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EVALUATING POWER TRADING IN SELECTED COUNTRIES OF THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

by

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DECLARATION

I, Lukamba-Muhiya Tshombe, declare that the factual contents of this thesis represent my own unaided work and have not been previously submitted for academic examination towards any other qualification. In addition, it represents my own findings and not those of any other individual or institution.

Signed **Date**

ABSTRACT

The research explores an evaluation of cross-border electricity trading among countries of the Southern African Development Community (SADC). Understanding this trading achieve through an analysis of various global electricity markets. The research disclose that in the electricity markets in Europe, North America, South America and Asia analysed in this thesis, none managed to successful eliminate power shortages. Their situation, however, is different from that of the Southern Africa Power Pool (SAPP). The apparent poor design of the SAPP as a regional power pool impacts negatively on power trading within its region.

A strategic public management model was used to analyse the organisational dynamics of the electricity companies of the three countries selected for this research (Democratic Republic of Congo, South Africa and Zimbabwe). A Strength Weakness Opportunities and Threats (SWOT) analysis carried out on these markets indicated that there are problems among different electricity companies, each requiring a solution. Each country's evaluation highlighted a need for an accountable government to implement a goal-directed policy to militate against any dysfunctional operations by the electricity companies.

The quantitative and qualitative data analyses of the fieldwork results showed the SAPP had struggled hard to increase the capacity of members' power trading. The study indicated internal problems in terms of increasing trading volumes. The time series analysis showed power trading in the short-term electricity market had decreased annually. Linear regression analysis also indicated a decline in the capacity of the SAPP. A number of factors could explain the reduction of capacity in the SAPP, but the research results suggested a strong probability that electricity capacity would decrease further, as the countries, trading in the power pool have experienced decreased electricity volume annually because of internal demand.

In addition to a number of recommendations, the research proposes a normative model that could be used by nations to manage and assess the electricity market. An understanding of the input as adapted from Easton input/output normative

transformational systems model, in terms of different governments, should assist policy-makers to transform the power trading generating distribution industry.

Global experience shows the need to establish a normative transformation of the electricity industry in the SADC region. It is clear from the results of this study that the SADC electricity markets have been poorly transformed in terms of a particular normative guideline.

The situation has also disadvantaged the SAPP, which, in recent times, had less electricity capacity with which to trade. Implementation of the normative model in the context of this study sought to analyse all aspects that might influence the transformation of the electricity sector, and to grow a currently dysfunctional state to that of functionality and reliability. While each country faced its own reality in terms of the transformation of its public enterprises, the study recommends the normative model be implemented in the same way in each selected country.

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AC:	Alternating Current
ABOM:	Agreement between Operating Member
ADB:	African Development Bank
APX:	Amsterdam Power Exchange
BEE:	Black Economic Empowerment
BETTA:	British Electricity Trading and Transmission Arrangement
BKWH:	Billion Kilowatts per Hour
BN:	Billion
BPC:	Botswana Power Corporation
CIA:	Central Intelligence Agency
CAPP:	Central African Power Pool
CBOT:	Chicago Board of Trade
CEO:	Chief executive officer
CEC:	Copperbelt Energy Corporation
CEF:	Central Energy Fund
CEGB:	Central Electricity Generating Board
CENTREL:	Central Europe
CIS:	Commonwealth of Independent States
CAPCO:	Central African Power Corporation
DC:	Direct Current
DOE:	Department of Energy
DME:	Department of Minerals and Energy
DRC:	Democratic Republic of the Congo
EIA:	Energy Information Administration
ESC:	Electricity Supply Commission
EDM:	Electricidade de Mozambique
EDEL:	Electricidad de Luanda
EU:	European Commission
EUC:	European Union Commission
ENE:	Empresa National de Electricidade
ECCAS:	Economy Community of Central African States
ESA:	Electricity Supply Act

