118 | 19,118 | 215 | 1 |
| KALOBWA | LUAPULA | 19,927 | 4,927 | 50 | 5 |
| KAMBWALI | LUAPULA | 28,261 | 6,261 | 400 | 20 |
| LUAMFUMU | LUAPULA | 145,943 | 145,943 | 200 | 34 |
| MUNKANTA | LUAPULA | 69,476 | 39,476 | 777 | 1 |
| CHIAWA | LUSAKA | 25,784 | 10,784 | 1,120 | 6 |
| NSELUKA | NORTHERN | 74,733 | 14,733 | 486 | 4 |
| All RGCs Average | | 53,722 | 30,417 | 450 | 9.5 |

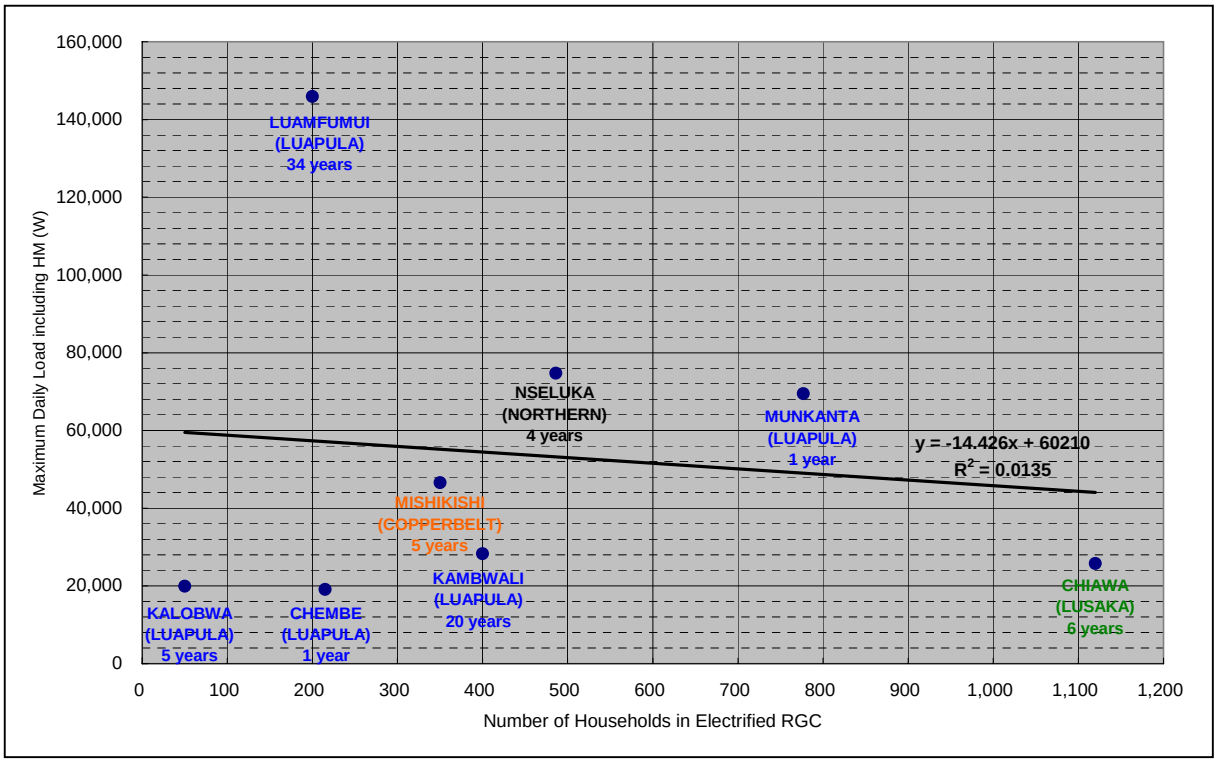



**Figure 5-7 Linear Regression Model for Peak Demand with Hammer Mills**

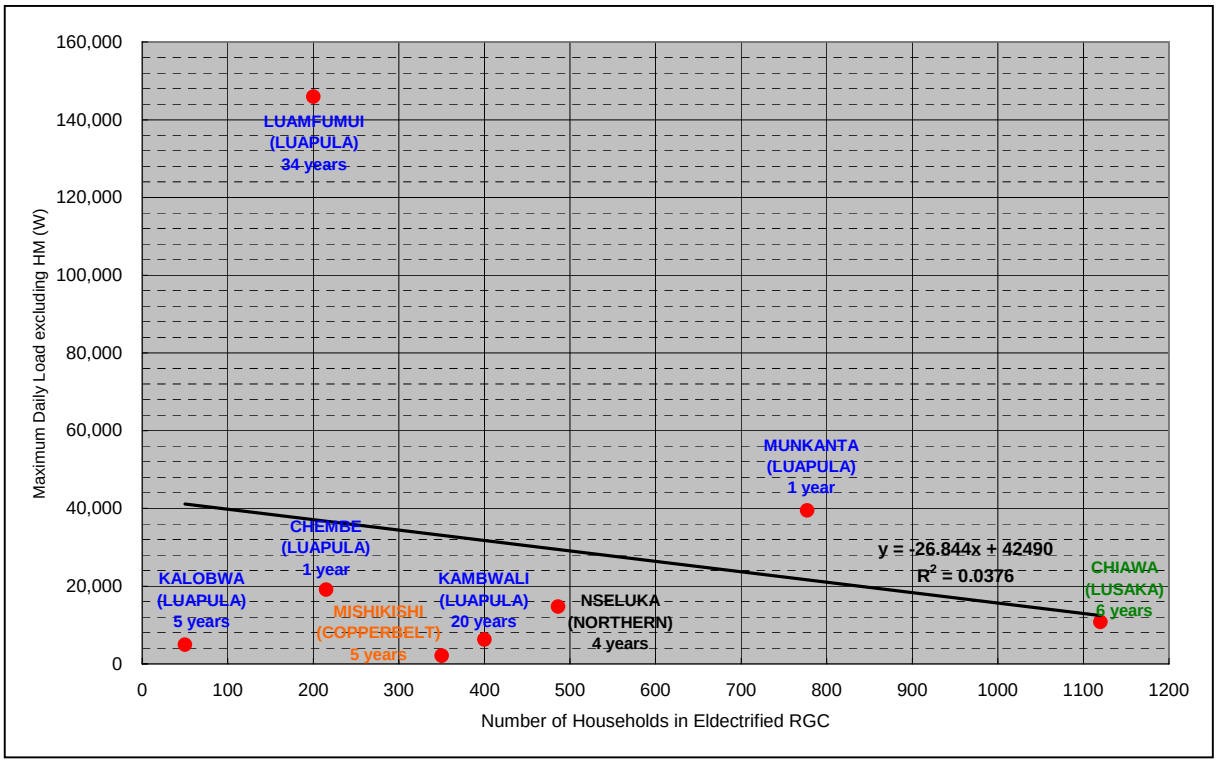



**Figure 5-8 Linear Regression Model for Peak Demand without Hammer Mills**

### 5.8.4. Number of Hammer Mills in Unelectrified RGCs

In order to forecast the potential demand in unelectrified RGCs in 2030, an increase in the number of hammer mills needs to be taken into account, as well as the number of households as explained in the section 5.8.2. The results of the socio-economic survey indicated that each hammer mill provides services to an average of 179 households in electrified RGCs, while it provides services to an average of 172 households in unelectrified RGCs, as shown in Tables 5-8 (on the next page). The average number of households served per hammer mill (179 in electrified RGC and 172 in unelectrified RGC), however, is not statistically different between electrified and unelectrified RGC with the significance level of 95%. Therefore, disregarding the electrification status, the total average of per unit hammer mill service ratio by 174 households are adopted to forecast installed number of hammer mill in each RGC in 2030.

Among 23 RGCs listed in Table 5-1, the relationship between the hammer mill electrification rates and the year after electrification for 19 electrified RGCs (except Kabanda and Mwandi RGCs that electrification years were uncertain) were plotted in Figure 5-10. As the figure shows, there is no relationship between them. Thus, the chronological transition (escalation) of hammer mill electrification rate is disregarded in the potential demand forecast.

Taken into account above findings, Equation 5-2 indicates how the number of hammer mills in each RGC in 2030 is forecasted by using the data as of 2006.

$$\begin{aligned} X_{HM\,[2030]} &= X_{HH\,[2030]} / HMSR \\ &= 1.986 \times X_{HH\,[2006]} / 174 \\ &= 0.0113 \times X_{HH\,[2006]} \end{aligned} \qquad \text{(Equation 5-2)}$$

$X_{HM\,[2030]}$: Forecasted Number of Hammer Mills in a RGC in 2030 (refer to Equation 5-1)
$X_{HH\,[2030]}$: Forecasted Number of Households in a RGC in 2030
$X_{HH\,[2006]}$: Number of Households in a RGC in 2006 (data submitted by district planners)
HMSR : A Unit Hammer Mill Service Ratio = 174 Household/Hammer Mill

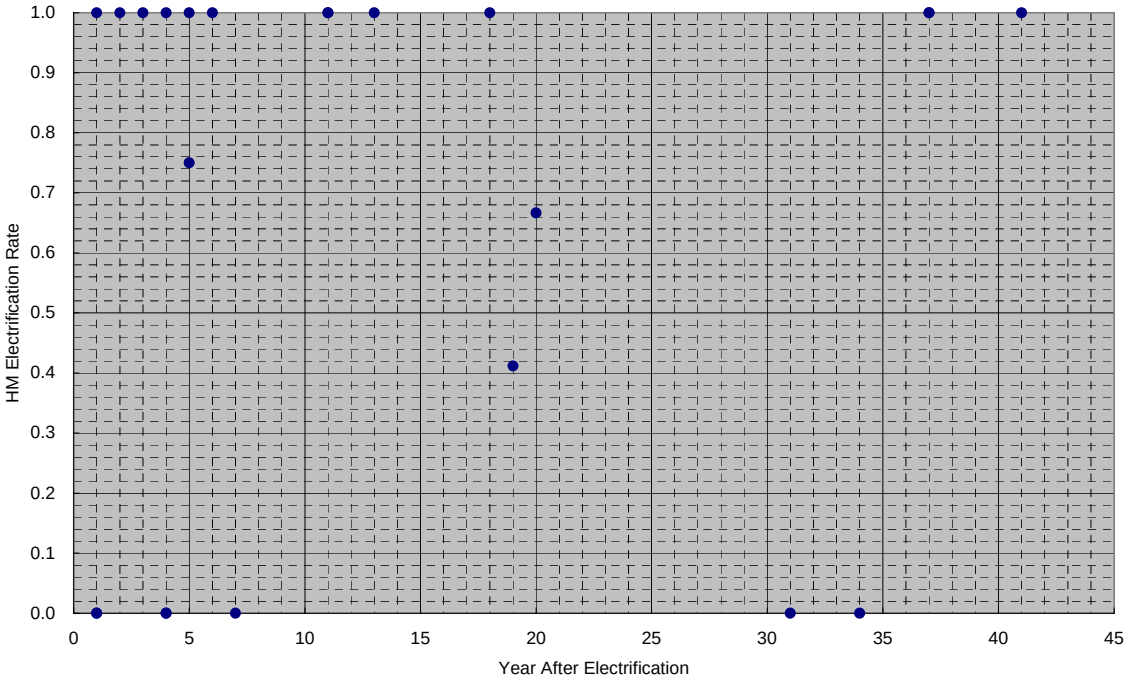



**Figure 5-10 Chronological Transition of Hammer Mill Electrification Rate**

### 5.8.2. Growth of Number of Households in Unelectrified RGCs

Number of households in each of 1,217 unelectrified RGCs as of 2006 has been obtained as a part of data submitted from the district planners in November 2006. To forecast potential demand in 2030, the target year of the rural electrification master plan, an increase rate in the number of households for unelectrified RGCs needs to be taken into account. Household growth rate, however, is not officially available even in the census report, while population growth rate with AIDs at 2.9% per annum up to 2025 is announced in "Population Projection Report" published by Central Statistics Office in November 2003. Therefore, this population growth rate is substituted as the household growth rate, and assumed to maintain at the same rate by 2030. Equation 5-1 indicates how the number of households in each RGC in 2030 is forecasted by using the data as of 2006.

$$X_{HH\,[2030]} = X_{HH\,[2006]} \times (1+0.029)^{24} = 1.986 \times X_{HH\,[2006]} \qquad \text{(Equation 5-1)}$$

$X_{HH\,[2030]}$: Forecasted Number of Households in a RGC in 2030
$X_{HH\,[2006]}$: Number of Households in a RGC in 2006 (data submitted by district planners)

### 5.8.3. Transition of Household Electrification Rate in Electrified RGCs

Among 23 RGCs listed in Table 5-1, the relationship between the household electrification rates and the year after electrification for 21 electrified RGCs (except Kabanda and Mwandi RGCs that electrification years were uncertain) were plotted in Figure 5-9. In general, it is expected that the household electrification rate increases according to the length (or years) after the electrification. Based on the collected data by the socio-economic survey, however, there are no relationships between them, even if provincial/regional aspects and the total number of households in RGCs are taken into consideration. Therefore, there is no convincing information regarding the chronological transition (escalation) of household electrification rate considered in the potential demand forecast.

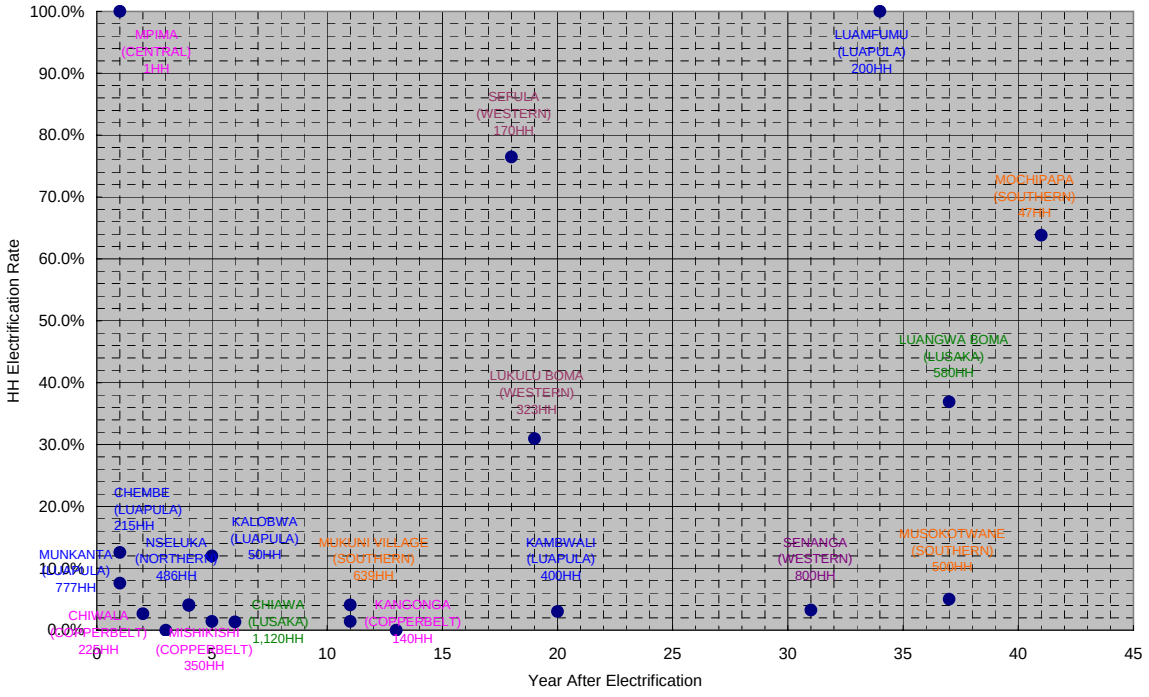



**Figure 5-9 Chronological Transition of Household Electrification Rate**

## Table 5-8 Number of Hammer Mills and Unit Servicing Households in Surveyed RGCs

| RGC | Province | Status | HM in RCG | HH in RGC | HH per HM |
|---|---|---|---|---|---|
| MPULA | CENTRAL | Electrified | 3 | 70 | 23 |
| CHIPEPO | CENTRAL | Un-Electrified | 1 | 583 | 583 |
| MPUNDE | CENTRAL | Electrified | 2 | 500 | 250 |
| CHIBALE | CENTRAL | Un-Electrified | 2 | 250 | 125 |
| OLD MKUSHI | CENTRAL | Un-Electrified | 2 | 440 | 220 |
| SHIMOKUNI | CENTRAL | Un-Electrified | 5 | 300 | 60 |
| MUMBWA BIG CONCESSION | CENTRAL | Un-Electrified | 4 | 85 | 21 |
| MISHIKISHI | COPPERBELT | Electrified | 4 | 350 | 88 |
| MUTABA | COPPERBELT | Un-Electrified | 2 | 30 | 15 |
| MIKATA | COPPERBELT | Un-Electrified | 2 | 38 | 19 |
| CHIWALA | COPPERBELT | Electrified | 2 | 225 | 113 |
| KANGONGA | COPPERBELT | Electrified | 1 | 750 | 750 |
| KAMEME | COPPERBELT | Un-Electrified | 0 | 100 | - |
| KAKOLO | COPPERBELT | Un-Electrified | 2 | 88 | 44 |
| MUTUNDU | COPPERBELT | Un-Electrified | 0 | 188 | - |
| KAFUBU | COPPERBELT | Un-Electrified | 2 | 100 | 50 |
| LUFWANYAMA EMMARALD MINING AREA | COPPERBELT | Un-Electrified | - | 0 | - |
| MUNGOMBA | COPPERBELT | Un-Electrified | 0 | 50 | - |
| KAMITETA | COPPERBELT | Un-Electrified | - | 10 | - |
| KAPUNGWE | EASTERN | Un-Electrified | - | 2,000 | - |
| CHIPEMBE | EASTERN | Un-Electrified | 1 | 128 | 128 |
| MPOMWA TSE-TSE | EASTERN | Un-Electrified | 3 | 750 | 250 |
| MWASE | EASTERN | Un-Electrified | 2 | 750 | 375 |
| MLOLO | EASTERN | Un-Electrified | 2 | 662 | 331 |
| KAGORO | EASTERN | Un-Electrified | 1 | 30 | 30 |
| CHEMBE | LUAPULA | Electrified | 2 | 215 | 108 |
| KASONGWA SUB-BOMA | LUAPULA | Un-Electrified | 2 | 474 | 237 |
| LUAMFUMU | LUAPULA | Electrified | 1 | 200 | 200 |
| MILENGE | LUAPULA | Un-Electrified | 0 | 780 | - |
| CHINSANKA | LUAPULA | Un-Electrified | 2 | 1,800 | 900 |
| MUSHOTA | LUAPULA | Un-Electrified | 2 | 443 | 222 |
| KALOBWA | LUAPULA | Electrified | 1 | 50 | 50 |
| KATUTA | LUAPULA | Un-Electrified | 1 | 155 | 155 |
| CHILONGO | LUAPULA | Un-Electrified | - | 950 | - |
| KANBWALI | LUAPULA | Electrified | 3 | 400 | 133 |
| MUNKANTA | LUAPULA | Electrified | 2 | 777 | 389 |
| CHIAWA | LUSAKA | Electrified | 1 | 112 | 112 |
| NCHUTE | LUSAKA | Un-Electrified | 1 | 93 | 93 |
| CHINYUNYU | LUSAKA | Un-Electrified | 1 | 247 | 247 |
| CHIPAPA | LUSAKA | Un-Electrified | - | 133 | - |
| LUANGWA BOMA | LUSAKA | Electrified | 3 | 580 | 193 |
| KAPIJIMPANGA | NORTH WESTERN | Electrified | 1 | 250 | 250 |
| MUMEMA | NORTH WESTERN | Un-Electrified | 4 | 163 | 41 |
| NSELAUKE | NORTH WESTERN | Un-Electrified | 9 | 275 | 31 |
| MATUSHI | NORTH WESTERN | Un-Electrified | 4 | 1,500 | 375 |
| CHITOKOLOKI | NORTH WESTERN | Un-Electrified | 3 | 1,000 | 333 |
| CHIVOMBO | NORTH WESTERN | Un-Electrified | 2 | 40 | 20 |
| KASHINAKAZI | NORTH WESTERN | Un-Electrified | 0 | 106 | - |
| KABANDA | NORTH WESTERN | Electrified | 15 | 500 | 33 |
| SHIWANG'ANDU | NORTHERN | Un-Electrified | 2 | 40 | 20 |
| KANCHIBIYA | NORTHERN | Un-Electrified | - | 50 | - |
| CHITIMBWA | NORTHERN | Un-Electrified | 4 | 230 | 58 |
| CHIMULA | NORTHERN | Un-Electrified | 0 | 100 | - |
| ROSA | NORTHERN | Un-Electrified | 1 | 416 | 416 |
| MASONDE | NORTHERN | Un-Electrified | - | 200 | - |
| WULONGO | NORTHERN | Un-Electrified | 0 | 200 | - |
| NSAMA SUB-BOMA | NORTHERN | Un-Electrified | 3 | 297 | 99 |
| KACHUMU | NORTHERN | Un-Electrified | - | 30 | - |
| MUKUPA KAOMA | NORTHERN | Un-Electrified | 3 | 202 | 67 |
| MATIPA | NORTHERN | Un-Electrified | 4 | 435 | 109 |
| NSELUKA | NORTHERN | Electrified | 4 | 486 | 122 |
| NAMOOMBA | SOUTHERN | Un-Electrified | 1 | 132 | 132 |
| NGWEZI | SOUTHERN | Un-Electrified | - | 15 | - |
| KAUMUZYA EAST | SOUTHERN | Un-Electrified | - | 69 | - |
| SINAKAIMBI | SOUTHERN | Un-Electrified | - | 17 | - |
| MOCHIPAPA | SOUTHERN | Electrified | 1 | 47 | 47 |
| MAMBOVA | SOUTHERN | Un-Electrified | - | 144 | - |
| SIABWENGO | SOUTHERN | Un-Electrified | 1 | 22 | 22 |
| KASIYA | SOUTHERN | Un-Electrified | 1 | 170 | 170 |
| KANCHOMBA | SOUTHERN | Un-Electrified | 0 | 600 | - |
| MUSOKOTWANE | SOUTHERN | Electrified | 1 | 71 | 71 |
| KABANGA | SOUTHERN | Un-Electrified | 2 | 422 | 211 |
| MUKUNI VILLAGE | SOUTHERN | Electrified | 2 | 639 | 320 |
| BAMBWE | SOUTHERN | Un-Electrified | 1 | 166 | 166 |
| LUBANDA | SOUTHERN | Un-Electrified | 2 | 200 | 100 |
| MWANDI | SOUTHERN | Electrified | 2 | 410 | 205 |
| LUKULU BOMA | WESTERN | Electrified | 17 | 323 | 19 |
| SEFULA | WESTERN | Electrified | 3 | 170 | 57 |
| SIANDA | WESTERN | Un-Electrified | 1 | 230 | 230 |
| SIOMA | WESTERN | Un-Electrified | 2 | 400 | 200 |
| NANGWESHI | WESTERN | Un-Electrified | 3 | 600 | 200 |
| SENANGA | WESTERN | Electrified | 2 | 800 | 400 |
| NANGULA | WESTERN | Un-Electrified | 0 | 26 | - |
| NKEYEMA | WESTERN | Un-Electrified | 5 | 428 | 86 |
| SICHILI | WESTERN | Un-Electrified | 7 | 150 | 21 |
| Average | | | 2 | 337 | 174 |
| (St. Dev) | | | (2.8) | (370.4) | (171.4) |
| Average for Electrified RGC | | | 3 | 360 | 179 |
| (St. Dev) | | | (4.2) | (243.3) | (170.4) |
| Average for Unelectrified RGC | | | 2 | 329 | 172 |
| (St. Dev) | | | (1.8) | (406.9) | (174.0) |