ESCOM:	Electricity Supply Commission of Malawi
ESI:	Electricity Supply Industry
EMA:	Empresa de Agua E Electricidad
EEMA:	Electric Energy Marketing Act
ESKOM:	Electricity Supply Commission of South Africa
ESC:	Electricity Supply Commission
EDI:	Electricity Distribution Industry
ETU:	Energy Technical Unit
EAPP:	Eastern African Power Pool
EEX:	European Energy Exchange
EXAA:	Energy Exchange Austria
FEC:	Federation Congolaise Des Entreprises Du Congo
GAP:	Global African Limited
GDP:	Gross Domestic Product
GW:	Gigawatt
HCB:	Hidroelectrica de Cahora Bassa
IEA:	International Energy Agency
IGMOU:	Inter-government Memorandum of Understanding
IUMOU:	Inter-Utility Memorandum of Understanding
IPP:	Independent Power Producer
ISO:	Independent System Operator
KM:	Kilometre
KGL:	Kafue Gorge Lower
KV:	Kilovolt
LAOPDR:	Lao People Democratic
LEC:	Lesotho Electricity Corporation
LHWP:	Lesotho Highlands Water Projects
LIC:	Lower Income Countries
MW:	Megawatt
M:	Million
MIC:	Middle Income Countries
MOU:	Memorandum of Understanding
NERSA:	National Energy Regulator of South Africa
NAMPOWER:	Namibia Power

NEC:	Nuclear Electric Company
NEM:	National Electricity Market
NETA:	New Electricity Agreement
NPC:	National Power Company
NP:	Nord Pool
NGC:	National Grid Company
MEPC:	Minerals Energy Policy Centre
NYMEX:	New York Mercantile Exchange
OG:	Operating Guideline
PPA:	Power Purchase Agreement
PPP:	Public Private Partnerships
PPI:	Private Participation in the Infrastructure
PX:	Power Exchange
PGC:	Power Generation Company
UCPTE:	Union for the Co-ordination of Power Generation and Transmission
UK:	United Kingdom
UK PX:	United Kingdom Power Exchange
USSR:	Union of Soviet Socialist Republic
UPS:	Unified Power System
USA:	United States of America
RED:	Regional Electricity Distributor
REGIDESO:	Regie des Distribution d' Eaux
SADC:	Southern African Development Community
SAPP:	Southern African Power Pool
SEB:	Swaziland Electricity Board
SEE:	South East Europe
SEEG:	Societe d'Energie et d'Eau du Gabon
SNCC :	Societe National des Chemin de Fer Congolaise
SNEL:	Societe Nationale d'Electricite
SNE:	Societe National d'Electricite
STEM:	Short Term Energy Market
SEGESA:	Sociedad de Electricidad de Guinea Equatorial
STEE:	Societe Tchadiene d'Eau

SWOT:	Strengths, Weakness, Opportunity and Threats
TANESCO:	Tanzania Electric Supply Company
TAU:	Technical Administrative Unity
WESTCOR:	Western Corridor
ZESA:	Zimbabwe Electricity Supply Authority
ZESCO:	Zambia Electricity Supply Corporation
ZPC:	Zimbabwe Power Company
ZTC:	Zimbabwe Power Transmission
ZEDC:	Zimbabwe Electricity Distribution Company
ZERC:	Zimbabwe Electricity Regulator Commission

CHAPTER 1. INTRODUCTION

1.1 Introduction and Background to the Study

According to Kooiman and Van Vliet "the fact that the government, politically and administratively, will be held responsible for the quality of the direct care (governing), as well as for the quality of the socio-political order (governance), means that public managing is not a sinecure" (1993:65). The improvement of service delivery within the government sphere demands a public manager possesses knowledge of policy implementation, since this ensures knowing where there is a need for improvement and to meet such need.

The aim of public management in government is to implement a policy to address problems facing government. In modern society public management sets out to achieve, maintain and enhance service delivery by implementing such policy. Public officials should function within such democratic values and principles prescribed by the constitution of a given country (Kooiman and Van Vliet: 1993).

The research evaluates power trading problems in selected countries within the Southern African Development Community (SADC). The respective role of the participant in the regulation of electricity supply in three selected countries in the SADC is discussed. The countries studied are South Africa, the Democratic Republic of the Congo (DRC) and Zimbabwe.

The reason for conducting an evaluation of power trading within the selected countries is that all three have power trading agreements. Bilateral agreements to import electricity exist because particular nations in that region frequently depend on neighbours for electricity. Such agreements among SADC countries have existed for more than 15 years. Power trading agreements were signed through complex bilateral contracts which were often difficult to understand. In addition, a power pool agreement, which is used to create a more efficient regional market (Donal, Charpentier and Minogue, 1998:1), exists among member states within the region. Electricity trading in the SADC region is a major priority for member states.