### 5.8.5. Other Assumptions for Demand Forecast

In addition to the numbers of households and hammer mills in a RGC, the numbers of public facilities and business entities in a RGC in 2030 also need to be assumed to forecast potential electricity demand. However, neither baseline data, such as the numbers of public facilities and business entities in each of RGCs before electrified, nor the official increase rate of these numbers are available as a secondary data. Therefore, as a most intelligent estimation, the population growth rate (2.9% per annum) is substituted as the growth rates of both public facilities and business entities. Equation 5-3 and 5-4 indicates how the number of each type of public facilities and business entities in each RGC in 2030 are forecasted by using the data as of 2006. Since the chronological transitions (escalations) of household and hammer mill electrification rate are disregarded, those for public facilities and business entities are also neglected in the potential demand forecast.

$$X_{PFi\ [2030]} = X_{PFi\ [2006]} \times (1+0.029)^{24} = 1.986 \times X_{PFi\ [2006]} \qquad \text{(Equation 5-3)}$$

$X_{PFi\ [2030]}$: Forecasted Number of Public Facility Type i in a RGC in 2030
$X_{PFi\ [2006]}$: Number of Public Facility Type i in a RGC in 2006 (data submitted by district planners)
i: Type of Public Facility shown in Table 5-2 (i = 1 ~ 18)

$$X_{BE\ [2030]} = X_{BE\ [2006]} \times (1+0.029)^{24} = 1.986 \times X_{BE\ [2006]} \qquad \text{(Equation 5-4)}$$

$X_{BE\ [2030]}$: Forecasted Number of Business Entities in a RGC in 2030
$X_{BE\ [2006]}$: Number of Business Entities in a RGC in 2006 (data submitted by district planners)

### 5.8.6. Daily Peak Demand Forecast Method

As studied in the section 5.8.1., the linear regression model does not work to forecast the daily peak demand in a RGC. On the other hand, unit daily load curves for all types of consumers – each type of Public Facilities, Business Entities, Hammer Mills, and Households – have been captured utilizing data collected by the socio-economic survey. In addition, the numbers of each type of Public Facilities, Business Entities, Hammer Mills, and Households in each of 1,217 unelectrified RGCs in 2030 are assumable based on the obtained basic RGC data as of 2006 from the district planners (refer to Equation 5-1, 5-2, 5-3 and 5-4). Therefore, in the same manner explained in the Section 5.7 to estimate daily load curve and peak demand for 8 electrified RGCs, the method of adding up the daily load curves for different types of consumers will be adopted. Assumptions for demand forecast, such as growth rates and unit daily load timetables for each type of consumers, are summarized in Table 5-9. Steps to create potential daily load curve for each of 1,217 RGCs are explained as follows and illustrated with a sample sheet shown in Table 5-10.

Step A: Assume the numbers of Public Facilities, Business Entities, Hammer Mills, and Households in a RGC in 2030 by using Equation 5-1, 5-2, 5-3 and 5-4

Step B: Multiply electrification rates of Public Facilities in each type, Business Entities, Hammer Mills, and Households by the number of them in 2030 obtained in Step A. Then, the numbers of electrified Public Facilities, Business Entities, Hammer Mills, and Households in a RGC in 2030 will be obtained.

Step C: Multiply the numbers of electrified consumers obtained in Step B by the unit daily load timetables for each type of consumers shown in Table 5-9 to create the daily load timetables.

Step D: Sum up the daily load timetables for each type of consumers and create the potential daily load table for a RGC.

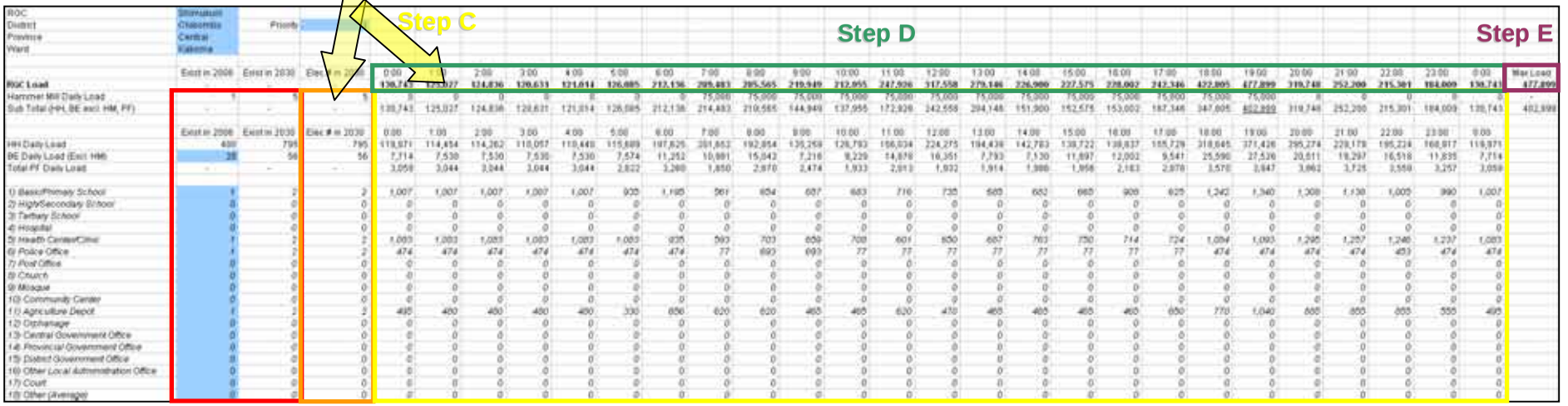
Step E: Select the maximum daily load as the daily peak demand for each RGC and use it as a design capacity of electrification facilities.

## Table 5-9 Assumptions for Demand Forecast

| | per Year | by 2030 |
|---|---|---|
| HH Growth Rate | 0.029 | 0.986 |
| BE Growth Rate | 0.029 | 0.986 |
| PF Growth Rate | 0.029 | 0.986 |
| # of HH per HM | 174 | |

| Time | 0:00 | 1:00 | 2:00 | 3:00 | 4:00 | 5:00 | 6:00 | 7:00 | 8:00 | 9:00 | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 | 21:00 | 22:00 | 23:00 | 0:00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hammer Mill Daily Load (Av.) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 0 | 0 | 0 | 0 | 0 |
| HH Daily Load (Av.) | 151 | 144 | 144 | 138 | 139 | 146 | 249 | 254 | 243 | 170 | 159 | 196 | 282 | 245 | 180 | 174 | 175 | 196 | 401 | 467 | 371 | 288 | 246 | 212 | 151 |
| BE Daily Load (Av. Excl. HM) | 138 | 134 | 134 | 134 | 134 | 135 | 201 | 196 | 269 | 129 | 165 | 266 | 292 | 139 | 127 | 212 | 214 | 179 | 457 | 492 | 366 | 345 | 295 | 211 | 138 |
| PF Daily Load (Av.) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1) Basic/Primary School | 503 | 503 | 503 | 503 | 503 | 468 | 597 | 280 | 327 | 328 | 342 | 358 | 367 | 342 | 341 | 332 | 454 | 313 | 621 | 670 | 654 | 569 | 503 | 495 | 503 |
| 2) High/Secondary School | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 240 | 240 | 240 | 240 | 240 | 240 | 0 | 0 | 0 | 30 | 270 | 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3) Tertiary School | 230 | 230 | 230 | 230 | 230 | 230 | 1,670 | 1,729 | 3,424 | 3,424 | 3,424 | 3,424 | 3,454 | 1,984 | 3,424 | 2,997 | 2,997 | 2,997 | 3,419 | 3,230 | 3,230 | 3,230 | 3,230 | 230 | 230 |
| 4) Hospital | 7,240 | 7,240 | 7,240 | 7,240 | 7,240 | 7,240 | 7,240 | 15,880 | 28,170 | 28,170 | 28,170 | 23,630 | 23,630 | 23,530 | 23,530 | 23,530 | 28,070 | 28,070 | 21,520 | 15,590 | 15,590 | 15,490 | 15,490 | 15,490 | 7,240 |
| 5) Health Center/Clinic | 541 | 541 | 541 | 541 | 541 | 541 | 467 | 295 | 351 | 329 | 354 | 300 | 325 | 344 | 382 | 375 | 357 | 362 | 542 | 546 | 648 | 629 | 623 | 619 | 541 |
| 6) Police Office | 237 | 237 | 237 | 237 | 237 | 237 | 237 | 38 | 347 | 347 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 237 | 237 | 237 | 237 | 226 | 237 | 237 |
| 7) Post Office | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 75 | 325 | 92 | 92 | 92 | 92 | 92 | 0 | 475 | 475 | 477 | 477 | 2 | 2 | 197 | 197 | 197 | 195 |
| 8) Church | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 73 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 104 | 171 | 171 | 171 | 171 | 123 | 123 |
| 9) Mosque | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 73 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 104 | 171 | 171 | 171 | 171 | 123 | 123 |
| 10) Community Center | 718 | 718 | 718 | 718 | 718 | 718 | 723 | 325 | 583 | 710 | 460 | 460 | 320 | 320 | 220 | 220 | 220 | 460 | 975 | 1,343 | 1,093 | 748 | 748 | 718 | 718 |
| 11) Agriculture Depot | 248 | 240 | 240 | 240 | 240 | 165 | 328 | 310 | 310 | 233 | 233 | 310 | 235 | 233 | 233 | 233 | 233 | 325 | 385 | 520 | 443 | 428 | 428 | 278 | 248 |
| 12) Orphanage | 1,005 | 1,023 | 1,023 | 1,023 | 1,005 | 1,005 | 1,005 | 1,005 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 35 | 35 | 5 | 5 | 5 | 1,005 |
| 13) Central Government Office | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 530 | 623 | 623 | 623 | 123 | 123 | 123 | 123 | 423 | 423 | 423 | 300 | 300 | 300 | 300 | 300 | 300 | 0 |
| 14) Provincial Government Office | 150 | 0 | 0 | 0 | 0 | 0 | 0 | 265 | 1,464 | 1,464 | 1,464 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 524 | 300 | 300 | 300 | 300 | 300 | 300 | 150 |
| 15) District Government Office | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,305 | 2,305 | 2,305 | 2,305 | 2,305 | 2,305 | 2,305 | 2,005 | 2,005 | 625 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| 16) Other Local Administration Office | 150 | 0 | 0 | 0 | 0 | 0 | 0 | 265 | 1,464 | 1,464 | 1,464 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 524 | 300 | 300 | 300 | 300 | 300 | 300 | 150 |
| 17) Court | 215 | 215 | 215 | 215 | 215 | 165 | 165 | 221 | 395 | 395 | 405 | 389 | 389 | 389 | 389 | 389 | 379 | 927 | 654 | 654 | 654 | 582 | 582 | 582 | 215 |
| 18) Other (Average) | 215 | 215 | 215 | 215 | 215 | 165 | 165 | 221 | 395 | 395 | 405 | 389 | 389 | 389 | 389 | 389 | 379 | 927 | 654 | 654 | 654 | 582 | 582 | 582 | 215 |

## Table 5-10 Sample Sheet to Select Daily Peak Demand in a RGC



In the electrified RGCs, actual electrification rates of Business Entities, Hammer Mills, and Households are shown in Table 5-1, and these of Public Facilities in different types are summarized on Table 5-2. In Step B, however, 100% of electrification rates, instead of the actual electrification rates, for all types of consumers are adopted. This assumption that all of the Public Facilities, Business Entities, Hammer Mills, and Households in the 1,217 RGCs are electrified by 2030 seems to result in over estimation of the potential demand. However, as DoE and REA are planning to extend the electrification area from the 1,217 RGCs to the villages in the catchment areas of these RGCs after 2030, some supply margin on the design capacity of the electrification facilities needs to be considered, to be on the safe side. Therefore, after the discussions with DoE and REA, it was decided to apply 100% electrification rates for all the types of consumers to forecast the daily load of each RGC.

## 5.9. Forecast of Potential Demand for Unelectrified RGCs [Step 3]

Table 5-11 (from next page) shows the calculation result of the forecasted potential daily peak demand for the long listed 1,217 unelectrified RGCs. Among these unelectrified RGCs, BOMA (District Center) are give priority over the other RGCs. Then, RGCs other than BOMA are ranked by the size of potential demand (application of “Demand Criteria”). This is the temporary electrification order for 1,217 RGCs.

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (1/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 1 | Mpulungu Central | Mpulungu | 4 | Northern | 2,000 | 3,972 | 2,200,731 |
| 2 | Mwinilunga Boma | Mwinilunga | 0 | North-Western | 1,900 | 3,774 | 2,093,225 |
| 3 | Shangombo | Shangombo | 1 | Western | 1,100 | 2,185 | 1,277,541 |
| 4 | Boma | Luangwa | 1 | Lusaka | 580 | 1,152 | 752,118 |
| 5 | Chienge | Chienge | 6 | Luapula | 560 | 1,113 | 642,046 |
| 6 | Mpongwe | Mpongwe | 22 | Copperbelt | 441 | 876 | 499,270 |
| 7 | Nsama Sub Boma | Kaputa | 1 | Northern | 441 | 876 | 499,270 |
| 8 | Talayi | Milenge | 1 | Luapula | 202 | 402 | 241,663 |
| 9 | KPG Market | Kapiri Mposhi | 22 | Central | 7,400 | 14,697 | 8,141,484 |
| 10 | Chisanga | Kasama | 9 | Northern | 5,000 | 9,930 | 5,530,061 |
| 11 | Chindenza School | Katete | 3 | Eastern | 5,000 | 9,930 | 5,515,225 |
| 12 | Mtandaza RHC | Katete | 5 | Eastern | 5,000 | 9,930 | 5,509,327 |
| 13 | Kagoro | Katete | 1 | Eastern | 4,000 | 7,944 | 4,401,462 |
| 14 | Sikapila | Mporokoso | 2 | Northern | 3,646 | 7,241 | 4,012,551 |
| 15 | Kauwe | Kazungula | 14 | Southern | 3,511 | 6,973 | 3,927,399 |
| 16 | Palace Chipepo Mukuni-Ngombe | Kapiri Mposhi | 23 | Central | 3,500 | 6,951 | 3,847,529 |
| 17 | Twapia | Ndola | 2 | Copperbelt | 3,333 | 6,620 | 3,735,864 |
| 18 | Nchembwe | Kapiri Mposhi | 20 | Central | 3,100 | 6,157 | 3,416,570 |
| 19 | Kapungwe | Petauke | 1 | Eastern | 3,084 | 6,125 | 3,407,622 |
| 20 | Nyamphinga | Petauke | 10 | Eastern | 3,084 | 6,125 | 3,405,327 |
| 21 | Chikalawa | Petauke | 12 | Eastern | 3,084 | 6,125 | 3,402,990 |
| 22 | Mwanjawanthu | Petauke | 3 | Eastern | 3,036 | 6,030 | 3,345,943 |
| 23 | Kasenengwa Rural Centre | Chipata | 5 | Eastern | 3,000 | 5,958 | 3,321,933 |
| 24 | Kamphambe | Katete | 7 | Eastern | 3,000 | 5,958 | 3,308,596 |
| 25 | Sikatengwa | Lundazi | 22 | Eastern | 2,949 | 5,857 | 3,246,409 |
| 26 | Mushili | Samfa | 18 | Luapula | 2,751 | 5,464 | 3,032,798 |
| 27 | Madimawe Rural Health Centre | Chipata | 8 | Eastern | 2,667 | 5,297 | 2,953,674 |
| 28 | Matonje | Petauke | 13 | Eastern | 2,587 | 5,138 | 2,851,518 |
| 29 | Mumbi | Petauke | 5 | Eastern | 2,503 | 4,971 | 2,762,099 |
| 30 | Kawama East | Mufulira | 6 | Copperbelt | 2,448 | 4,862 | 2,732,408 |
| 31 | Chimutende, | Katete | 2 | Eastern | 2,472 | 4,910 | 2,728,967 |
| 32 | Thendere | Isoka | 4 | Northern | 2,400 | 4,767 | 2,698,020 |
| 33 | Ntipo | Isoka | 7 | Northern | 2,420 | 4,807 | 2,685,921 |
| 34 | Chinkhombe | Katete | 13 | Eastern | 2,385 | 4,737 | 2,634,234 |
| 35 | Mushindomo | Solwezi | 21 | North-Western | 2,380 | 4,727 | 2,628,469 |
| 36 | Mulekatembo | Isoka | 5 | Northern | 2,350 | 4,667 | 2,618,045 |
| 37 | Kaula | Kabompo | 14 | North-Western | 2,350 | 4,667 | 2,585,437 |
| 38 | Lukulu Township | Lukulu | 1 | Western | 2,012 | 3,996 | 2,512,048 |
| 39 | Nande | Senanga | 8 | Western | 2,148 | 4,266 | 2,393,483 |
| 40 | George Camp | Ndola | 4 | Copperbelt | 2,165 | 4,300 | 2,383,973 |
| 41 | Sansamwente | Isoka | 8 | Northern | 2,120 | 4,211 | 2,368,121 |
| 42 | Chipashi Island | Nchelenge | 13 | Luapula | 2,114 | 4,199 | 2,341,746 |
| 43 | Kasheke | Mongu | 38 | Western | 2,100 | 4,171 | 2,308,704 |
| 44 | Musakashi | Kalulushi | 2 | Copperbelt | 2,000 | 3,972 | 2,251,135 |
| 45 | Nyembe | Katete | 10 | Eastern | 2,000 | 3,972 | 2,210,561 |
| 46 | Sinunga | Senanga | 5 | Western | 1,990 | 3,953 | 2,207,358 |
| 47 | Muchabi | Mumbwa | 8 | Central | 2,000 | 3,972 | 2,202,071 |
| 48 | Mng'omba School | Katete | 4 | Eastern | 2,000 | 3,972 | 2,200,731 |
| 49 | Makuku | Mongu | 36 | Western | 2,000 | 3,972 | 2,200,731 |
| 50 | Kaulu | Petauke | 7 | Eastern | 1,988 | 3,949 | 2,192,975 |
| 51 | Mukupakaoma | Mporokoso | 1 | Northern | 1,974 | 3,921 | 2,176,903 |
| 52 | Lui-mwemba | Senanga | 4 | Western | 1,935 | 3,843 | 2,165,744 |
| 53 | Namabuka | Senanga | 18 | Western | 1,935 | 3,843 | 2,154,070 |
| 54 | Chishamwamba | Mporokoso | 5 | Northern | 1,930 | 3,833 | 2,135,790 |
| 55 | Mwimba | Lundazi | 24 | Eastern | 1,842 | 3,659 | 2,039,496 |
| 56 | Lukulu HC, Sch, Mkt | Mpika | 8 | Northern | 1,800 | 3,575 | 2,011,559 |
| 57 | Matipa | Chilubi | 2 | Northern | 1,817 | 3,609 | 2,001,136 |
| 58 | Ikelenge | Mwinilunga | 2 | North-Western | 1,763 | 3,502 | 1,995,148 |
| 59 | Likondwana | Shangombo | 17 | Western | 1,800 | 3,575 | 1,990,633 |
| 60 | Chitoshi | Mporokoso | 3 | Northern | 1,730 | 3,436 | 1,905,310 |
| 61 | Nasilimwe | Senanga | 13 | Western | 1,634 | 3,246 | 1,823,877 |
| 62 | Mulundu | Mwense | 20 | Luapula | 1,584 | 3,146 | 1,822,353 |
| 63 | Nyamphande NSS | Petauke | 4 | Eastern | 1,650 | 3,277 | 1,819,103 |
| 64 | Monde | Petauke | 9 | Eastern | 1,650 | 3,277 | 1,817,477 |
| 65 | Nasilimwe_ | Senanga | 15 | Western | 1,634 | 3,246 | 1,817,115 |
| 66 | Nalolo | Senanga | 7 | Western | 1,634 | 3,246 | 1,810,953 |
| 67 | Sasali | Petauke | 6 | Eastern | 1,608 | 3,194 | 1,781,938 |
| 68 | Chikowa | Petauke | 8 | Eastern | 1,608 | 3,194 | 1,780,008 |
| 69 | Liliachi | Senanga | 3 | Western | 1,533 | 3,045 | 1,715,109 |
| 70 | Nangucha | Senanga | 9 | Western | 1,511 | 3,001 | 1,699,508 |
| 71 | Chitawe RHC | Katete | 6 | Eastern | 1,500 | 2,979 | 1,661,798 |
| 72 | Bwalinde | Luwingu | 25 | Northern | 1,500 | 2,979 | 1,661,798 |
| 73 | Murundu | Mufulira | 4 | Copperbelt | 1,476 | 2,932 | 1,658,437 |
| 74 | Luansobe | Mufulira | 2 | Copperbelt | 1,488 | 2,956 | 1,651,057 |
| 75 | Kaunga Mashi | Shangombo | 15 | Western | 1,474 | 2,928 | 1,626,387 |
| 76 | SITULU | Kalabo | 29 | Western | 1,472 | 2,924 | 1,621,102 |
| 77 | Big Concession | Mumbwa | 1 | Central | 1,463 | 2,906 | 1,612,692 |
| 78 | Township | Kawambwa | 9 | Luapula | 1,281 | 2,545 | 1,608,850 |
| 79 | Chasela | Lundazi | 25 | Eastern | 1,444 | 2,868 | 1,594,939 |
| 80 | Lwanda | Kalabo | 22 | Western | 1,436 | 2,852 | 1,591,204 |
| 81 | Ngundi | Senanga | 14 | Western | 1,398 | 2,777 | 1,557,863 |
| 82 | Silumbi | Senanga | 6 | Western | 1,398 | 2,777 | 1,554,040 |
| 83 | Muyombe | Isoka | 1 | Northern | 1,340 | 2,662 | 1,543,584 |
| 84 | Misolo | Petauke | 11 | Eastern | 1,398 | 2,777 | 1,541,581 |
| 85 | Kazabami | Kaoma | 42 | Western | 1,385 | 2,751 | 1,525,276 |
| 86 | Kafumbwe School | Katete | 14 | Eastern | 1,308 | 2,598 | 1,468,131 |
| 87 | Natukoma | Shangombo | 8 | Western | 1,312 | 2,606 | 1,452,188 |
| 88 | Chinyingi | Zambezi | 18 | North-Western | 1,307 | 2,596 | 1,437,859 |
| 89 | Mbeza | Namwala | 5 | Southern | 1,283 | 2,548 | 1,433,278 |
| 90 | Kawanda | Kabompo | 13 | North-Western | 1,300 | 2,582 | 1,431,318 |
| 91 | Kaba Hill | Kaoma | 39 | Western | 1,287 | 2,556 | 1,420,511 |
| 92 | Mulela | Mpongwe | 12 | Copperbelt | 1,270 | 2,523 | 1,408,669 |
| 93 | St. Anthony | Mpongwe | 21 | Copperbelt | 1,270 | 2,523 | 1,403,754 |
| 94 | Nakamboma (Namakaka) | Namwala | 11 | Southern | 1,250 | 2,483 | 1,398,475 |
| 95 | Kafwimbi | Isoka | 2 | Northern | 1,230 | 2,443 | 1,388,576 |
| 96 | Kapatu | Mporokoso | 14 | Northern | 1,200 | 2,384 | 1,369,252 |
| 97 | Chilasa | Katete | 8 | Eastern | 1,215 | 2,413 | 1,337,361 |
| 98 | Katibunga | Mpika | 5 | Northern | 1,200 | 2,384 | 1,335,519 |
| 99 | Lukali Community School | Kabwe | 6 | Central | 1,200 | 2,384 | 1,328,418 |
| 100 | Sinde | Kazungula | 15 | Southern | 1,200 | 2,384 | 1,323,812 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (2/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 101 | Mwiima | Chilubi | 14 | Northern | 1,192 | 2,368 | 1,316,337 |
| 102 | Chalabesa Hospital | Mpika | 4 | Northern | 1,167 | 2,318 | 1,303,700 |
| 103 | Kawngu | Isoka | 3 | Northern | 1,125 | 2,235 | 1,251,248 |
| 104 | Kampumbu (Kamrinsu) | Isoka | 6 | Northern | 1,102 | 2,189 | 1,231,982 |
| 105 | Muwele | Mpika | 17 | Northern | 1,100 | 2,185 | 1,228,814 |
| 106 | Moobola | Namwala | 2 | Southern | 1,083 | 2,151 | 1,221,232 |
| 107 | Mupamadzi Farm Block | Mpika | 3 | Northern | 1,100 | 2,185 | 1,221,213 |
| 108 | Chilanga_ | Mambwe | 13 | Eastern | 1,100 | 2,185 | 1,215,839 |
| 109 | Katutwa | Mporokoso | 9 | Northern | 1,100 | 2,185 | 1,215,839 |
| 110 | Mwense | Mwense | 18 | Luapula | 1,013 | 2,012 | 1,212,634 |
| 111 | Ukwimi | Petauke | 2 | Eastern | 1,070 | 2,125 | 1,194,181 |
| 112 | Kasaba | Samfa | 16 | Luapula | 1,023 | 2,032 | 1,193,337 |
| 113 | Mpepo HC, Sch, Palace | Mpika | 6 | Northern | 1,050 | 2,086 | 1,178,152 |
| 114 | Itapa | Namwala | 3 | Southern | 1,000 | 1,986 | 1,146,383 |
| 115 | Mbati | Mpika | 18 | Northern | 1,000 | 1,986 | 1,145,733 |
| 116 | Sipuma | Shangombo | 16 | Western | 1,023 | 2,032 | 1,132,773 |
| 117 | Mulele | Shangombo | 9 | Western | 1,017 | 2,020 | 1,128,725 |
| 118 | Kaindu | Mumbwa | 11 | Central | 1,000 | 1,986 | 1,125,917 |
| 119 | Baambwe | Namwala | 1 | Southern | 1,000 | 1,986 | 1,125,502 |
| 120 | Simakumba | Lukulu | 7 | Western | 1,000 | 1,986 | 1,116,242 |
| 121 | Kaunga Lueti | Senanga | 11 | Western | 992 | 1,971 | 1,115,114 |
| 122 | Mansha Farm Block | Mpika | 2 | Northern | 1,000 | 1,986 | 1,114,908 |
| 123 | Tuuwa | Kalabo | 26 | Western | 1,006 | 1,998 | 1,113,472 |
| 124 | Nile Kapambwe | Nchelenge | 4 | Luapula | 1,000 | 1,986 | 1,112,230 |
| 125 | Matunga School | Katete | 12 | Eastern | 1,000 | 1,986 | 1,108,465 |
| 126 | Naviluri | Chadiza | 7 | Eastern | 1,000 | 1,986 | 1,107,865 |
| 127 | Mano | Samfa | 19 | Luapula | 1,000 | 1,986 | 1,107,865 |
| 128 | Munshinga | Luwingu | 23 | Northern | 1,000 | 1,986 | 1,107,865 |
| 129 | Likutwe | Mongu | 37 | Western | 1,000 | 1,986 | 1,107,865 |
| 130 | Chifulube | Luanshya | 2 | Copperbelt | 992 | 1,971 | 1,106,950 |
| 131 | Kalilo | Chingola | 3 | Copperbelt | 953 | 1,893 | 1,079,160 |
| 132 | Mutenda | Chingola | 6 | Copperbelt | 954 | 1,895 | 1,078,866 |
| 133 | Kamiteta | Chingola | 1 | Copperbelt | 950 | 1,887 | 1,069,442 |
| 134 | Mutaba | Masaiti | 1 | Copperbelt | 960 | 1,907 | 1,061,796 |
| 135 | Mutundu North (Conner Bar) | Mufulira | 1 | Copperbelt | 952 | 1,891 | 1,061,520 |
| 136 | Chinsanka | Samfa | 1 | Luapula | 914 | 1,816 | 1,049,654 |
| 137 | Lukwesa | Mwense | 14 | Luapula | 944 | 1,875 | 1,040,539 |
| 138 | Mabo Kafutuma | Nchelenge | 14 | Luapula | 932 | 1,851 | 1,036,124 |
| 139 | Musangu | Mwense | 15 | Luapula | 917 | 1,822 | 1,034,612 |
| 140 | Ngabo | Namwala | 7 | Southern | 917 | 1,822 | 1,021,934 |
| 141 | Beshe | Shangombo | 10 | Western | 912 | 1,812 | 1,017,937 |
| 142 | Chilese | Masaiti | 13 | Copperbelt | 909 | 1,806 | 1,017,488 |
| 143 | Lubwe | Samfa | 17 | Luapula | 841 | 1,671 | 1,015,104 |
| 144 | Kaf GRZ | Masaiti | 3 | Copperbelt | 909 | 1,806 | 1,013,898 |
| 145 | Mupambe | Mufulira | 7 | Copperbelt | 900 | 1,788 | 1,000,359 |
| 146 | Ncheka_ | Mambwe | 12 | Eastern | 900 | 1,788 | 1,000,359 |
| 147 | Kanfinsa | Luwingu | 24 | Northern | 900 | 1,788 | 1,000,359 |
| 148 | Chilwa | Kapiri Mposhi | 9 | Central | 892 | 1,772 | 996,433 |
| 149 | Mata | Senanga | 10 | Western | 878 | 1,744 | 993,470 |
| 150 | Songa | Senanga | 12 | Western | 878 | 1,744 | 992,378 |
| 151 | Mwanamwalye | Senanga | 16 | Western | 878 | 1,744 | 988,485 |
| 152 | Kantanta | Chilubi | 13 | Northern | 887 | 1,762 | 988,212 |
| 153 | Chichile | Chilubi | 6 | Northern | 863 | 1,714 | 950,786 |
| 154 | Luamba | Kaoma | 40 | Western | 860 | 1,708 | 947,983 |
| 155 | Mwase | Lundazi | 1 | Eastern | 797 | 1,583 | 947,541 |
| 156 | Mumba | Mumbwa | 14 | Central | 850 | 1,689 | 940,446 |
| 157 | Mofu R4 | Chilubi | 16 | Northern | 849 | 1,687 | 938,172 |
| 158 | Muchila | Namwala | 6 | Southern | 833 | 1,655 | 937,271 |
| 159 | Kantengwa | Namwala | 9 | Southern | 833 | 1,655 | 935,323 |
| 160 | Nangula | Mongu | 1 | Western | 821 | 1,631 | 930,972 |
| 161 | Matondo | Zambezi | 14 | North-Western | 840 | 1,669 | 929,762 |
| 162 | Liangati | Senanga | 21 | Western | 800 | 1,589 | 927,702 |
| 163 | Ipafu | Chingola | 4 | Copperbelt | 800 | 1,589 | 926,433 |
| 164 | Emusa | Lundazi | 2 | Eastern | 797 | 1,583 | 926,078 |
| 165 | Lukalanys | Mongu | 4 | Western | 834 | 1,657 | 925,496 |
| 166 | Kalengola | Shangombo | 6 | Western | 826 | 1,641 | 925,019 |
| 167 | Nangweshi | Shangombo | 4 | Western | 800 | 1,589 | 924,841 |
| 168 | Chiwele | Chilubi | 11 | Northern | 824 | 1,637 | 914,812 |
| 169 | Josias Chiwala Farm | Kabwe | 7 | Central | 820 | 1,629 | 914,309 |
| 170 | Mupapa | Masaiti | 5 | Copperbelt | 818 | 1,625 | 913,649 |
| 171 | Kataba | Senanga | 17 | Western | 799 | 1,587 | 910,948 |
| 172 | Kachuma | Kasama | 1 | Northern | 805 | 1,599 | 900,733 |
| 173 | Chilanga | Mambwe | 9 | Eastern | 800 | 1,589 | 897,768 |
| 174 | Mwansabombwe | Kawambwa | 15 | Luapula | 750 | 1,490 | 893,832 |
| 175 | keezwa | Mumbwa | 7 | Central | 800 | 1,589 | 893,726 |
| 176 | Katanhsya | Samfa | 7 | Luapula | 786 | 1,561 | 893,334 |
| 177 | Maimwene settlement | Mumbwa | 5 | Central | 800 | 1,589 | 892,386 |
| 178 | Kawasa | Chilubi | 15 | Northern | 800 | 1,589 | 892,386 |
| 179 | Isoko | Mpulungu | 6 | Northern | 800 | 1,589 | 892,386 |
| 180 | Chilumba | Mpulungu | 12 | Northern | 800 | 1,589 | 892,386 |
| 181 | Dipalata | Zambezi | 5 | North-Western | 800 | 1,589 | 892,386 |
| 182 | Ikabako | Mongu | 40 | Western | 800 | 1,589 | 892,386 |
| 183 | Mimbula Block | Chingola | 2 | Copperbelt | 780 | 1,550 | 870,943 |
| 184 | Kabole | Chienge | 7 | Luapula | 730 | 1,450 | 867,114 |
| 185 | Chabukasansha | Chilubi | 23 | Northern | 787 | 1,563 | 865,238 |
| 186 | Kambashi | Chilubi | 1 | Northern | 715 | 1,420 | 861,662 |
| 187 | Mwansakombe | Samfa | 14 | Luapula | 767 | 1,524 | 856,639 |
| 188 | Kangomba Health Centre | Kabwe | 10 | Central | 770 | 1,530 | 852,925 |
| 189 | Mayuka | Chilubi | 5 | Northern | 762 | 1,514 | 842,346 |
| 190 | Ichila | Namwala | 13 | Southern | 750 | 1,490 | 839,343 |
| 191 | Siluwe | Kalabo | 23 | Western | 755 | 1,500 | 835,805 |
| 192 | Mokambo | Mufulira | 3 | Copperbelt | 719 | 1,428 | 832,900 |
| 193 | Lambwe Chomba | Chienge | 2 | Luapula | 720 | 1,430 | 832,044 |
| 194 | Kaande | Mongu | 13 | Western | 746 | 1,482 | 827,395 |
| 195 | Mundubi | Samfa | 15 | Luapula | 716 | 1,422 | 815,642 |
| 196 | Sianda | Senanga | 1 | Western | 711 | 1,413 | 807,323 |
| 197 | Mununga | Chienge | 9 | Luapula | 710 | 1,411 | 805,208 |
| 198 | Sitoti | Shangombo | 5 | Western | 710 | 1,411 | 799,948 |
| 199 | Mutomena | Shangombo | 7 | Western | 706 | 1,403 | 797,194 |
| 200 | Madziayera | Chadiza | 13 | Eastern | 710 | 1,411 | 794,224 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (3/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 201 | Kashitu | Chilubi | 18 | Northern | 705 | 1,401 | 792,232 |
| 202 | Katima | Sesheke | 3 | Western | 685 | 1,361 | 790,330 |
| 203 | Kasamanda | Mambwe | 4 | Eastern | 670 | 1,331 | 784,002 |
| 204 | Chiwena | Mumbwa | 15 | Central | 700 | 1,391 | 775,152 |
| 205 | Chibwika | Mwinilunga | 8 | North-Western | 697 | 1,385 | 773,525 |
| 206 | Sakandingo | Kabompo | 2 | North-Western | 685 | 1,361 | 771,159 |
| 207 | Mutamba | Mufulira | 8 | Copperbelt | 700 | 1,391 | 769,880 |
| 208 | Zingalume | Chadiza | 15 | Eastern | 700 | 1,391 | 769,880 |
| 209 | Isunga | Mpulungu | 13 | Northern | 700 | 1,391 | 769,880 |
| 210 | Milomboyi | Zambezi | 12 | North-Western | 700 | 1,391 | 769,880 |
| 211 | Mubili | Chilubi | 7 | Northern | 691 | 1,373 | 761,470 |
| 212 | Shinono | Kaoma | 7 | Western | 656 | 1,303 | 760,211 |
| 213 | Matebele | Shangombo | 11 | Western | 680 | 1,351 | 759,172 |
| 214 | Nyela | Nakonde | 6 | Northern | 656 | 1,303 | 758,766 |
| 215 | Mabo-Ninge | Samfa | 6 | Luapula | 648 | 1,287 | 758,703 |
| 216 | Lubunda | Mwense | 17 | Luapula | 664 | 1,319 | 751,284 |
| 217 | Puta | Chienge | 5 | Luapula | 620 | 1,232 | 749,854 |
| 218 | Katongo Kapala | Mpika | 12 | Northern | 650 | 1,291 | 729,504 |
| 219 | Egichakeni | Lundazi | 5 | Eastern | 638 | 1,268 | 728,160 |
| 220 | Miulwe | Mongu | 22 | Western | 655 | 1,301 | 727,831 |
| 221 | Kambowa | Masaiti | 8 | Copperbelt | 650 | 1,291 | 727,603 |
| 222 | Twingi | Samfa | 3 | Luapula | 640 | 1,272 | 726,560 |
| 223 | Magumwi | Sesheke | 11 | Western | 651 | 1,293 | 726,119 |
| 224 | Mufubushi Resettlement | Mpika | 7 | Northern | 650 | 1,291 | 725,870 |
| 225 | Nkhanga | Lundazi | 19 | Eastern | 640 | 1,272 | 723,299 |
| 226 | Mukangu | Mongu | 30 | Western | 648 | 1,287 | 721,290 |
| 227 | Chilolwa | Nakonde | 4 | Northern | 600 | 1,192 | 721,029 |
| 228 | M_Mphanga | Lundazi | 4 | Eastern | 618 | 1,228 | 718,733 |