In order to solve the problem of inequality in electricity production, most countries in this region formed a regional body aimed to normalise electricity trading throughout the region. In southern Africa, the regional body is known as the South African Power Pool "SAPP" (SAPP, 1999: 5). The disparities in production and consumption of electricity by the different countries offered a rationale for integration and development of regional electricity trading.

In 1995, 12 member states established the Southern Africa Power Pool (SAPP) for the endorsement of electricity trading reduction in costs and to provide security of supply. The SAPP annual report (1995:1) shows 12 national utility companies endorsing the SAPP agreement. These were Botswana Power Corporation (BPC), Electricidade de Mozambique (EDM), Angola's Empresa Nacional de Electricidade (ENE), Electricity Supply Commission of Malawi (Escom), South Africa's (Electricity Supply Commission of South Africa (Eskom), the Lesotho Electricity Corporation (LEC), Namibia's NamPower, the Swaziland Electricity Board (SEB), the Democratic Republic of Congo's (DRC's) Societe Nationale d'Electricite (SNEL), the Tanzania Electric Supply Company (Tanesco), the Zimbabwe Electricity Supply Authority (Zesa) and the Zambia Electricity Supply Corporation (Zesco). SAPP membership is currently restricted to national electricity utilities. One private sector company, Hidroelectrica de Cahora Bassa (HCB) in Mozambique, was allowed has a temporary observer within the SAPP (SAPP: 1999). The reason was that the Mozambican government to take over the HCB in October, 2006. This decision was promulgated by the Mozambique government in collaboration with the Portuguese government. No other private company has since been granted observer status.

The SAPP's main objective was to facilitate a reliable electricity supply to consumers in its member states. According to Energy Administration Information (2003:1), SAPP evolved from a co-operative power pool to a competitive power pool. The extent of electricity trading continued to increase annually at an average rate of 20%.

The value of the electricity traded in 1999 exceeded $150 million[1] (ZAR 1 billion). A short-term energy market (STEM), which began live power trading in April 2001, utilises the Internet to conduct its trade.

1.2 Problem Statement

South Africa's Eskom needs to expand its capacity before 2008 to respond to future demands. Currently, Eskom is able to meet electricity demands, but, its reserves are being heavily depleted, particularly during winter, when demand is at its highest.

In 1994 to 2000, Eskom was able to operate with reserves of up to 20% of normal electricity production. However, with increased industrialisation, technical and equipment related problems and domestic use, this reserve capacity has diminished approximately 5%, which is not sustainable in terms of current demand (Eskom, 2001:53). Projections indicate at this rate, by end of 2008, there could be an acute energy crisis in South Africa. As part of the attempts to avert this looming crisis there is a need to develop a new model for power trading in the SADC region.

Currently, there is general concern among SAPP members about electricity capacity within the region. The electricity shortage in different countries suggested the establishment of the power pool, to alleviate the shortfall. South Africa, Zimbabwe and other countries within the SADC region anticipated an electricity shortage because of economic growth and resultant population demands impacting on infrastructure.

1.3 Aim of the Research

The aim of the research was to study and evaluate the impact of power trading in SADC and its policy mechanisms. The researcher further aimed to contribute to existing knowledge, taking into accounts the strengths and weaknesses integral to organisations. The opportunities and threats emanating from external and internal environments were also to be considered.

[1] The US dollar will be used as a monetary value in this regional study

1.4 Research Objectives

The main objectives of this study were to:

- Study and evaluate the impact of power trading in selected countries within the SADC;
- Design and present a normative model to improve power trading in the Southern African Development Community; and
- Evaluate the potential of power trading in the Southern African Power Pool;
- Review policy mechanisms and private sector involvement within the electricity sector in the SADC;
- Investigate the applicability of a Public Private Partnership (PPP) model in the electricity sector in the SADC;
- Investigate key factors which influence the performance of PPP in the electricity sector in the SADC;
- Make recommendations to improve power trading amongst member states.

1.5 Key Questions

The principal questions are:

- How does power trading occur in the different countries within the SADC region?
- Can power trading in selected countries in the SADC be improved?
- What are the key factors that influence the performance and extent of power trading in the Southern African region?
- What are the seasonality factors influencing power trading in the SADC?
- What is the PPP application in energy generation in the SADC?