| 229 | Nakato | Mongu | 16 | Western | 645 | 1,281 | 718,487 |
| 230 | Lucembe | Mpika | 11 | Northern | 620 | 1,232 | 709,285 |
| 231 | Lupiya | Chienge | 1 | Luapula | 600 | 1,192 | 708,616 |
| 232 | Mulenga M | Mporokoso | 16 | Northern | 600 | 1,192 | 707,346 |
| 233 | Lwata | Luwingu | 25 | Northern | 630 | 1,252 | 704,938 |
| 234 | Chilubula | Kasama | 11 | Northern | 615 | 1,222 | 704,161 |
| 235 | Mchereka | Lundazi | 13 | Eastern | 618 | 1,228 | 701,009 |
| 236 | Kawena | Chilubi | 9 | Northern | 623 | 1,238 | 698,397 |
| 237 | Mwenda | Mwense | 21 | Luapula | 600 | 1,192 | 687,254 |
| 238 | Kakolo | Kitwe | 1 | Copperbelt | 600 | 1,192 | 679,323 |
| 239 | Nawinda | Sesheke | 10 | Western | 613 | 1,218 | 676,829 |
| 240 | Kasembe | Chienge | 3 | Luapula | 590 | 1,172 | 675,608 |
| 241 | Chiunda Ponde | Mpika | 15 | Northern | 590 | 1,172 | 674,171 |
| 242 | Chipepa | Kawambwa | 13 | Luapula | 603 | 1,198 | 672,612 |
| 243 | Mpusu | Mumbwa | 12 | Central | 600 | 1,192 | 671,111 |
| 244 | Keyana | Shangombo | 18 | Western | 601 | 1,194 | 666,256 |
| 245 | Kapeya Farms | Katete | 9 | Eastern | 600 | 1,192 | 665,346 |
| 246 | Ndau | Mongu | 20 | Western | 603 | 1,198 | 664,709 |
| 247 | Nambolomoka | Shangombo | 20 | Western | 600 | 1,192 | 664,229 |
| 248 | Chinunda | Chipata | 11 | Eastern | 600 | 1,192 | 663,246 |
| 249 | Lukulu RR Scheme | Kasama | 13 | Northern | 600 | 1,192 | 662,506 |
| 250 | Mbilimamwenge | Samfa | 5 | Luapula | 586 | 1,164 | 662,018 |
| 251 | Mawawa | Mongu | 10 | Western | 600 | 1,192 | 661,906 |
| 252 | Sinjembela | Shangombo | 14 | Western | 593 | 1,178 | 659,764 |
| 253 | Makaba | Namwala | 8 | Southern | 583 | 1,158 | 657,604 |
| 254 | Kasanka | Samfa | 2 | Luapula | 565 | 1,123 | 655,828 |
| 255 | Chalabesa | Mporokoso | 11 | Northern | 590 | 1,172 | 653,590 |
| 256 | Lukweta | Mongu | 12 | Western | 584 | 1,160 | 646,956 |
| 257 | Mayukwayukwa | Kaoma | 9 | Western | 564 | 1,121 | 644,531 |
| 258 | Kaloko | Masaiti | 2 | Copperbelt | 571 | 1,134 | 644,123 |
| 259 | Mnauke | Lundazi | 15 | Eastern | 571 | 1,134 | 637,758 |
| 260 | Henry Kapata | Kasama | 10 | Northern | 570 | 1,132 | 636,868 |
| 261 | Mutotosho | Mporokoso | 7 | Northern | 573 | 1,138 | 636,677 |
| 262 | Muchinshi | Chingola | 5 | Copperbelt | 537 | 1,067 | 636,432 |
| 263 | Sibukali | Senanga | 2 | Western | 554 | 1,101 | 635,651 |
| 264 | Nalwei | Mongu | 2 | Western | 566 | 1,125 | 631,696 |
| 265 | Kapala | Mwense | 13 | Luapula | 567 | 1,127 | 630,604 |
| 266 | Kalumwange | Kaoma | 3 | Western | 553 | 1,099 | 629,225 |
| 267 | Luampungu | Sesheke | 16 | Western | 554 | 1,101 | 621,073 |
| 268 | Mule | Chilubi | 21 | Northern | 551 | 1,095 | 616,587 |
| 269 | Chikumbi | Masaiti | 9 | Copperbelt | 539 | 1,071 | 613,110 |
| 270 | Malaila | Mporokoso | 15 | Northern | 510 | 1,013 | 608,717 |
| 271 | Kanama | Chilubi | 20 | Northern | 542 | 1,077 | 608,178 |
| 272 | Kanama_ | Chilubi | 24 | Northern | 542 | 1,077 | 608,178 |
| 273 | Ilendela | Nakonde | 2 | Northern | 514 | 1,021 | 607,530 |
| 274 | Chinondo | Masaiti | 4 | Copperbelt | 530 | 1,053 | 606,768 |
| 275 | Kaf Miss | Masaiti | 12 | Copperbelt | 532 | 1,057 | 604,603 |
| 276 | Likungu | Zambezi | 15 | North-Western | 534 | 1,061 | 600,703 |
| 277 | Mporokoso | Mporokoso | 13 | Northern | 500 | 993 | 599,994 |
| 278 | Wulongo | Nakonde | 1 | Northern | 500 | 993 | 599,967 |
| 279 | Kantongo | Nakonde | 3 | Northern | 500 | 993 | 589,901 |
| 280 | Mushota | Kawambwa | 2 | Luapula | 500 | 993 | 587,344 |
| 281 | Nsefu | Mambwe | 7 | Eastern | 523 | 1,039 | 583,496 |
| 282 | Shibuyunji | Mumbwa | 2 | Central | 500 | 993 | 580,710 |
| 283 | Namakube | Monze | 22 | Southern | 514 | 1,021 | 579,258 |
| 284 | Mwewa | Samfa | 13 | Luapula | 501 | 995 | 579,257 |
| 285 | Sakania | Ndola | 3 | Copperbelt | 500 | 993 | 578,859 |
| 286 | Kaanja | Shangombo | 13 | Western | 518 | 1,029 | 577,460 |
| 287 | Nasange | Mongu | 28 | Western | 525 | 1,043 | 577,293 |
| 288 | Salanga | Kawambwa | 8 | Luapula | 500 | 993 | 577,010 |
| 289 | Kanchibiya Farm Block | Mpika | 1 | Northern | 515 | 1,023 | 573,628 |
| 290 | Sioma | Shangombo | 2 | Western | 500 | 993 | 573,556 |
| 291 | Makunka | Kazungula | 4 | Southern | 482 | 958 | 573,137 |
| 292 | Kamphasa_ | Mambwe | 14 | Eastern | 520 | 1,033 | 572,621 |
| 293 | Niko | Namwala | 4 | Southern | 500 | 993 | 571,985 |
| 294 | Mukungule | Mpika | 14 | Northern | 492 | 978 | 569,414 |
| 295 | Kawiku | Mwinilunga | 20 | North-Western | 512 | 1,017 | 568,904 |
| 296 | St. Joseph | Lufwanyama | 42 | Copperbelt | 500 | 993 | 568,157 |
| 297 | Namono | Shangombo | 19 | Western | 512 | 1,017 | 567,469 |
| 298 | Malama | Mporokoso | 12 | Northern | 513 | 1,019 | 566,080 |
| 299 | Kabinga | Mpika | 16 | Northern | 493 | 980 | 564,767 |
| 300 | Rufunsa | Chongwe | 2 | Lusaka | 507 | 1,007 | 563,380 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (4/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 301 | Mukumbo | Lufwanyama | 12 | Copperbelt | 500 | 993 | 562,696 |
| 302 | Kanyemba | Mwense | 8 | Luapula | 500 | 993 | 559,250 |
| 303 | Ncheka | Mambwe | 8 | Eastern | 500 | 993 | 558,267 |
| 304 | Kapofu | Chilubi | 10 | Northern | 504 | 1,001 | 557,670 |
| 305 | Kalundwans | Mongu | 5 | Western | 502 | 997 | 555,802 |
| 306 | Lukanga | Mpongwe | 4 | Copperbelt | 500 | 993 | 553,933 |
| 307 | Kapirimphika | Chadiza | 12 | Eastern | 500 | 993 | 553,933 |
| 308 | Isangano | Luwingu | 24 | Northern | 500 | 993 | 553,933 |
| 309 | Mudunyama | Mwinilunga | 21 | North-Western | 500 | 993 | 553,933 |
| 310 | Chitupila | Chilubi | 8 | Northern | 499 | 991 | 552,998 |
| 311 | Luandui | Mongu | 34 | Western | 499 | 991 | 552,998 |
| 312 | Simulumbe | Mongu | 3 | Western | 493 | 980 | 548,202 |
| 313 | Mabumbu | Sesheke | 7 | Western | 490 | 974 | 547,722 |
| 314 | Kalobwa | Chienge | 12 | Luapula | 475 | 944 | 547,328 |
| 315 | Mweeke | Mongu | 23 | Western | 490 | 974 | 545,056 |
| 316 | Nkhoko | Mambwe | 5 | Eastern | 480 | 954 | 542,995 |
| 317 | Chasefu | Lundazi | 6 | Eastern | 473 | 940 | 537,890 |
| 318 | Chalata | Mkushi | 2 | Central | 441 | 876 | 537,200 |
| 319 | Emerald Mining Area | Lufwanyama | 1 | Copperbelt | 441 | 876 | 535,746 |
| 320 | Chambeshi Sch, Mkt | Mpika | 9 | Northern | 450 | 894 | 534,029 |
| 321 | Chipunka | Kawambwa | 18 | Luapula | 455 | 904 | 533,907 |
| 322 | Kalembwe | Chienge | 10 | Luapula | 450 | 894 | 533,146 |
| 323 | Ntambu | Mwinilunga | 1 | North-Western | 416 | 827 | 532,399 |
| 324 | Nsumbu RH | Chilubi | 19 | Northern | 476 | 946 | 531,974 |
| 325 | Namengo | Mongu | 26 | Western | 476 | 946 | 531,974 |
| 326 | Njola Camp | Monze | 27 | Southern | 450 | 894 | 529,553 |
| 327 | Ngoli | Mungwi | 3 | Northern | 472 | 938 | 528,237 |
| 328 | Chibale | Serenje | 1 | Central | 441 | 876 | 521,726 |
| 329 | Myooye | Mumbwa | 3 | Central | 450 | 894 | 521,326 |
| 330 | Mukando | Serenje | 3 | Central | 441 | 876 | 519,945 |
| 331 | Itumbi | Itezhi-tezhi | 4 | Southern | 462 | 918 | 518,892 |
| 332 | Kawama | Chiliabombwe | 3 | Copperbelt | 450 | 894 | 518,757 |
| 333 | Fikola | Kapiri Mposhi | 15 | Central | 441 | 876 | 518,472 |
| 334 | Chishimba | Kasama | 12 | Northern | 450 | 894 | 516,229 |
| 335 | Chilumba | Kapiri Mposhi | 12 | Central | 441 | 876 | 514,483 |
| 336 | Nankaga | Kafue | 6 | Lusaka | 441 | 876 | 513,777 |
| 337 | Bbombo | Monze | 29 | Southern | 450 | 894 | 513,461 |
| 338 | Fube | Chilubi | 4 | Northern | 456 | 906 | 513,286 |
| 339 | Nchimishi | Serenje | 2 | Central | 441 | 876 | 512,769 |
| 340 | Chankomo | Kapiri Mposhi | 14 | Central | 441 | 876 | 512,245 |
| 341 | Old Mkushi | Mkushi | 1 | Central | 421 | 837 | 510,794 |
| 342 | Kafulu | Kapiri Mposhi | 18 | Central | 441 | 876 | 510,550 |
| 343 | Mpelembe | Serenje | 7 | Central | 441 | 876 | 509,458 |
| 344 | Ndabala | Serenje | 6 | Central | 441 | 876 | 508,668 |
| 345 | Kabweza | Kafue | 9 | Lusaka | 441 | 876 | 508,564 |
| 346 | Kabanga | Kalomo | 2 | Southern | 441 | 876 | 508,325 |
| 347 | Muyembe | Zambezi | 19 | North-Western | 450 | 894 | 507,680 |
| 348 | Njelele | Serenje | 4 | Central | 441 | 876 | 506,508 |
| 349 | Chalilo | Serenje | 5 | Central | 441 | 876 | 506,151 |
| 350 | Liande | Mongu | 29 | Western | 448 | 890 | 505,811 |
| 351 | Nkandanzovu | Kalomo | 3 | Southern | 441 | 876 | 505,526 |
| 352 | Napatizya | Kalomo | 1 | Southern | 441 | 876 | 505,143 |
| 353 | Mbereshi | Kawambwa | 17 | Luapula | 400 | 795 | 504,582 |
| 354 | Lunchu | Kapiri Mposhi | 4 | Central | 441 | 876 | 503,993 |
| 355 | Mukubwe | Kapiri Mposhi | 10 | Central | 441 | 876 | 503,993 |
| 356 | Kaungeta | Mongu | 14 | Western | 446 | 886 | 503,942 |
| 357 | Gibson | Serenje | 8 | Central | 441 | 876 | 503,726 |
| 358 | Machende | Serenje | 9 | Central | 441 | 876 | 503,202 |
| 359 | Luyaba | Kalomo | 4 | Southern | 441 | 876 | 503,085 |
| 360 | Kanchele | Kalomo | 6 | Southern | 441 | 876 | 503,085 |
| 361 | Bbilili | Kalomo | 7 | Southern | 441 | 876 | 503,085 |
| 362 | Chilala | Kalomo | 8 | Southern | 441 | 876 | 503,085 |
| 363 | Mabombo | Kalomo | 9 | Southern | 441 | 876 | 503,085 |
| 364 | Likumbo | Kapiri Mposhi | 3 | Central | 441 | 876 | 502,957 |
| 365 | Kasukwe | Kalomo | 5 | Southern | 441 | 876 | 502,593 |
| 366 | Nakatambo | Serenje | 13 | Central | 441 | 876 | 502,429 |
| 367 | Kofi Kunda | Serenje | 16 | Central | 441 | 876 | 502,219 |
| 368 | Sichili | Sesheke | 1 | Western | 402 | 799 | 502,063 |
| 369 | Katikululu | Serenje | 11 | Central | 441 | 876 | 501,955 |
| 370 | Katongo | Serenje | 12 | Central | 441 | 876 | 501,767 |
| 371 | Kafumba | Kapiri Mposhi | 13 | Central | 441 | 876 | 501,703 |
| 372 | Mphamba | Lundazi | 21 | Eastern | 441 | 876 | 501,670 |
| 373 | Mubalashi | Kapiri Mposhi | 16 | Central | 441 | 876 | 500,983 |
| 374 | Simakakata | Kalomo | 10 | Southern | 441 | 876 | 500,953 |
| 375 | Mutala | Kalomo | 11 | Southern | 441 | 876 | 500,953 |
| 376 | Darphan | Kalomo | 14 | Southern | 441 | 876 | 500,953 |
| 377 | Lukanda | Kapiri Mposhi | 6 | Central | 441 | 876 | 500,610 |
| 378 | Chipundu | Serenje | 10 | Central | 441 | 876 | 500,610 |
| 379 | Mailo | Serenje | 17 | Central | 441 | 876 | 500,610 |
| 380 | C. Saili | Serenje | 18 | Central | 441 | 876 | 500,610 |
| 381 | Kawama | Serenje | 19 | Central | 441 | 876 | 500,610 |
| 382 | Masase | Serenje | 20 | Central | 441 | 876 | 500,610 |
| 383 | Mpande | Serenje | 21 | Central | 441 | 876 | 500,610 |
| 384 | C. Serenje | Serenje | 22 | Central | 441 | 876 | 500,610 |
| 385 | Chisale | Katete | 15 | Eastern | 441 | 876 | 500,610 |
| 386 | Kafunka | Katete | 16 | Eastern | 441 | 876 | 500,610 |
| 387 | Kazonde | Lundazi | 23 | Eastern | 441 | 876 | 500,363 |
| 388 | Chikoli | Kalomo | 12 | Southern | 441 | 876 | 499,613 |
| 389 | Kinnertone | Kalomo | 13 | Southern | 441 | 876 | 499,613 |
| 390 | Mubofwa | Kapiri Mposhi | 5 | Central | 441 | 876 | 499,270 |
| 391 | Lubuto | Kapiri Mposhi | 17 | Central | 441 | 876 | 499,270 |
| 392 | Kaswende | Kapiri Mposhi | 19 | Central | 441 | 876 | 499,270 |
| 393 | Masansa | Kapiri Mposhi | 21 | Central | 441 | 876 | 499,270 |
| 394 | Musangashi | Serenje | 14 | Central | 441 | 876 | 499,270 |
| 395 | Nsala | Serenje | 15 | Central | 441 | 876 | 499,270 |
| 396 | Ibenga | Mpongwe | 23 | Copperbelt | 441 | 876 | 499,270 |
| 397 | Chikonka | Chadiza | 8 | Eastern | 441 | 876 | 499,270 |
| 398 | Mchenjera | Chadiza | 9 | Eastern | 441 | 876 | 499,270 |
| 399 | Chigwe | Chadiza | 10 | Eastern | 441 | 876 | 499,270 |
| 400 | Kapachi | Chadiza | 11 | Eastern | 441 | 876 | 499,270 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (5/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 401 | Kalemba | Chadiza | 14 | Eastern | 441 | 876 | 499,270 |
| 402 | Kaozi Settlement | Chama | 2 | Eastern | 441 | 876 | 499,270 |
| 403 | Kalimankonde | Samfa | 20 | Luapula | 441 | 876 | 499,270 |
| 404 | Kapilibila | Samfa | 21 | Luapula | 441 | 876 | 499,270 |
| 405 | Kapumbu | Samfa | 22 | Luapula | 441 | 876 | 499,270 |
| 406 | Maela | Chilubi | 12 | Northern | 441 | 876 | 499,270 |
| 407 | Bukotelo | Chilubi | 17 | Northern | 441 | 876 | 499,270 |
| 408 | Chilamba | Chilubi | 22 | Northern | 441 | 876 | 499,270 |
| 409 | Kampinda | Kaputa | 2 | Northern | 441 | 876 | 499,270 |
| 410 | Munwa | Kaputa | 3 | Northern | 441 | 876 | 499,270 |
| 411 | Masonde Farming Block | Luwingu | 1 | Northern | 441 | 876 | 499,270 |
| 412 | Ipusukilo Mission | Luwingu | 2 | Northern | 441 | 876 | 499,270 |
| 413 | Njeke Basic School | Luwingu | 3 | Northern | 441 | 876 | 499,270 |
| 414 | Chiponde Basic School and Chief Chipalo's Palace | Luwingu | 4 | Northern | 441 | 876 | 499,270 |
| 415 | Chitofwe Basic School | Luwingu | 5 | Northern | 441 | 876 | 499,270 |
| 416 | Tolopa Basic School | Luwingu | 6 | Northern | 441 | 876 | 499,270 |
| 417 | Nsanja Basic School | Luwingu | 7 | Northern | 441 | 876 | 499,270 |
| 418 | Menga Basic School and Clinic | Luwingu | 8 | Northern | 441 | 876 | 499,270 |
| 419 | Chakungubala Basic School | Luwingu | 9 | Northern | 441 | 876 | 499,270 |
| 420 | Lwenge Basic School | Luwingu | 10 | Northern | 441 | 876 | 499,270 |
| 421 | Laurent Chita Basic School and Clinic | Luwingu | 11 | Northern | 441 | 876 | 499,270 |
| 422 | Mufili Basic School | Luwingu | 12 | Northern | 441 | 876 | 499,270 |
| 423 | Makolongo Basic School | Luwingu | 13 | Northern | 441 | 876 | 499,270 |
| 424 | Lwena Basic School and Clinic | Luwingu | 14 | Northern | 441 | 876 | 499,270 |
| 425 | Tungati Basic School and Clinic | Luwingu | 15 | Northern | 441 | 876 | 499,270 |
| 426 | Saili Basic School | Luwingu | 16 | Northern | 441 | 876 | 499,270 |
| 427 | Chikumanino Market | Luwingu | 17 | Northern | 441 | 876 | 499,270 |
| 428 | Isandulula Peri-urban Community | Luwingu | 18 | Northern | 441 | 876 | 499,270 |
| 429 | Chief Tungati s Palace and School | Luwingu | 19 | Northern | 441 | 876 | 499,270 |
| 430 | Kapisha School | Luwingu | 20 | Northern | 441 | 876 | 499,270 |
| 431 | Lupili Market | Luwingu | 21 | Northern | 441 | 876 | 499,270 |
| 432 | Nsombo | Luwingu | 22 | Northern | 441 | 876 | 499,270 |
| 433 | Chiwala | Mporokoso | 4 | Northern | 441 | 876 | 499,270 |
| 434 | Samende | Kabompo | 10 | North-Western | 441 | 876 | 499,270 |
| 435 | Kalumbu | Kalabo | 24 | Western | 441 | 876 | 499,270 |
| 436 | LULANUNYI | Kalabo | 27 | Western | 441 | 876 | 499,270 |
| 437 | Kapili | Kaoma | 41 | Western | 441 | 876 | 499,270 |
| 438 | Kanglonga | Ndola | 1 | Copperbelt | 400 | 795 | 496,733 |
| 439 | Mwembeshi_ mano | Kafue | 8 | Lusaka | 400 | 795 | 494,497 |
| 440 | Chewe | Mporokoso | 17 | Northern | 400 | 795 | 491,867 |
| 441 | Z Chanda | Mporokoso | 18 | Northern | 400 | 795 | 491,867 |
| 442 | Namakwi | Kasama | 8 | Northern | 430 | 854 | 491,428 |
| 443 | Chiawa Central | Kafue | 4 | Lusaka | 425 | 845 | 488,291 |
| 444 | Kafweku | Mwinilunga | 15 | North-Western | 435 | 864 | 484,388 |
| 445 | Miponda | Samfa | 4 | Luapula | 431 | 856 | 483,959 |
| 446 | Nyakaseya | Mwinilunga | 3 | North-Western | 400 | 795 | 482,400 |
| 447 | Kopa | Mpika | 10 | Northern | 410 | 815 | 478,208 |
| 448 | Shitwa | Kaoma | 5 | Western | 423 | 841 | 477,944 |
| 449 | Shimukuni | Chibombo | 1 | Central | 400 | 795 | 477,768 |
| 450 | Ngwezi | Mazabuka | 1 | Southern | 410 | 815 | 476,507 |
| 451 | Kambwali | Nchelenge | 20 | Luapula | 420 | 835 | 475,457 |
| 452 | Loazamba | Sesheke | 21 | Western | 428 | 850 | 474,491 |
| 453 | Matala | Mumbwa | 18 | Central | 420 | 835 | 474,319 |
| 454 | Kalabwe | Mporokoso | 10 | Northern | 425 | 845 | 471,157 |
| 455 | Nyengo | Kalabo | 25 | Western | 425 | 845 | 469,787 |
| 456 | Mukuma | Kawambwa | 5 | Luapula | 402 | 799 | 469,068 |
| 457 | Nalikwanda | Mongu | 19 | Western | 424 | 843 | 468,852 |
| 458 | Mwabu | Chienge | 4 | Luapula | 408 | 811 | 468,579 |
| 459 | Mukunta | Chienge | 8 | Luapula | 400 | 795 | 466,175 |
| 460 | Sitoya | Mongu | 9 | Western | 420 | 835 | 465,115 |
| 461 | Chikomem | Lundazi | 3 | Eastern | 402 | 799 | 464,791 |
| 462 | Mushima | Mufumbwe | 5 | North-Western | 400 | 795 | 462,739 |
| 463 | Mpidi | Zambezi | 3 | North-Western | 392 | 779 | 462,282 |
| 464 | Waya | Chibombo | 4 | Central | 400 | 795 | 460,856 |
| 465 | Bwina | Sesheke | 9 | Western | 412 | 819 | 460,758 |
| 466 | Kashikishi | Nchelenge | 19 | Luapula | 380 | 755 | 460,646 |
| 467 | Lufubu | Kawambwa | 12 | Luapula | 400 | 795 | 459,639 |
| 468 | Nshinda | Nchelenge | 11 | Luapula | 400 | 795 | 458,771 |