1.6 Hypotheses to key questions

The hypotheses outlined in the research were verified or rejected during the development of the study. They were:

- Power trading in the SADC countries is not uniform to all member states;
- Power trading is based on bilateral agreements, and on political friendship between countries;

- The factors that influence powers trading in the region emanate from different circumstances. The first is the variety in economic development and subsequent energy demand within the region; secondly, some countries are dependent on others that import electricity such as Botswana, Zimbabwe and Namibia;
- A few PPP projects exist in power generation within the selected SADC countries, and
- Seasonality factors influence capacity trade.

1.7 Significance of the study

The research is of significance to South Africa and other countries within the SADC region because of their interrelated dependency on electricity. The complexity of the electricity market in this region is highlighted. The research encompasses a wide range of interest groups ranging from researchers at universities, public officials within energy ministries, and ministries of public enterprise and electricity companies in different countries within the region. The following information is gained from this study:

- A new, improved framework for the implementation of power trading in the energy sector within the Southern African region;
- A contribution to existing scientific knowledge and the understanding of different power trading solutions within the energy sector;
- A contribution to the existing body of knowledge within the research areas; and
- A normative model as a contribution to existing knowledge and to conduct partnerships between government and the private sector within the energy sector.

1.8 Delimitation of the study field

The delimitations of this study are:

- Of the existing 14 member states in the SADC region, three have been selected to serve as case studies for the research.
- The research focuses only on evaluating power trading for selected countries in the Southern African region.

1.9 Research Methodology

The researcher used a case study method to investigate the evaluation of power trading within selected countries in the SADC region. The objective of using a case study method was to create understanding of the different processes emanating from the implementation of the power trading agreements. The research embarked first on a literature search to gain theoretical knowledge of the topic. Subsequently, an empirical survey was undertaken via self-administered questionnaires. The empirical survey explored various case studies pertaining to the resources topic and to identify normative criteria for power trading in selected countries of the SADC (see Section 1.9.1.1). This was followed by a statistical analysis, after which a normative model for power trading was constructed and proposed, concomitant to a number of recommendations to improve the electricity trading scenario in the selected countries.

1. 9.1 Literature Search

The researcher consulted published literature on global power trading and studies, different World Bank reports on energy trading in developing countries were studied to obtain an international overview. The research also consulted the European Union (EU) report on energy trading among EU members.

Furthermore, government policies were reviewed, including legislation and subordinate legislation, minutes of meetings, official publications and other policies concerning power trading in the SAPP. In addition, the study reviewed newspaper articles regarding electricity issues in the region, plus other unpublished research on this topic.

The collection of secondary data in the research was based on government legislation. For example, a White Paper on Energy Policy for the South African Government, as well as an economic policy review report from the Reserve Bank of Zimbabwe were consulted. Documents were collected from the library at the University of Cape Town, the Cape Peninsula University of Technology and overseas universities, also from the World Bank, the European Union website and other relevant organisations.

1.9.1.1 Extracting Normative Criteria from Existing Literature

The information gleaned from a literature search on power trading provided the basis for the researcher to find and extract selected normative criteria pertaining to the trading of electricity. It also facilitated an understanding of the research topic, providing knowledge for the researcher to evaluate electricity trading in the region. From this study a set of selected normative criteria was compiled which served as a theoretical yardstick against which the results of the empirical survey were measured.

1.9.1.2 Empirical Survey

Primary and secondary data were used by the researcher to provide a comprehensive understanding of the evaluation of power trading in the energy sector. Primary data is defined by Berkeley (2005:1) as primary sources, which allow the researcher to get as close as possible to what actually happened during a historical event or time period. Primary data reflects the viewpoint of a participant or observer.

As an example, the empirical survey in the research targeted the directors of the departments of electricity in the ministries of minerals and energy in selected countries, as well as the directors of trading and marketing at Eskom, Societé National d'Electricité (SNEL) and Zimbabwe Electricity Supply Authority (ZESA). In addition, the SAPP headquarters in Harare was visited to collect data for electricity trade during a five years period between 2002 and 2006. An interview was held with the co-ordination manager in the SAPP head office in Harare to gain insight into problems related to power trading in the SADC region.

1.9.1.3 Case Studies

According to Yin (1984:35), a case study is an empirical inquiry, which investigates a contemporary phenomenon within a real-life context when the boundaries between phenomenon and context are unclear and during which multiple sources of evidence are used (Yin, 1984:35). The rational for using a case study method in the research was that it provided additional information on power trading within the energy sector. It assisted in the analysis of the trading of electricity in the SAPP among the selected countries.