| 469 | Mushiwala | Kaoma | 10 | Western | 409 | 813 | 458,512 |
| 470 | Lyamunale | Kaoma | 18 | Western | 410 | 815 | 458,481 |
| 471 | Mbanga | Lukulu | 9 | Western | 400 | 795 | 456,110 |
| 472 | Mbalango Mine Farm Block | Lufwanyama | 3 | Copperbelt | 400 | 795 | 456,023 |
| 473 | Mitete | Lukulu | 4 | Western | 392 | 779 | 454,254 |
| 474 | Mumpolokoso | Mwense | 5 | Luapula | 400 | 795 | 454,131 |
| 475 | Kafulwe | Chienge | 13 | Luapula | 395 | 785 | 453,372 |
| 476 | Kanongesha | Mwinilunga | 7 | North-Western | 384 | 763 | 453,001 |
| 477 | Mukumbi | Solwezi | 12 | North-Western | 400 | 795 | 451,040 |
| 478 | Tumva | Solwezi | 18 | North-Western | 400 | 795 | 450,185 |
| 479 | Mwange | Zambezi | 13 | North-Western | 402 | 799 | 448,295 |
| 480 | Kakeki | Zambezi | 8 | North-Western | 400 | 795 | 446,426 |
| 481 | Mombo | Mongu | 39 | Western | 400 | 795 | 446,426 |
| 482 | Mununshi | Mwense | 12 | Luapula | 383 | 761 | 444,859 |
| 483 | Kama | Mongu | 18 | Western | 398 | 791 | 444,558 |
| 484 | KALUWA | Kalabo | 28 | Western | 396 | 787 | 442,689 |
| 485 | Kashiba | Mwense | 19 | Luapula | 378 | 751 | 441,089 |
| 486 | Nkeyama | Kaoma | 1 | Western | 351 | 698 | 440,575 |
| 487 | Chibale | Chama | 7 | Eastern | 389 | 773 | 436,148 |
| 488 | Ikwiichi | Mongu | 21 | Western | 386 | 767 | 433,345 |
| 489 | Mangango | Kaoma | 4 | Western | 336 | 668 | 432,057 |
| 490 | Chitokoloki | Zambezi | 1 | North-Western | 350 | 696 | 431,271 |
| 491 | Kimsala | Solwezi | 19 | North-Western | 380 | 755 | 431,154 |
| 492 | Munwa Basic School | Kabwe | 8 | Central | 380 | 755 | 430,062 |
| 493 | Mwandi | Sesheke | 4 | Western | 326 | 648 | 425,519 |
| 494 | Nandombe | Mongu | 27 | Western | 376 | 747 | 424,001 |
| 495 | Kaumba | Monze | 26 | Southern | 360 | 715 | 422,323 |
| 496 | Ntambo Agricultural Camp | Monze | 24 | Southern | 360 | 715 | 420,699 |
| 497 | Samuteba | Mwinilunga | 12 | North-Western | 361 | 717 | 419,984 |
| 498 | Chiwoma | Mwinilunga | 14 | North-Western | 361 | 717 | 418,075 |
| 499 | Kapoche | Luangwa | 11 | Lusaka | 364 | 723 | 414,128 |
| 500 | Loona | Mongu | 11 | Western | 364 | 723 | 412,788 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (6/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 501 | Chinkuli | Chongwe | 6 | Lusaka | 361 | 717 | 411,325 |
| 502 | Kenani | Nchelenge | 15 | Luapula | 354 | 704 | 408,658 |
| 503 | Litawa | Mongu | 33 | Western | 359 | 713 | 408,116 |
| 504 | Chipili | Mwense | 22 | Luapula | 350 | 696 | 406,717 |
| 505 | Nkumbi | Mkushi | 13 | Central | 328 | 652 | 405,008 |
| 506 | Mwalilia | Luangwa | 7 | Lusaka | 352 | 700 | 403,382 |
| 507 | Katondwe | Luangwa | 3 | Lusaka | 328 | 652 | 400,875 |
| 508 | Mphomwa | Mambwe | 2 | Eastern | 350 | 696 | 392,921 |
| 509 | Chikowa | Mambwe | 11 | Eastern | 350 | 696 | 391,226 |
| 510 | Bwalya Mponda | Samfa | 8 | Luapula | 335 | 666 | 390,649 |
| 511 | Munkonge | Kasama | 7 | Northern | 339 | 674 | 389,643 |
| 512 | Mwamba | Kasama | 5 | Northern | 345 | 686 | 389,542 |
| 513 | Sunkutu | Mporokoso | 8 | Northern | 350 | 696 | 385,173 |
| 514 | Nangili | Mongu | 35 | Western | 350 | 696 | 385,173 |
| 515 | Ngangu | Mongu | 25 | Western | 349 | 694 | 384,239 |
| 516 | Hoya | Lundazi | 18 | Eastern | 337 | 670 | 383,556 |
| 517 | St. Mary's | Lufwanyama | 8 | Copperbelt | 330 | 656 | 381,475 |
| 518 | Lulambo | Mongu | 32 | Western | 344 | 684 | 379,567 |
| 519 | Kambilombilo | Lufwanyama | 2 | Copperbelt | 330 | 656 | 379,524 |
| 520 | Kasomalunga | Samfa | 9 | Luapula | 315 | 626 | 377,867 |
| 521 | Mukutuma | Lufwanyama | 7 | Copperbelt | 330 | 656 | 377,132 |
| 522 | Fungulwe | Lufwanyama | 9 | Copperbelt | 330 | 656 | 375,231 |
| 523 | Milopa_ | Lufwanyama | 15 | Copperbelt | 330 | 656 | 375,139 |
| 524 | Kafubu Depot | Kalulushi | 4 | Copperbelt | 300 | 596 | 374,770 |
| 525 | Nkana | Lufwanyama | 40 | Copperbelt | 300 | 596 | 373,009 |
| 526 | Sambula | Chienge | 11 | Luapula | 320 | 636 | 370,925 |
| 527 | Lumwana | Mwinilunga | 5 | North-Western | 310 | 616 | 370,693 |
| 528 | Shapopa | Namwala | 14 | Southern | 333 | 662 | 369,631 |
| 529 | Maposa | Ndola | 5 | Copperbelt | 333 | 662 | 369,288 |
| 530 | Namayula | Lukulu | 17 | Western | 323 | 642 | 368,645 |
| 531 | Mulobezi | Sesheke | 2 | Western | 307 | 610 | 367,642 |
| 532 | Kamifungo | Masaiti | 6 | Copperbelt | 326 | 648 | 365,180 |
| 533 | Katoba | Chongwe | 5 | Lusaka | 325 | 646 | 364,363 |
| 534 | Chondwe | Masaiti | 10 | Copperbelt | 324 | 644 | 364,295 |
| 535 | Mangwere | Chama | 4 | Eastern | 327 | 650 | 363,682 |
| 536 | Mateko | Solwezi | 9 | North-Western | 320 | 636 | 360,900 |
| 537 | Chitope | Luangwa | 2 | Lusaka | 313 | 622 | 359,499 |
| 538 | Kangwena | Solwezi | 17 | North-Western | 320 | 636 | 359,464 |
| 539 | Kapiji | Solwezi | 3 | North-Western | 320 | 636 | 358,194 |
| 540 | Luangwa Bridge | Chongwe | 11 | Lusaka | 317 | 630 | 357,135 |
| 541 | Kanyenshya Resettlement Scheme | Mkushi | 20 | Central | 300 | 596 | 355,572 |
| 542 | Nyakulena | Zambezi | 2 | North-Western | 300 | 596 | 355,014 |
| 543 | Chama | Kawambwa | 1 | Luapula | 306 | 608 | 354,086 |
| 544 | Mapunga | Solwezi | 4 | North-Western | 300 | 596 | 353,470 |
| 545 | Kameme | Kalulushi | 1 | Copperbelt | 300 | 596 | 353,258 |
| 546 | Luminu | Mwense | 3 | Luapula | 300 | 596 | 353,130 |
| 547 | Madzimoyo Sec. School | Chipata | 4 | Eastern | 312 | 620 | 352,346 |
| 548 | Kapichila | Lundazi | 10 | Eastern | 298 | 592 | 351,880 |
| 549 | Ipongo | Chibombo | 5 | Central | 300 | 596 | 351,402 |
| 550 | Lungo | Kitwe | 2 | Copperbelt | 300 | 596 | 350,986 |
| 551 | Mphomwa Tse-tse | Mambwe | 1 | Eastern | 300 | 596 | 350,636 |
| 552 | Kakoma | Mwinilunga | 17 | North-Western | 301 | 598 | 349,711 |
| 553 | Mabinga | Chama | 3 | Eastern | 311 | 618 | 348,732 |
| 554 | Kambila | Lufwanyama | 25 | Copperbelt | 300 | 596 | 348,374 |
| 555 | Munyama | Siavonga | 4 | Southern | 300 | 596 | 347,903 |
| 556 | Tomu | Mwinilunga | 13 | North-Western | 299 | 594 | 345,609 |
| 557 | Shantumbu | Kafue | 2 | Lusaka | 300 | 596 | 343,880 |
| 558 | Musaka | Solwezi | 13 | North-Western | 300 | 596 | 341,571 |
| 559 | Sanda | Solwezi | 7 | North-Western | 300 | 596 | 340,776 |
| 560 | Nalubanda | Mumbwa | 9 | Central | 300 | 596 | 339,793 |
| 561 | Chiparamba | Chipata | 1 | Eastern | 300 | 596 | 339,793 |
| 562 | Council Farm | Kitwe | 5 | Copperbelt | 300 | 596 | 338,453 |
| 563 | Kapara | Chipata | 3 | Eastern | 300 | 596 | 338,453 |
| 564 | Lwatembo | Zambezi | 7 | North-Western | 300 | 596 | 338,453 |
| 565 | Liyovu | Zambezi | 16 | North-Western | 300 | 596 | 338,453 |
| 566 | Kashona | Zambezi | 20 | North-Western | 300 | 596 | 338,453 |
| 567 | Nshinso | Mkushi | 4 | Central | 274 | 545 | 333,277 |
| 568 | Chibondo | Mwense | 6 | Luapula | 286 | 568 | 331,431 |
| 569 | Kikonge | Mufumbwe | 12 | North-Western | 280 | 557 | 330,510 |
| 570 | Jimbe | Mwinilunga | 9 | North-Western | 281 | 559 | 329,200 |
| 571 | Mujima | Solwezi | 5 | North-Western | 280 | 557 | 327,625 |
| 572 | Nakanjoli | Mumbwa | 21 | Central | 280 | 557 | 327,471 |
| 573 | Chiombo | Kasama | 6 | Northern | 270 | 537 | 327,076 |
| 574 | Bweengwa | Monze | 17 | Southern | 275 | 547 | 326,866 |
| 575 | Ndunga | Kabompo | 11 | North-Western | 286 | 568 | 325,371 |
| 576 | Kibanza | Solwezi | 20 | North-Western | 280 | 557 | 325,361 |
| 577 | Tapo | Mongu | 24 | Western | 285 | 566 | 324,437 |
| 578 | Musele | Solwezi | 14 | North-Western | 280 | 557 | 323,648 |
| 579 | Shilenda | Solwezi | 10 | North-Western | 280 | 557 | 322,555 |
| 580 | Ndanda | Mongu | 6 | Western | 280 | 557 | 320,232 |
| 581 | Kaputa | Nchelenge | 6 | Luapula | 277 | 551 | 319,797 |
| 582 | Katuntulu Com. School | Kabwe | 5 | Central | 265 | 527 | 318,227 |
| 583 | Kabuta Central | Nchelenge | 18 | Luapula | 245 | 487 | 317,875 |
| 584 | Ushaa | Mongu | 7 | Western | 277 | 551 | 317,429 |
| 585 | Lusu | Sesheke | 8 | Western | 274 | 545 | 316,308 |
| 586 | Mugula mano | Kafue | 3 | Lusaka | 265 | 527 | 315,466 |
| 587 | Lalafuta | Mufumbwe | 16 | North-Western | 266 | 529 | 313,793 |
| 588 | Kapongo | Kafue | 7 | Lusaka | 270 | 537 | 313,599 |
| 589 | Lumimba | Lundazi | 12 | Eastern | 264 | 525 | 313,187 |
| 590 | Kaunga | Luangwa | 5 | Lusaka | 268 | 533 | 312,382 |
| 591 | Kayuni | Monze | 3 | Southern | 264 | 525 | 311,692 |
| 592 | Chinyunyu | Chongwe | 1 | Lusaka | 247 | 491 | 309,207 |
| 593 | Masansa | Mkushi | 12 | Central | 218 | 433 | 309,065 |
| 594 | Namilaugi | Kaoma | 6 | Western | 260 | 517 | 304,420 |
| 595 | Koni Bunda Community | Kabwe | 9 | Central | 250 | 497 | 297,011 |
| 596 | Simaubi | Choma | 10 | Southern | 250 | 497 | 295,863 |
| 597 | Nselauke | Kasempa | 1 | North-Western | 238 | 473 | 295,305 |
| 598 | Munsakamba | Mkushi | 7 | Central | 246 | 489 | 294,881 |
| 599 | Chapula | Lufwanyama | 41 | Copperbelt | 250 | 497 | 293,937 |
| 600 | Kansoka | Lufwanyama | 10 | Copperbelt | 250 | 497 | 293,555 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (7/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 601 | Chisuwo Agric Camp | Monze | 19 | Southern | 250 | 497 | 292,062 |
| 602 | Matushi | Mufumbwe | 1 | North-Western | 250 | 497 | 291,817 |
| 603 | Kafulamase Basic School | Kabwe | 4 | Central | 260 | 517 | 291,233 |
| 604 | Mumena | Solwezi | 1 | North-Western | 248 | 493 | 290,622 |
| 605 | Keemba | Monze | 13 | Southern | 250 | 497 | 290,582 |
| 606 | Sitwe | Chama | 11 | Eastern | 262 | 521 | 288,413 |
| 607 | Lweeta Agric Camp | Monze | 20 | Southern | 250 | 497 | 288,390 |
| 608 | Shombe | Lufwanyama | 11 | Copperbelt | 250 | 497 | 287,930 |
| 609 | Mujika | Monze | 25 | Southern | 250 | 497 | 287,787 |
| 610 | Kamalamba | Solwezi | 8 | North-Western | 260 | 517 | 287,527 |
| 611 | Kamiliambo | Mumbwa | 13 | Central | 250 | 497 | 287,388 |
| 612 | Siwa | Mongu | 15 | Western | 258 | 513 | 284,675 |
| 613 | Chikanda | Mumbwa | 22 | Central | 250 | 497 | 284,438 |
| 614 | Chifunda | Chama | 6 | Eastern | 244 | 485 | 284,373 |
| 615 | Chilongo (Mtepuke) | Nchelenge | 1 | Luapula | 251 | 499 | 283,154 |
| 616 | Saw-Mills | Lufwanyama | 6 | Copperbelt | 250 | 497 | 282,974 |
| 617 | Namitone | Mongu | 17 | Western | 256 | 509 | 282,806 |
| 618 | Kasomo | Chinsali | 23 | Northern | 246 | 489 | 282,026 |
| 619 | Chikola | Solwezi | 16 | North-Western | 250 | 497 | 281,644 |
| 620 | Kamphasa | Mambwe | 10 | Eastern | 250 | 497 | 281,534 |
| 621 | Nyamanongo | Chongwe | 10 | Lusaka | 253 | 503 | 281,343 |
| 622 | Mulonga | Solwezi | 6 | North-Western | 250 | 497 | 280,208 |
| 623 | Lundu | Chama | 8 | Eastern | 253 | 503 | 280,003 |
| 624 | Chaanga | Siavonga | 6 | Southern | 250 | 497 | 279,866 |
| 625 | Longe | Kaoma | 25 | Western | 244 | 485 | 279,860 |
| 626 | Mpale_Tuyu | Mkushi | 9 | Central | 232 | 461 | 279,842 |
| 627 | Kashinakazhi | Kabompo | 1 | North-Western | 250 | 497 | 279,815 |
| 628 | Konikalila | Samfa | 11 | Luapula | 246 | 489 | 279,449 |
| 629 | Mukulushi | Chibombo | 3 | Central | 250 | 497 | 279,225 |
| 630 | Lukulu North | Kasama | 2 | Northern | 250 | 497 | 278,913 |
| 631 | Chibwe | Kawambwa | 14 | Luapula | 240 | 477 | 278,386 |
| 632 | Kaminzeke | Mufumbwe | 4 | North-Western | 240 | 477 | 277,841 |
| 633 | Mphuka | Luangwa | 6 | Lusaka | 249 | 495 | 277,249 |
| 634 | Chamanza Resettlement | Kalulushi | 9 | Copperbelt | 250 | 497 | 277,200 |
| 635 | Chikowa_ | Mambwe | 15 | Eastern | 250 | 497 | 277,200 |
| 636 | Kambobe | Mporokoso | 6 | Northern | 250 | 497 | 277,200 |
| 637 | Ndondo | Mongu | 31 | Western | 250 | 497 | 277,200 |
| 638 | Kafironda | Mufulira | 5 | Copperbelt | 221 | 439 | 277,002 |
| 639 | Mulonga | Mwense | 16 | Luapula | 234 | 465 | 276,757 |
| 640 | Naluama | Mazabuka | 2 | Southern | 226 | 449 | 273,738 |
| 641 | Lubuka | Kaoma | 24 | Western | 236 | 469 | 272,024 |
| 642 | Sianyoolo | Siavonga | 3 | Southern | 230 | 457 | 267,303 |
| 643 | Kasalamakanga | Mkushi | 15 | Central | 219 | 435 | 266,801 |
| 644 | Mwanambuyu | Kaoma | 22 | Western | 233 | 463 | 265,741 |
| 645 | Mulwa | Kaoma | 38 | Western | 233 | 463 | 264,648 |
| 646 | Mbanyutu | Kaoma | 11 | Western | 230 | 457 | 264,263 |
| 647 | Musa | Kasama | 3 | Northern | 230 | 457 | 263,298 |
| 648 | U_Lunsemfwa | Mkushi | 8 | Central | 215 | 427 | 262,379 |
| 649 | Kampampi (Chipakila) | Nchelenge | 2 | Luapula | 226 | 449 | 262,355 |
| 650 | Nsamba | Samfa | 10 | Luapula | 223 | 443 | 262,259 |
| 651 | Nalutanga | Monze | 18 | Southern | 225 | 447 | 261,478 |
| 652 | Chinyaku Palace | Chipata | 9 | Eastern | 230 | 457 | 261,192 |
| 653 | Chiyota | Chongwe | 7 | Lusaka | 231 | 459 | 260,786 |
| 654 | Miluji | Mufumbwe | 10 | North-Western | 220 | 437 | 259,943 |
| 655 | Lui | Kaoma | 13 | Western | 215 | 427 | 259,437 |
| 656 | Mwito | Lukulu | 5 | Western | 214 | 425 | 258,845 |
| 657 | Kakulunda | Lukulu | 8 | Western | 227 | 451 | 258,827 |
| 658 | Muyondoti | Lukulu | 13 | Western | 227 | 451 | 258,827 |
| 659 | Mukangala | Mwinilunga | 19 | North-Western | 225 | 447 | 257,598 |
| 660 | Kalwelwe Rail Station | Kabwe | 3 | Central | 220 | 437 | 257,280 |
| 661 | Lwakela | Mwinilunga | 18 | North-Western | 216 | 429 | 256,943 |
| 662 | Manga | Chama | 5 | Eastern | 227 | 451 | 255,709 |
| 663 | Chisengisengi | Mwinilunga | 6 | North-Western | 220 | 437 | 255,585 |
| 664 | Chitimbwa RHC | Mpulungu | 2 | Northern | 226 | 449 | 254,774 |
| 665 | Nabwalya | Mpika | 13 | Northern | 215 | 427 | 254,389 |
| 666 | Mukonshi | Mwense | 7 | Luapula | 216 | 429 | 254,251 |
| 667 | Kamapanda | Mwinilunga | 16 | North-Western | 211 | 420 | 254,174 |
| 668 | Mtambali | Lundazi | 17 | Eastern | 216 | 429 | 253,788 |
| 669 | Kanchomba | Choma | 1 | Southern | 200 | 398 | 253,460 |
| 670 | Mapamba | Chama | 12 | Eastern | 223 | 443 | 253,342 |
| 671 | Kampenba | Mwinilunga | 10 | North-Western | 220 | 437 | 253,269 |
| 672 | Kanyama | Mwinilunga | 4 | North-Western | 210 | 418 | 252,430 |
| 673 | Musonweji | Mufumbwe | 15 | North-Western | 212 | 422 | 250,471 |
| 674 | Musende | Mpulungu | 3 | Northern | 220 | 437 | 249,168 |
| 675 | Manyinga | Kabompo | 15 | North-Western | 220 | 437 | 249,168 |
| 676 | Nalusanga | Mumbwa | 17 | Central | 200 | 398 | 248,999 |
| 677 | Lubansa | Chiliabombwe | 5 | Copperbelt | 180 | 358 | 248,801 |
| 678 | Chamuka | Chibombo | 17 | Central | 200 | 398 | 248,121 |
| 679 | Njonjolo | Kaoma | 16 | Western | 214 | 425 | 247,579 |
| 680 | Mpima Dairy Scheme Shed | Kabwe | 1 | Central | 210 | 418 | 247,513 |
| 681 | Shabo (Kapambwe | Nchelenge | 16 | Luapula | 212 | 422 | 247,185 |
| 682 | Mingomba | Chiliabombwe | 1 | Copperbelt | 210 | 418 | 246,422 |
| 683 | Mwalumina | Chongwe | 9 | Lusaka | 217 | 431 | 246,365 |
| 684 | Chiyobola Agricultural Camp | Monze | 21 | Southern | 200 | 398 | 244,503 |
| 685 | Lwabwe | Kasama | 4 | Northern | 210 | 418 | 243,699 |
| 686 | Lusinina | Sesheke | 12 | Western | 211 | 420 | 243,593 |
| 687 | Sikusi | Mongu | 8 | Western | 214 | 425 | 243,561 |
| 688 | Malali | Mkushi | 14 | Central | 200 | 398 | 243,274 |
| 689 | Chipapa VC | Kafue | 1 | Lusaka | 197 | 392 | 243,265 |
| 690 | Kapupulu | Luanshya | 3 | Copperbelt | 209 | 416 | 243,005 |
| 691 | Kayambi | Mungwi | 14 | Northern | 200 | 398 | 241,760 |
| 692 | Munyama B. School | Kabwe | 2 | Central | 200 | 398 | 241,644 |
| 693 | Chisha | Mpulungu | 11 | Northern | 210 | 418 | 241,631 |
| 694 | Mubamba | Nchelenge | 9 | Luapula | 201 | 400 | 240,844 |
| 695 | Lukau | Lukulu | 10 | Western | 208 | 414 | 240,790 |
| 696 | Haatontola | Monze | 28 | Southern | 200 | 398 | 240,661 |
| 697 | Naimbu | Lukulu | 11 | Western | 202 | 402 | 240,209 |
| 698 | Siachele | Mumbwa | 6 | Central | 200 | 398 | 240,151 |
| 699 | Kachenge | Choma | 12 | Southern | 200 | 398 | 239,911 |
| 700 | Kashima W | Mufumbwe | 2 | North-Western | 200 | 398 | 239,854 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (8/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 701 | Kapuku Fish Camp | Chibombo | 2 | Central | 200 | 398 | 239,821 |
| 702 | Manyonyo | Mazabuka | 5 | Southern | 200 | 398 | 239,680 |
| 703 | Chunga | Chinsali | 14 | Northern | 200 | 398 | 239,635 |
| 704 | Chizuzu | Zambezi | 4 | North-Western | 200 | 398 | 239,525 |
| 705 | Sumi | Senanga | 19 | Western | 200 | 398 | 238,555 |
| 706 | Manuele | Luangwa | 9 | Lusaka | 204 | 406 | 237,991 |
| 707 | Singani | Choma | 5 | Southern | 200 | 398 | 237,259 |
| 708 | Chisengu | Mambwe | 3 | Eastern | 200 | 398 | 237,247 |
| 709 | Chinonwe | Lukulu | 15 | Western | 200 | 398 | 237,247 |
| 710 | Namoomba | Siavonga | 1 | Southern | 200 | 398 | 237,033 |
| 711 | Mutipula | Mwense | 4 | Luapula | 200 | 398 | 236,698 |
| 712 | Kalilele | Solwezi | 2 | North-Western | 200 | 398 | 236,562 |
| 713 | Namateba Agricultural Camp | Monze | 23 | Southern | 200 | 398 | 235,978 |
| 714 | Malengo | Siavonga | 8 | Southern | 200 | 398 | 235,710 |
| 715 | Salujinga | Mwinilunga | 11 | North-Western | 201 | 400 | 235,640 |
| 716 | Chisakila | Kafue | 12 | Lusaka | 200 | 398 | 234,938 |
| 717 | Dongwe | Lukulu | 2 | Western | 200 | 398 | 234,687 |
| 718 | Chovwe | Solwezi | 15 | North-Western | 200 | 398 | 234,363 |
| 719 | Mukulaikwa | Mumbwa | 4 | Central | 200 | 398 | 233,380 |
| 720 | Mumbezi | Solwezi | 11 | North-Western | 200 | 398 | 233,273 |
| 721 | Nwanachmgurela | Mazabuka | 3 | Southern | 180 | 358 | 233,188 |
| 722 | Kenje | Chipata | 10 | Eastern | 199 | 396 | 232,693 |
| 723 | Naluvwi | Mumbwa | 10 | Central | 200 | 398 | 232,287 |
| 724 | Makolongo | Mkushi | 16 | Central | 187 | 372 | 232,065 |
| 725 | Luela | Kalulushi | 5 | Copperbelt | 200 | 398 | 231,632 |
| 726 | Kakaro | Luangwa | 10 | Lusaka | 198 | 394 | 231,401 |
| 727 | Kalimeta | Katete | 11 | Eastern | 200 | 398 | 230,947 |
| 728 | Katamba | Chilubi | 3 | Northern | 200 | 398 | 230,947 |
| 729 | Iyendwe | Mpulungu | 7 | Northern | 200 | 398 | 230,947 |
| 730 | Katontu | Zambezi | 9 | North-Western | 200 | 398 | 230,947 |
| 731 | Kmgubudu | Chipata | 2 | Eastern | 198 | 394 | 230,418 |
| 732 | Mutima | Mwense | 9 | Luapula | 190 | 378 | 229,869 |
| 733 | Khulamayen | Lundazi | 20 | Eastern | 187 | 372 | 229,729 |
| 734 | Kakwacha | Lukulu | 14 | Western | 194 | 386 | 229,675 |
| 735 | Kawama | Luanshya | 4 | Copperbelt | 182 | 362 | 228,357 |
| 736 | Naliele | Kaoma | 14 | Western | 192 | 382 | 227,490 |
| 737 | Lishiko | Kafue | 5 | Lusaka | 190 | 378 | 226,622 |
| 738 | Watopa | Lukulu | 3 | Western | 183 | 364 | 225,747 |
| 739 | Chungu Agric Camp | Monze | 14 | Southern | 190 | 378 | 225,309 |
| 740 | Mwata | Lundazi | 11 | Eastern | 187 | 372 | 224,814 |
| 741 | Nambwa | Mumbwa | 20 | Central | 180 | 358 | 224,412 |
| 742 | Kasupe | Kafue | 13 | Lusaka | 180 | 358 | 223,703 |
| 743 | Kalengwa | Mufumbwe | 6 | North-Western | 180 | 358 | 222,944 |
| 744 | Kazembe | Lundazi | 8 | Eastern | 182 | 362 | 222,702 |
| 745 | Lupui | Lukulu | 6 | Western | 186 | 370 | 221,966 |
| 746 | Kabosha | Nchelenge | 10 | Luapula | 190 | 378 | 221,603 |
| 747 | Mangonza | Choma | 11 | Southern | 180 | 358 | 221,520 |
| 748 | Munyambala | Mufumbwe | 9 | North-Western | 178 | 354 | 220,434 |
| 749 | Maguya | Chipata | 6 | Eastern | 185 | 368 | 219,611 |
| 750 | Neganega | Mazabuka | 4 | Southern | 173 | 344 | 218,307 |
| 751 | Lishuwa | Lukulu | 12 | Western | 179 | 356 | 217,716 |
| 752 | Kalundu | Mwense | 2 | Luapula | 179 | 356 | 217,094 |
| 753 | Kawaya | Lukulu | 18 | Western | 181 | 360 | 215,561 |
| 754 | Mumila | Mpulungu | 8 | Northern | 180 | 358 | 212,259 |
| 755 | Kafubu | Luanshya | 1 | Copperbelt | 146 | 290 | 203,050 |
| 756 | Shukwe | Mufumbwe | 7 | North-Western | 170 | 338 | 199,771 |
| 757 | Milopa | Lufwanyama | 5 | Copperbelt | 160 | 318 | 196,375 |
| 758 | Mbabala | Samfa | 12 | Luapula | 173 | 344 | 196,362 |
| 759 | Nkole | Kapiri Mposhi | 2 | Central | 169 | 336 | 196,236 |
| 760 | Kansoka_ | Lufwanyama | 39 | Copperbelt | 160 | 318 | 195,180 |
| 761 | Kantende | Lufwanyama | 26 | Copperbelt | 160 | 318 | 194,000 |
| 762 | Kabapupu | Mufumbwe | 11 | North-Western | 168 | 334 | 193,439 |
| 763 | Waya | Kapiri Mposhi | 8 | Central | 159 | 316 | 192,982 |
| 764 | Mafungautsi | Kafue | 15 | Lusaka | 160 | 318 | 192,811 |
| 765 | Chikupili | Mkushi | 5 | Central | 149 | 296 | 192,544 |
| 766 | Upper Kaleya | Mazabuka | 6 | Southern | 158 | 314 | 191,921 |
| 767 | Chipepo | Gwembe | 5 | Southern | 159 | 316 | 191,858 |
| 768 | Chiriwe | Luangwa | 8 | Lusaka | 169 | 336 | 191,005 |
| 769 | Likapai | Lukulu | 16 | Western | 169 | 336 | 190,972 |
| 770 | Mamvule | Mumbwa | 23 | Central | 160 | 318 | 190,724 |
| 771 | Kapilamikwa | Lufwanyama | 19 | Copperbelt | 160 | 318 | 187,865 |
| 772 | Kansoka_ | Lufwanyama | 16 | Copperbelt | 160 | 318 | 187,522 |
| 773 | Mazaba | Sesheke | 19 | Western | 167 | 332 | 187,480 |
| 774 | Funda | Lufwanyama | 32 | Copperbelt | 160 | 318 | 187,180 |
| 775 | Phikamalaza | Lundazi | 9 | Eastern | 159 | 316 | 186,977 |
| 776 | Milulu Mitambo | Lufwanyama | 14 | Copperbelt | 160 | 318 | 186,694 |
| 777 | Tukunka | Kafue | 14 | Lusaka | 160 | 318 | 186,566 |
| 778 | Kamabuta | Mufumbwe | 3 | North-Western | 160 | 318 | 185,556 |
| 779 | Maggobo | Mazabuka | 8 | Southern | 150 | 298 | 185,181 |
| 780 | Moyo | Choma | 3 | Southern | 150 | 298 | 183,456 |
| 781 | Milulu Kabamba | Lufwanyama | 30 | Copperbelt | 160 | 318 | 182,548 |
| 782 | ZASP | Lundazi | 16 | Eastern | 159 | 316 | 181,395 |
| 783 | Malende | Monze | 4 | Southern | 156 | 310 | 180,732 |
| 784 | Katuta | Mwense | 1 | Luapula | 155 | 308 | 180,633 |
| 785 | Kalundu | Namwala | 10 | Southern | 160 | 318 | 180,582 |
| 786 | Silumbu | Sesheke | 20 | Western | 158 | 314 | 180,163 |
| 787 | Minsenga | Kalulushi | 11 | Copperbelt | 145 | 288 | 179,857 |
| 788 | Nchakwa | Lufwanyama | 23 | Copperbelt | 160 | 318 | 179,554 |
| 789 | Nteme | Monze | 12 | Southern | 150 | 298 | 179,001 |
| 790 | Lukwesa | Nchelenge | 12 | Luapula | 150 | 298 | 178,184 |
| 791 | Lengwe | Kawambwa | 7 | Luapula | 150 | 298 | 177,648 |
| 792 | Chibuluma | Mumbwa | 16 | Central | 150 | 298 | 177,448 |
| 793 | Lipumpu | Sesheke | 5 | Western | 148 | 294 | 176,774 |
| 794 | Kasapa | Chiliabombwe | 2 | Copperbelt | 150 | 298 | 176,574 |
| 795 | Kasompa | Sesheke | 18 | Western | 156 | 310 | 176,516 |
| 796 | Mulumbu | Milenge | 3 | Luapula | 157 | 312 | 175,767 |
| 797 | Siambabala | Gwembe | 11 | Southern | 153 | 304 | 175,736 |
| 798 | Kangalati_ | Lufwanyama | 34 | Copperbelt | 150 | 298 | 175,512 |
| 799 | Mbaya Musuma | Mazabuka | 7 | Southern | 138 | 275 | 173,338 |
| 800 | Malundu | Monze | 16 | Southern | 135 | 269 | 171,350 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (9/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 801 | Myamdafuka | Mufumbwe | 14 | North-Western | 150 | 298 | 171,252 |
| 802 | Maguya_ | Chipata | 7 | Eastern | 152 | 302 | 171,095 |
| 803 | Chisau | Mungwi | 17 | Northern | 150 | 298 | 170,567 |
| 804 | Chitina | Mkushi | 19 | Central | 135 | 269 | 170,269 |
| 805 | Kalombe | Mkushi | 17 | Central | 139 | 277 | 170,074 |
| 806 | Mulangwa | Kafue | 11 | Lusaka | 149 | 296 | 169,975 |
| 807 | Manyemunyemu | Kazungula | 10 | Southern | 119 | 237 | 169,759 |
| 808 | Tanganyika | Mpulungu | 5 | Northern | 150 | 298 | 169,227 |
| 809 | Posa, Muzabuwera, Mupata (Itimbwe) | Mpulungu | 9 | Northern | 150 | 298 | 169,227 |
| 810 | Vyamba | Mpulungu | 10 | Northern | 150 | 298 | 169,227 |
| 811 | Lukunyi | Zambezi | 10 | North-Western | 150 | 298 | 169,227 |
| 812 | Chitimukulu | Mungwi | 10 | Northern | 140 | 279 | 169,197 |
| 813 | Mushukula | Sesheke | 15 | Western | 145 | 288 | 168,358 |
| 814 | Mambova | Kazungula | 1 | Southern | 92 | 183 | 168,124 |
| 815 | Chikakala | Mpika | 20 | Northern | 140 | 279 | 168,085 |
| 816 | Bulbe | Lundazi | 14 | Eastern | 143 | 284 | 167,601 |
| 817 | Chipembe | Nyimba | 1 | Eastern | 128 | 255 | 167,510 |
| 818 | Musofu | Mkushi | 3 | Central | 123 | 245 | 167,450 |
| 819 | Mwalede | Sinazongwe | 15 | Southern | 140 | 279 | 166,948 |
| 820 | Ketani | Chinsali | 9 | Northern | 138 | 275 | 166,702 |
| 821 | Kashima E | Mufumbwe | 8 | North-Western | 136 | 271 | 164,238 |
| 822 | Simango | Kazungula | 11 | Southern | 130 | 259 | 163,326 |
| 823 | Lufila | Mpika | 19 | Northern | 130 | 259 | 163,016 |
| 824 | Muzuri (Kamuzya East) | Monze | 1 | Southern | 138 | 275 | 162,529 |
| 825 | Lumpuma | Lufwanyama | 4 | Copperbelt | 127 | 253 | 162,251 |
| 826 | Luashimba | Kapiri Mposhi | 7 | Central | 120 | 239 | 162,234 |
| 827 | Kazungula | Monze | 32 | Southern | 138 | 275 | 162,187 |
| 828 | Bankaila | Monze | 15 | Southern | 130 | 259 | 161,438 |
| 829 | Chilimina | Chiliabombwe | 7 | Copperbelt | 135 | 269 | 161,162 |
| 830 | Kalinkhu | Chama | 1 | Eastern | 138 | 275 | 160,880 |
| 831 | Nkulungwe | Chinsali | 18 | Northern | 127 | 253 | 160,466 |
| 832 | Mukamunga | Choma | 2 | Southern | 135 | 269 | 160,310 |
| 833 | Imusho | Sesheke | 13 | Western | 136 | 271 | 160,073 |
| 834 | Lumwana | Lufwanyama | 24 | Copperbelt | 130 | 259 | 159,957 |
| 835 | Chilombo | Chinsali | 13 | Northern | 133 | 265 | 159,191 |
| 836 | Chitimba | Chinsali | 20 | Northern | 133 | 265 | 159,081 |
| 837 | Makasa | Mungwi | 1 | Northern | 133 | 265 | 159,002 |
| 838 | Kandende | Kaoma | 36 | Western | 133 | 265 | 157,548 |
| 839 | Chiteve | Kabompo | 12 | North-Western | 137 | 273 | 157,546 |
| 840 | Musungu | Kawambwa | 20 | Luapula | 115 | 229 | 157,505 |
| 841 | Kavalamanja | Luangwa | 12 | Lusaka | 132 | 263 | 156,507 |
| 842 | Nchelenge boma | Nchelenge | 17 | Luapula | 97 | 193 | 156,201 |
| 843 | Chiyengele | Kabompo | 4 | North-Western | 93 | 185 | 156,045 |
| 844 | Chimba | Mungwi | 6 | Northern | 135 | 269 | 155,678 |
| 845 | Siamejele | Sinazongwe | 19 | Southern | 131 | 261 | 154,249 |
| 846 | Sanjongo | Chavuma | 2 | North-Western | 132 | 263 | 154,215 |
| 847 | Shimwalule | Chinsali | 27 | Northern | 125 | 249 | 153,572 |
| 848 | Kabila | Mwense | 10 | Luapula | 129 | 257 | 153,422 |
| 849 | Kabele | Kasempa | 12 | North-Western | 128 | 255 | 153,185 |
| 850 | Mumba | Mungwi | 8 | Northern | 128 | 255 | 153,069 |
| 851 | Kanselele | Chama | 10 | Eastern | 132 | 263 | 152,874 |
| 852 | Hangoma | Gwembe | 4 | Southern | 132 | 263 | 152,874 |
| 853 | Mufwaya | Kawambwa | 10 | Luapula | 120 | 239 | 152,757 |
| 854 | Hufwa | Monze | 8 | Southern | 130 | 259 | 152,688 |
| 855 | Dengwe | Kasempa | 5 | North-Western | 129 | 257 | 152,097 |
| 856 | Mimpongo | Kaoma | 33 | Western | 129 | 257 | 152,097 |
| 857 | Luangwa Sec | Luangwa | 4 | Lusaka | 127 | 253 | 152,092 |
| 858 | Nyango | Kaoma | 8 | Western | 126 | 251 | 151,693 |
| 859 | Kasongwa sub boma | Mansa | 1 | Luapula | 98 | 195 | 150,908 |
| 860 | Kanyangala | Kafue | 10 | Lusaka | 125 | 249 | 150,668 |
| 861 | Masuku | Choma | 7 | Southern | 120 | 239 | 150,660 |
| 862 | Nyawa Central | Kazungula | 3 | Southern | 90 | 179 | 150,526 |
| 863 | Manungu A | Monze | 9 | Southern | 103 | 205 | 150,477 |
| 864 | Muyembe | Kawambwa | 19 | Luapula | 120 | 239 | 150,437 |
| 865 | Fitobaula | Chiliabombwe | 4 | Copperbelt | 120 | 239 | 150,173 |
| 866 | Mukolo | Kabompo | 3 | North-Western | 100 | 199 | 150,019 |
| 867 | Kantenda | Kasempa | 4 | North-Western | 122 | 243 | 149,979 |
| 868 | Ndasa | Mungwi | 9 | Northern | 128 | 255 | 149,137 |
| 869 | Mandia | Kazungula | 12 | Southern | 120 | 239 | 149,067 |
| 870 | Shemu | Nakonde | 5 | Northern | 114 | 227 | 148,770 |
| 871 | Kakhoma | Chavuma | 6 | North-Western | 120 | 239 | 148,751 |
| 872 | Siampande | Gwembe | 10 | Southern | 121 | 241 | 148,611 |
| 873 | Katimba | Monze | 30 | Southern | 120 | 239 | 147,443 |
| 874 | Luili | Mumbwa | 19 | Central | 110 | 219 | 147,420 |
| 875 | Chisangwa | Kalulushi | 7 | Copperbelt | 120 | 239 | 147,277 |
| 876 | Simeweendengwe | Monze | 10 | Southern | 120 | 239 | 147,277 |
| 877 | Lwimba | Chongwe | 3 | Lusaka | 110 | 219 | 146,030 |
| 878 | Hakasenke | Monze | 6 | Southern | 120 | 239 | 145,808 |
| 879 | Mulakupikwa | Chinsali | 3 | Northern | 105 | 209 | 145,633 |
| 880 | Mukandamina | Kaoma | 34 | Western | 122 | 243 | 145,556 |
| 881 | Senamba | Sesheke | 17 | Western | 121 | 241 | 144,621 |
| 882 | Chiluli | Kaoma | 29 | Western | 120 | 239 | 144,372 |
| 883 | Misaka | Kitwe | 4 | Copperbelt | 120 | 239 | 141,662 |
| 884 | Chifulo | Mungwi | 12 | Northern | 120 | 239 | 141,662 |
| 885 | Kakoto | Zambezi | 17 | North-Western | 120 | 239 | 141,662 |
| 886 | Kanyembo | Nchelenge | 7 | Luapula | 100 | 199 | 141,162 |
| 887 | Shivuma | Kasempa | 14 | North-Western | 111 | 221 | 140,702 |
| 888 | Kahokoto | Kaoma | 37 | Western | 116 | 231 | 140,635 |
| 889 | Chikanda | Chinsali | 4 | Northern | 115 | 229 | 140,296 |
| 890 | Mpungu | Kasempa | 7 | North-Western | 110 | 219 | 139,768 |
| 891 | Malyango | Sinazongwe | 7 | Southern | 110 | 219 | 139,625 |
| 892 | Mwatishi Farm block 2 | Nchelenge | 3 | Luapula | 112 | 223 | 139,102 |
| 893 | Mayumbelo | Livingstone | 9 | Southern | 117 | 233 | 138,858 |
| 894 | Manungu B | Monze | 5 | Southern | 105 | 209 | 138,611 |
| 895 | Hamusankwa | Monze | 11 | Southern | 108 | 215 | 137,932 |
| 896 | Kalobolelwa | Sesheke | 6 | Western | 108 | 215 | 137,842 |
| 897 | Nguba | Kazungula | 7 | Southern | 91 | 181 | 136,715 |
| 898 | Katungulu | Kawambwa | 11 | Luapula | 110 | 219 | 136,633 |
| 899 | Napenzi | Livingstone | 4 | Southern | 113 | 225 | 136,461 |
| 900 | Sianqwaze | Gwembe | 7 | Southern | 106 | 211 | 136,207 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (10/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 901 | Milambo | Milenge | 5 | Luapula | 113 | 225 | 135,121 |
| 902 | Kalela | Chinsali | 16 | Northern | 101 | 201 | 135,078 |
| 903 | Fibanga | Mkushi | 18 | Central | 105 | 209 | 135,012 |
| 904 | Kabangala | Chibombo | 8 | Central | 100 | 199 | 134,978 |
| 905 | Mtilizi Scheme | Nyimba | 3 | Eastern | 108 | 215 | 134,459 |
| 906 | Mwanya | Lundazi | 7 | Eastern | 104 | 207 | 134,303 |
| 907 | Hamapande | Monze | 7 | Southern | 112 | 223 | 134,186 |
| 908 | Chibote | Kawambwa | 4 | Luapula | 90 | 179 | 132,179 |
| 909 | Zemba | Chadiza | 2 | Eastern | 90 | 179 | 132,063 |
| 910 | Chungulo | Chinsali | 24 | Northern | 97 | 193 | 131,341 |
| 911 | Kalombe | Kasempa | 6 | North-Western | 106 | 211 | 131,246 |
| 912 | Mukamba | Kawambwa | 16 | Luapula | 100 | 199 | 131,240 |
| 913 | Chimbwese | Chinsali | 12 | Northern | 103 | 205 | 131,049 |
| 914 | Mulilo | Chama | 9 | Eastern | 108 | 215 | 130,449 |
| 915 | Lima | Lufwanyama | 35 | Copperbelt | 100 | 199 | 129,900 |
| 916 | Chilanga | Chinsali | 10 | Northern | 97 | 193 | 129,484 |
| 917 | Kundamfumu | Mansa | 6 | Luapula | 98 | 195 | 128,885 |
| 918 | Chimoto | Lufwanyama | 22 | Copperbelt | 100 | 199 | 128,291 |
| 919 | Kavumbo | Mbala | 3 | Northern | 105 | 209 | 127,645 |
| 920 | Mwachilele | Chongwe | 8 | Lusaka | 103 | 205 | 127,117 |
| 921 | Kamakuku | Kasempa | 10 | North-Western | 95 | 189 | 126,975 |
| 922 | Kakiakasa | Mufumbwe | 13 | North-Western | 100 | 199 | 126,667 |
| 923 | Lukoshi | Kalulushi | 6 | Copperbelt | 100 | 199 | 126,310 |
| 924 | Sinakaimbi | Sinazongwe | 1 | Southern | 90 | 179 | 126,229 |
| 925 | Kalombo | Chavuma | 5 | North-Western | 92 | 183 | 126,118 |
| 926 | Chombela | Chibombo | 9 | Central | 100 | 199 | 125,964 |
| 927 | Lingundu | Chavuma | 12 | North-Western | 95 | 189 | 125,718 |
| 928 | Sikoongo | Siavonga | 10 | Southern | 100 | 199 | 125,297 |
| 929 | Chamfubu | Mungwi | 5 | Northern | 102 | 203 | 124,842 |
| 930 | Namilongwe | Monze | 33 | Southern | 89 | 177 | 124,650 |
| 931 | Chilobwe | Kitwe | 3 | Copperbelt | 100 | 199 | 124,066 |
| 932 | Shikabeta | Chongwe | 12 | Lusaka | 97 | 193 | 123,910 |
| 933 | Kaputo | Nchelenge | 5 | Luapula | 101 | 201 | 123,908 |
| 934 | Muuka | Sinazongwe | 12 | Southern | 94 | 187 | 123,732 |
| 935 | Lima Com. School | Chipata | 12 | Eastern | 100 | 199 | 122,973 |
| 936 | Ishima | Zambezi | 6 | North-Western | 100 | 199 | 122,973 |
| 937 | Kayenge | Zambezi | 11 | North-Western | 100 | 199 | 122,973 |
| 938 | Sikongo | Kalabo | 1 | Western | 98 | 195 | 122,445 |
| 939 | Vizimumba Central | Nyimba | 2 | Eastern | 90 | 179 | 122,339 |
| 940 | Fumbwe | Lufwanyama | 28 | Copperbelt | 90 | 179 | 122,050 |
| 941 | Chama | Nchelenge | 8 | Luapula | 97 | 193 | 121,948 |
| 942 | Chaposwa | Gwembe | 12 | Southern | 97 | 193 | 121,153 |
| 943 | Kalweu Kasakalabwe | Lufwanyama | 31 | Copperbelt | 90 | 179 | 120,213 |
| 944 | Mboroma | Mkushi | 10 | Central | 88 | 175 | 119,833 |
| 945 | Munyati | Sinazongwe | 5 | Southern | 90 | 179 | 119,697 |
| 946 | Kamisamba | Chavuma | 7 | North-Western | 90 | 179 | 119,632 |
| 947 | M_Mfino | Mungwi | 13 | Northern | 96 | 191 | 119,236 |
| 948 | Manyati | Choma | 9 | Southern | 91 | 181 | 117,972 |
| 949 | Luson'a | Kabompo | 8 | North-Western | 63 | 126 | 117,890 |
| 950 | C_Weyaya | Mungwi | 18 | Northern | 92 | 183 | 117,878 |
| 951 | Nchute | Chongwe | 4 | Lusaka | 93 | 185 | 117,773 |
| 952 | Kalisha | Kalulushi | 10 | Copperbelt | 90 | 179 | 117,647 |
| 953 | Kamano | Chibombo | 18 | Central | 90 | 179 | 117,380 |
| 954 | Hofmeyre | Nyimba | 7 | Eastern | 90 | 179 | 117,257 |
| 955 | Sokontwe | Milenge | 4 | Luapula | 91 | 181 | 116,530 |
| 956 | Chinwandumba | Chavuma | 4 | North-Western | 89 | 177 | 116,434 |
| 957 | Mulala | Livingstone | 5 | Southern | 93 | 185 | 116,433 |
| 958 | Kanyafimbolo | Lufwanyama | 37 | Copperbelt | 90 | 179 | 115,938 |
| 959 | Nsampa | Mungwi | 16 | Northern | 92 | 183 | 115,498 |
| 960 | Chimula | Mbala | 1 | Northern | 90 | 179 | 113,629 |
| 961 | Kaka | Mbala | 12 | Northern | 90 | 179 | 113,629 |
| 962 | Siambelele | Kazungula | 13 | Southern | 72 | 143 | 110,842 |
| 963 | Kalaba | Mansa | 8 | Luapula | 86 | 171 | 109,295 |
| 964 | Mweemba | Sinazongwe | 3 | Southern | 80 | 159 | 109,237 |
| 965 | Chipepo | Kapiri Mposhi | 1 | Central | 85 | 169 | 109,170 |
| 966 | Siacheka | Gwembe | 6 | Southern | 79 | 157 | 108,998 |
| 967 | Ngwezi Mataki | Kazungula | 5 | Southern | 78 | 155 | 105,635 |
| 968 | Ntoposhi | Mansa | 7 | Luapula | 87 | 173 | 104,602 |
| 969 | Lifwambula | Chibombo | 12 | Central | 85 | 169 | 104,545 |
| 970 | Nangoma | Senanga | 20 | Western | 80 | 159 | 103,650 |
| 971 | Nachanowe | Choma | 8 | Southern | 86 | 171 | 103,390 |
| 972 | Kabanda | Chinsali | 11 | Northern | 80 | 159 | 101,194 |
| 973 | Lombelombe | Kaoma | 2 | Western | 86 | 171 | 100,304 |
| 974 | Kanogo | Kasempa | 11 | North-Western | 84 | 167 | 100,130 |
| 975 | Kalulu | Mungwi | 15 | Northern | 82 | 163 | 98,792 |
| 976 | Nzala | Gwembe | 13 | Southern | 86 | 171 | 98,541 |
| 977 | Chingombe | Mkushi | 11 | Central | 78 | 155 | 98,516 |
| 978 | Mwalala | Chinsali | 17 | Northern | 80 | 159 | 97,507 |
| 979 | Lunga | Kasempa | 3 | North-Western | 66 | 132 | 97,141 |
| 980 | Kankunko_ | Lufwanyama | 33 | Copperbelt | 85 | 169 | 96,951 |
| 981 | Lukolwe | Chavuma | 3 | North-Western | 80 | 159 | 96,911 |
| 982 | Kangalati | Lufwanyama | 18 | Copperbelt | 85 | 169 | 96,907 |
| 983 | Chikabuke | Lufwanyama | 17 | Copperbelt | 85 | 169 | 96,733 |
| 984 | Chantete | Lufwanyama | 20 | Copperbelt | 85 | 169 | 95,968 |
| 985 | Kafwambila | Sinazongwe | 6 | Southern | 80 | 159 | 94,471 |
| 986 | Kanenga | Chiliabombwe | 6 | Copperbelt | 80 | 159 | 94,427 |
| 987 | Peleti | Mungwi | 2 | Northern | 85 | 169 | 93,957 |
| 988 | Gamela | Choma | 4 | Southern | 80 | 159 | 92,648 |
| 989 | Kambuya | Chavuma | 8 | North-Western | 72 | 143 | 92,385 |
| 990 | Chiyabi | Sinazongwe | 4 | Southern | 80 | 159 | 92,318 |
| 991 | Sinamalima | Sinazongwe | 11 | Southern | 80 | 159 | 92,234 |
| 992 | Siansalama | Sinazongwe | 20 | Southern | 78 | 155 | 92,158 |
| 993 | Chabulabwambe | Gwembe | 8 | Southern | 82 | 163 | 92,137 |
| 994 | Kayosha | Chibombo | 10 | Central | 80 | 159 | 92,061 |
| 995 | St-Pauls | Mbala | 8 | Northern | 80 | 159 | 91,900 |
| 996 | Michinka | Kalulushi | 3 | Copperbelt | 80 | 159 | 91,311 |
| 997 | Mulumbi | Milenge | 6 | Luapula | 82 | 163 | 91,154 |
| 998 | Siadazya | Livingstone | 3 | Southern | 79 | 157 | 90,784 |
| 999 | Namafulu | Sinazongwe | 2 | Southern | 75 | 149 | 90,383 |
| 1000 | Chowa | Chibombo | 15 | Central | 68 | 136 | 90,288 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (11/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 1001 | Mandalo | Chavuma | 9 | North-Western | 78 | 155 | 90,127 |
| 1002 | Banamwaze | Itezhi-tezhi | 5 | Southern | 79 | 157 | 89,691 |
| 1003 | Kawimbe | Mbala | 2 | Northern | 80 | 159 | 89,285 |
| 1004 | Mpande | Mbala | 4 | Northern | 80 | 159 | 89,285 |
| 1005 | Mwiluzi | Mbala | 6 | Northern | 80 | 159 | 89,285 |
| 1006 | Senka | Mbala | 15 | Northern | 80 | 159 | 89,285 |
| 1007 | Mwamba | Mbala | 16 | Northern | 80 | 159 | 89,285 |
| 1008 | Zimba Hills Settlements | Kazungula | 2 | Southern | 72 | 143 | 89,215 |
| 1009 | Lubofu | Kasempa | 13 | North-Western | 74 | 147 | 88,820 |
| 1010 | Nashinga | Chinsali | 5 | Northern | 70 | 140 | 88,630 |
| 1011 | Fiwila | Mkushi | 6 | Central | 48 | 96 | 88,139 |
| 1012 | Vubwi | Chadiza | 3 | Eastern | 60 | 120 | 88,134 |
| 1013 | Kamakechi | Kasempa | 2 | North-Western | 74 | 147 | 87,652 |
| 1014 | Liumba | Kalabo | 3 | Western | 78 | 155 | 87,416 |
| 1015 | Nyamaluma | Mambwe | 6 | Eastern | 75 | 149 | 86,922 |
| 1016 | Shiwan'gandu area | Chinsali | 1 | Northern | 60 | 120 | 85,651 |
| 1017 | Ibbwemunyama | Siavonga | 2 | Southern | 70 | 140 | 84,167 |
| 1018 | Momboshi | Chibombo | 19 | Central | 55 | 110 | 82,923 |
| 1019 | Musolo | Milenge | 9 | Luapula | 73 | 145 | 82,744 |
| 1020 | Muchinga | Mwense | 11 | Luapula | 70 | 140 | 82,434 |
| 1021 | Ma Hundred | Livingstone | 6 | Southern | 71 | 142 | 81,343 |
| 1022 | Siabwengo | Gwembe | 1 | Southern | 68 | 136 | 79,865 |
| 1023 | Nyangwali | Kabompo | 5 | North-Western | 65 | 130 | 79,818 |
| 1024 | Mukwikile | Chinsali | 8 | Northern | 56 | 112 | 79,805 |
| 1025 | Chinyongola | Chibombo | 20 | Central | 62 | 124 | 79,743 |
| 1026 | Silwili | Monze | 2 | Southern | 65 | 130 | 79,728 |
| 1027 | Namakaka_ | Namwala | 12 | Southern | 50 | 100 | 78,889 |
| 1028 | Lameck | Chinsali | 19 | Northern | 60 | 120 | 78,303 |
| 1029 | Sakurita | Livingstone | 18 | Southern | 66 | 132 | 78,238 |
| 1030 | Kanengo | Kawambwa | 3 | Luapula | 60 | 120 | 78,186 |
| 1031 | Mchimadzi Scheme | Nyimba | 4 | Eastern | 62 | 124 | 77,901 |
| 1032 | Mbesuma area | Chinsali | 2 | Northern | 55 | 110 | 77,563 |
| 1033 | Chimphanje | Nyimba | 8 | Eastern | 66 | 132 | 77,356 |
| 1034 | Nangombe | Sinazongwe | 13 | Southern | 64 | 128 | 77,111 |
| 1035 | Mibenge | Mansa | 5 | Luapula | 54 | 108 | 76,530 |
| 1036 | Chisengi | Kabompo | 6 | North-Western | 60 | 120 | 76,453 |
| 1037 | Musanya | Chinsali | 6 | Northern | 50 | 100 | 76,254 |
| 1038 | Taferansoni | Chadiza | 5 | Eastern | 55 | 110 | 76,106 |
| 1039 | Natebe | Livingstone | 2 | Southern | 62 | 124 | 76,051 |
| 1040 | Nyathanda | Chavuma | 13 | North-Western | 65 | 130 | 75,736 |
| 1041 | Gwena | Siavonga | 9 | Southern | 60 | 120 | 75,463 |
| 1042 | Chipete | Mansa | 9 | Luapula | 56 | 112 | 75,405 |
| 1043 | Mbila | Itezhi-tezhi | 3 | Southern | 63 | 126 | 75,208 |
| 1044 | Simuloongo | Gwembe | 3 | Southern | 57 | 114 | 74,969 |
| 1045 | Kalyongo | Mansa | 17 | Luapula | 60 | 120 | 74,868 |
| 1046 | Sikalinda Resettlement | Monze | 31 | Southern | 60 | 120 | 74,770 |
| 1047 | Chiwaula | Chadiza | 4 | Eastern | 30 | 60 | 74,503 |
| 1048 | Chimbola | Mungwi | 7 | Northern | 62 | 124 | 74,241 |
| 1049 | Chichele | Ndola | 6 | Copperbelt | 63 | 126 | 73,868 |
| 1050 | Mulinga | Kalabo | 21 | Western | 63 | 126 | 73,868 |
| 1051 | Muswishi | Chibombo | 14 | Central | 45 | 90 | 73,682 |
| 1052 | Kapolyo | Mungwi | 11 | Northern | 61 | 122 | 73,339 |
| 1053 | Mushingashi | Lufwanyama | 21 | Copperbelt | 60 | 120 | 72,778 |
| 1054 | Kampemba | Chinsali | 28 | Northern | 60 | 120 | 72,404 |
| 1055 | Kabombo | Kalulushi | 8 | Copperbelt | 60 | 120 | 71,750 |
| 1056 | Nyalugwe | Nyimba | 14 | Eastern | 56 | 112 | 70,884 |
| 1057 | Chimbele | Chinsali | 7 | Northern | 50 | 100 | 70,356 |
| 1058 | Chinkonkwelo | Kabompo | 9 | North-Western | 46 | 92 | 70,143 |
| 1059 | Siameja | Sinazongwe | 14 | Southern | 48 | 96 | 69,849 |
| 1060 | Mlolo | Chadiza | 1 | Eastern | 50 | 100 | 69,735 |
| 1061 | Kankwanda | Kaoma | 32 | Western | 48 | 96 | 69,723 |
| 1062 | Siatwiinda | Sinazongwe | 8 | Southern | 57 | 114 | 69,601 |
| 1063 | Lueti | Kalabo | 9 | Western | 57 | 114 | 69,601 |
| 1064 | Mundoza | Gwembe | 9 | Southern | 56 | 112 | 69,293 |
| 1065 | Rosa | Mungwi | 4 | Northern | 56 | 112 | 68,667 |
| 1066 | Musonko | Chinsali | 26 | Northern | 45 | 90 | 68,219 |
| 1067 | Nkenga | Kaoma | 12 | Western | 43 | 86 | 68,155 |
| 1068 | Mutiti | Mansa | 10 | Luapula | 46 | 92 | 67,444 |
| 1069 | Maako | Kasempa | 8 | North-Western | 50 | 100 | 67,392 |
| 1070 | Kalongwa | Kasempa | 15 | North-Western | 49 | 98 | 67,234 |
| 1071 | Mansa Ressetlement Scheme | Mansa | 2 | Luapula | 51 | 102 | 66,748 |
| 1072 | Chinemu | Lufwanyama | 13 | Copperbelt | 45 | 90 | 66,452 |
| 1073 | Chambi | Chavuma | 10 | North-Western | 52 | 104 | 65,957 |
| 1074 | Ngweze | Sesheke | 14 | Western | 52 | 104 | 65,957 |
| 1075 | Ndoba | Mansa | 11 | Luapula | 36 | 72 | 65,907 |
| 1076 | Lukena | Kaoma | 15 | Western | 49 | 98 | 65,897 |
| 1077 | Makunku | Itezhi-tezhi | 7 | Southern | 53 | 106 | 65,864 |
| 1078 | Namusenga | Namwala | 15 | Southern | 50 | 100 | 65,712 |
| 1079 | Miyombe | Kasempa | 9 | North-Western | 46 | 92 | 65,546 |
| 1080 | Kasiya | Livingstone | 1 | Southern | 50 | 100 | 64,496 |
| 1081 | Chalubilo | Nyimba | 11 | Eastern | 38 | 76 | 64,386 |
| 1082 | No.57 (Lubanda) | Itezhi-tezhi | 1 | Southern | 50 | 100 | 64,153 |
| 1083 | Chikonkomene | Chibombo | 13 | Central | 36 | 72 | 63,649 |
| 1084 | Namasheshe | Kaoma | 30 | Western | 42 | 84 | 63,495 |
| 1085 | Mwerya | Sinazongwe | 9 | Southern | 49 | 98 | 63,219 |
| 1086 | Masongo | Chinsali | 29 | Northern | 50 | 100 | 63,060 |
| 1087 | Sekute | Kazungula | 6 | Southern | 42 | 84 | 62,633 |
| 1088 | Sulwegonde | Sinazongwe | 18 | Southern | 45 | 90 | 61,790 |
| 1089 | Namando | Kaoma | 21 | Western | 46 | 92 | 61,315 |
| 1090 | Kandole | Lufwanyama | 36 | Copperbelt | 45 | 90 | 61,040 |
| 1091 | Ndake | Nyimba | 5 | Eastern | 42 | 84 | 60,863 |
| 1092 | Chintu | Milenge | 7 | Luapula | 49 | 98 | 60,786 |
| 1093 | Kalale | Kaoma | 17 | Western | 44 | 88 | 60,448 |
| 1094 | Mano | Mansa | 4 | Luapula | 44 | 88 | 60,207 |
| 1095 | Wilison | Nyimba | 10 | Eastern | 44 | 88 | 60,115 |
| 1096 | kalasa kando | Mansa | 16 | Luapula | 45 | 90 | 59,759 |
| 1097 | Kabangama | Chinsali | 25 | Northern | 34 | 68 | 58,980 |
| 1098 | Syangwemu | Siavonga | 7 | Southern | 40 | 80 | 58,820 |
| 1099 | Kabunda | Mansa | 13 | Luapula | 41 | 82 | 58,440 |
| 1100 | Mukelangombe | Chavuma | 11 | North-Western | 45 | 90 | 58,388 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (12/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 1101 | Namatindi | Kalabo | 5 | Western | 45 | 90 | 58,388 |
| 1102 | Chivombo | Chavuma | 1 | North-Western | 40 | 80 | 58,146 |
| 1103 | Mutenda | Lufwanyama | 43 | Copperbelt | 45 | 90 | 58,076 |
| 1104 | Muchinshi | Lufwanyama | 44 | Copperbelt | 45 | 90 | 58,076 |
| 1105 | Inonge | Livingstone | 7 | Southern | 41 | 82 | 58,074 |
| 1106 | Bukanda | Mansa | 15 | Luapula | 42 | 84 | 58,049 |
| 1107 | Chipe | Milenge | 2 | Luapula | 41 | 82 | 57,243 |
| 1108 | Muliro | Nyimba | 16 | Eastern | 40 | 80 | 57,238 |
| 1109 | Mulila Nsolo | Kafue | 16 | Lusaka | 45 | 90 | 57,048 |
| 1110 | Nakayembe | Kaoma | 19 | Western | 41 | 82 | 56,429 |
| 1111 | Kalongo Mwape | Nyimba | 15 | Eastern | 41 | 82 | 56,344 |
| 1112 | Namaloba | Kaoma | 20 | Western | 40 | 80 | 56,052 |
| 1113 | mbaso | Mansa | 19 | Luapula | 38 | 76 | 55,825 |
| 1114 | Malimba | Kazungula | 8 | Southern | 21 | 42 | 55,790 |
| 1115 | Lunyiwe Basic School | Kabompo | 7 | North-Western | 36 | 72 | 55,779 |
| 1116 | Mukunkiki | Kaoma | 27 | Western | 41 | 82 | 55,679 |
| 1117 | Loke West | Kalabo | 10 | Western | 42 | 84 | 55,585 |
| 1118 | Mudonki | Gwembe | 2 | Southern | 42 | 84 | 55,571 |
| 1119 | Dibbwi | Siavonga | 5 | Southern | 40 | 80 | 55,042 |
| 1120 | Chambula | Nyimba | 9 | Eastern | 42 | 84 | 54,588 |
| 1121 | Manje | Chadiza | 6 | Eastern | 36 | 72 | 54,420 |
| 1122 | Kafunda | Kaoma | 31 | Western | 29 | 58 | 53,766 |
| 1123 | Kalamba | Kawambwa | 6 | Luapula | 40 | 80 | 53,747 |
| 1124 | Muyumbana | Kalabo | 7 | Western | 40 | 80 | 53,716 |
| 1125 | Majeledi | Livingstone | 16 | Southern | 41 | 82 | 53,311 |
| 1126 | Sihole | Kalabo | 2 | Western | 41 | 82 | 53,311 |
| 1127 | Kasoma Iwela | Mansa | 3 | Luapula | 35 | 70 | 52,548 |
| 1128 | Uningi | Mbala | 9 | Northern | 40 | 80 | 52,376 |
| 1129 | Kaluluzi | Mbala | 11 | Northern | 40 | 80 | 52,376 |
| 1130 | Matanga | Mbala | 13 | Northern | 40 | 80 | 52,376 |
| 1131 | Katapazi | Kazungula | 9 | Southern | 31 | 62 | 52,355 |
| 1132 | Shishamba | Kaoma | 23 | Western | 36 | 72 | 52,314 |
| 1133 | chisunka | Mansa | 18 | Luapula | 35 | 70 | 51,508 |
| 1134 | Lukola | Mansa | 21 | Luapula | 34 | 68 | 51,104 |
| 1135 | Mikula | Mansa | 22 | Luapula | 35 | 70 | 51,010 |
| 1136 | mwanachama | Mansa | 20 | Luapula | 32 | 64 | 50,671 |
| 1137 | Kalingindi | Nyimba | 13 | Eastern | 36 | 72 | 50,605 |
| 1138 | Kapanda | Mansa | 14 | Luapula | 35 | 70 | 49,730 |
| 1139 | Mulira | Nyimba | 6 | Eastern | 34 | 68 | 49,679 |
| 1140 | Afumba | Kaoma | 28 | Western | 32 | 64 | 49,669 |
| 1141 | Lwanya | Chinsali | 21 | Northern | 30 | 60 | 49,288 |
| 1142 | Mutwewankoko | Mansa | 12 | Luapula | 34 | 68 | 49,138 |
| 1143 | Kotinteden | Masaiti | 7 | Copperbelt | 25 | 50 | 48,818 |
| 1144 | Dengera | Sinazongwe | 16 | Southern | 30 | 60 | 48,647 |
| 1145 | Mulundumano | Kalabo | 16 | Western | 36 | 72 | 48,639 |
| 1146 | Muchenje | Chibombo | 6 | Central | 26 | 52 | 48,542 |
| 1147 | Chibuluma Mine Area | Lufwanyama | 45 | Copperbelt | 35 | 70 | 47,704 |
| 1148 | Kabimba | Choma | 6 | Southern | 30 | 60 | 47,024 |
| 1149 | Luchena | Itezhi-tezhi | 2 | Southern | 30 | 60 | 46,448 |
| 1150 | Kacholola | Nyimba | 12 | Eastern | 32 | 64 | 46,241 |
| 1151 | Nyambi 2 | Kaoma | 26 | Western | 29 | 58 | 46,116 |
| 1152 | Chilele | Sinazongwe | 10 | Southern | 21 | 42 | 45,495 |
| 1153 | Kapopo | Chibombo | 11 | Central | 30 | 60 | 45,058 |
| 1154 | Sinde | Livingstone | 14 | Southern | 32 | 64 | 44,901 |
| 1155 | Ngoma | Sinazongwe | 17 | Southern | 23 | 46 | 44,072 |
| 1156 | Konja | Chinsali | 15 | Northern | 20 | 40 | 44,042 |
| 1157 | Kapimbe | Lufwanyama | 29 | Copperbelt | 25 | 50 | 43,335 |
| 1158 | Luela | Lufwanyama | 27 | Copperbelt | 25 | 50 | 43,332 |
| 1159 | Sumbi | Mbala | 5 | Northern | 30 | 60 | 43,032 |
| 1160 | Kalukanya | Mbala | 7 | Northern | 30 | 60 | 43,032 |
| 1161 | Chalele | Mbala | 10 | Northern | 30 | 60 | 43,032 |
| 1162 | Chisanzu | Mbala | 14 | Northern | 30 | 60 | 43,032 |
| 1163 | Kasaba Bay | Mpulungu | 1 | Northern | 30 | 60 | 43,032 |
| 1164 | Lutwi | Kalabo | 12 | Western | 30 | 60 | 43,032 |
| 1165 | Ngabwe | Kapiri Mposhi | 11 | Central | 25 | 50 | 42,100 |
| 1166 | Chikwasha | Nyimba | 17 | Eastern | 29 | 58 | 42,098 |
| 1167 | Kananga | Livingstone | 20 | Southern | 29 | 58 | 42,098 |
| 1168 | Kasosolo | Chibombo | 16 | Central | 20 | 40 | 42,056 |
| 1169 | Malekani | Chinsali | 22 | Northern | 25 | 50 | 41,666 |
| 1170 | Mahelituna | Livingstone | 11 | Southern | 27 | 54 | 41,257 |
| 1171 | Nguvu | Chavuma | 14 | North-Western | 25 | 50 | 38,360 |
| 1172 | Muwezwa | Itezhi-tezhi | 6 | Southern | 24 | 48 | 37,426 |
| 1173 | Sichilore | Livingstone | 13 | Southern | 24 | 48 | 37,426 |
| 1174 | Chipeso | Chibombo | 7 | Central | 16 | 32 | 35,754 |
| 1175 | Fidashi | Masaiti | 15 | Copperbelt | 20 | 40 | 35,714 |
| 1176 | Namatoya | Shangombo | 12 | Western | 18 | 36 | 34,878 |
| 1177 | Simwizi | Livingstone | 17 | Southern | 21 | 42 | 34,623 |
| 1178 | Chilizya | Livingstone | 12 | Southern | 19 | 38 | 34,094 |
| 1179 | Kuuli | Kalabo | 4 | Western | 20 | 40 | 33,688 |
| 1180 | Mishuwundu | Kalabo | 17 | Western | 20 | 40 | 33,688 |
| 1181 | Palace | Shangombo | 3 | Western | 20 | 40 | 33,688 |
| 1182 | Mubalu | Livingstone | 15 | Southern | 19 | 38 | 32,754 |
| 1183 | Sishekanu | Kalabo | 18 | Western | 18 | 36 | 32,505 |
| 1184 | Winda | Kaoma | 35 | Western | 16 | 32 | 31,976 |
| 1185 | Liuwa | Kalabo | 14 | Western | 18 | 36 | 31,819 |
| 1186 | Matete | Masaiti | 14 | Copperbelt | 15 | 30 | 31,042 |
| 1187 | Katubia | Livingstone | 10 | Southern | 17 | 34 | 30,885 |
| 1188 | Kalenga | Kalabo | 6 | Western | 15 | 30 | 30,356 |
| 1189 | Liumena | Kalabo | 11 | Western | 15 | 30 | 30,356 |
| 1190 | Salati | Masaiti | 11 | Copperbelt | 15 | 30 | 29,999 |
| 1191 | Mbilisao | Nyimba | 18 | Eastern | 15 | 30 | 29,016 |
| 1192 | Munde | Kalabo | 15 | Western | 15 | 30 | 29,016 |
| 1193 | Malasha | Kalabo | 19 | Western | 15 | 30 | 29,016 |
| 1194 | Smachuma | Livingstone | 8 | Southern | 14 | 28 | 28,424 |
| 1195 | Zangala | Livingstone | 19 | Southern | 13 | 26 | 27,147 |
| 1196 | Salunda | Kalabo | 8 | Western | 13 | 26 | 27,147 |
| 1197 | Mwandi | Kalabo | 13 | Western | 13 | 26 | 27,147 |
| 1198 | Mikata | Mpongwe | 1 | Copperbelt | 11 | 22 | 26,619 |
| 1199 | Chipundu | Milenge | 8 | Luapula | 8 | 16 | 22,475 |
| 1200 | Chibuli | Mpongwe | 7 | Copperbelt | 6 | 12 | 21,947 |

## Table 5-11 Temporary Electrification Priority of RGCs Based on Demand Criteria (13/13)

| Ranking | RGC | District | Priority | Province | # of HHs (2006) | # of HHs (2030) | Daily Max Load |
|---|---|---|---|---|---|---|---|
| 1201 | Munsongwe | Mpongwe | 11 | Copperbelt | 6 | 12 | 21,947 |
| 1202 | Mbalala | Kalabo | 20 | Western | 7 | 14 | 21,541 |
| 1203 | Mushipushi | Mpongwe | 15 | Copperbelt | 4 | 8 | 21,170 |
| 1204 | Munkunpa | Mpongwe | 3 | Copperbelt | 5 | 10 | 21,012 |
| 1205 | Chinwa | Mpongwe | 9 | Copperbelt | 5 | 10 | 21,012 |
| 1206 | Chowa | Mpongwe | 10 | Copperbelt | 5 | 10 | 21,012 |
| 1207 | Luswishi | Mpongwe | 16 | Copperbelt | 5 | 10 | 21,012 |
| 1208 | Shingwa | Mpongwe | 8 | Copperbelt | 6 | 12 | 20,606 |
| 1209 | Chitabale | Mpongwe | 13 | Copperbelt | 4 | 8 | 20,078 |
| 1210 | Machiya | Mpongwe | 5 | Copperbelt | 4 | 8 | 19,830 |
| 1211 | Chisanga | Mpongwe | 6 | Copperbelt | 3 | 6 | 19,143 |
| 1212 | Ipumbu | Mpongwe | 14 | Copperbelt | 3 | 6 | 19,143 |
| 1213 | Kasamba | Mpongwe | 2 | Copperbelt | 3 | 6 | 18,896 |
| 1214 | Kapili | Mpongwe | 18 | Copperbelt | 2 | 4 | 18,209 |
| 1215 | Mushine | Mpongwe | 17 | Copperbelt | 2 | 4 | 17,962 |
| 1216 | Chisapa | Mpongwe | 19 | Copperbelt | 3 | 6 | 17,803 |
| 1217 | Musofu | Mpongwe | 20 | Copperbelt | 3 | 6 | 17,803 |
| | | | | Total | 537,617 | 1,068,233 | 612,302,427 |