In the above context, Yin (2003:87) argues that, because of their value, documents play an explicit role in any data collection when considering case studies and a systematic search for relevant documents as essential to any data collection plan. The case studies method provided an opportunity for the researcher to verify the data collected from other sources. The researcher also arranged access to files or reports from the relevant organisations under scrutiny.

The case study method utilised interviews, a widely accepted tool to obtain information (Yin, 2003:87). These helped to obtain fieldwork information from Eskom in South Africa, SNEL in the DRC, the SAPP office in Harare (Zimbabwe), ZESA and Zimbabwe's Department of Energy and Power. The contribution of these interviews was that it enabled direct communication with senior officials involved in decision-making on power trading in the SADC region and allowed the generation of data that could be triangulated with a number of other sources.

The research utilised qualitative and quantitative research to enable the researcher to collect data. According to Fellows and Liu (1997: 20), as triangulated studies use two or more research techniques, qualitative and quantitative approaches may be employed to reduce or eliminate disadvantages of each individual approach, while gaining through synergy the advantages of each in a combination of a multi-dimensional view of the subject. Fellows and Liu (1997:21) continued by saying that irrespective of the approach or style of research it was necessary that authenticity and applicability of their outcome and conclusions were appreciated and understood.

1.9.2 Statistical Analysis

Interpretation and articulation of the findings were initiated once the fieldwork in the three selected SADC countries was completed. The analysis focused on the responses of senior public officials of the different countries. At the same time, an analysis of power trading in the short-term electricity market over five years was used to interpret a normative model to evaluate power trading in the SADC region.

A recommendation is included at the end of the study for an improved implementation of power trading throughout the African continent.

1.9.3 Qualitative and Quantitative Analysis

Qualitative and quantitative data were used to enable the researcher to analyse the findings. Both techniques were imperative for the analysis of the study. The details of these techniques are explained in the research methodology chapter. The qualitative method will focus on the fieldwork interview in the selected countries of the research. In addition the quantitative method will analyse the five years of data about power trading in the short-term energy market. The triangulation of both methods will justify the hypotheses of the study.

1.10 Outcome of the Research

The objectives were to delineate six aspects for the evaluation of power trading in selected countries within the SADC region in the energy sector. The research contributes to the existing body of knowledge in a number of areas. These elements also include:

- An international review on power trading around the world;
- The case study descriptions;
- Lessons for other countries who want to apply PPP to power trading in the energy sector;
- Development of a normative model on power trading in the energy sector in SADC;
- Recommendations on power trading; and
- Clarify a future research agenda on power trading in the region and for the African continent.

1.11 Chapter Outline

The first chapter outlines the background of the study and provides a general overview of the electricity sector in selected countries in the SADC region. Information on power trading in the SADC countries was used. A research problem was provided to contextualise the current dysfunctionalities of power trading in this region. Chapter two outlines a global overview of power trading around the world.

Chapter three focuses on public management policies relating to the role of the states in the management of energy needs supply within selected SADC nations. Chapter four provides a discussion of the role of management of energy supply and demand in the three selected countries within the SADC.

Chapter five explains the implementation of the SWOT analysis method in the selected electricity companies of the SADC. Chapter six discusses various mechanisms to fund the electricity sector in the region.

Chapter seven presents the argument for the methodology and data collection methods used in the study. Chapter eight presents the results of the data analysis, while Chapter nine presents the normative model on power trading in the SADC region. Chapter ten presents the conclusions drawn from the study; recommendations are provided based on the proposed normative model.

1.12 Summary

Chapter One outlines an introduction and general background to the study, which concerns the electricity sector in the SADC region. The aim of public management and its relevance within public governance are explained. Furthermore, the research outlines the impact of the implementation of the Southern African Power Pool in the region. The creation of the SAPP in 1995 was because of an inequality of electricity production and distribution in the SADC region. Finally, the researcher presents the research problem of this study through which different objectives are provided. A case study research method is indicated, as well as qualitative and quantitative methods, also known as triangulation, to present the results of this research. The following chapter, Chapter Two will, present a global overview of power trading around the world.

CHAPTER 2. GLOBAL OVERVIEW OF POWER TRADING

2.1 Introduction

The first chapter provides an introduction and background to the energy sector within the SADC region and outlines the problem statement of the study. It focuses on international experience with regards to power trading on different continents. The need for highlighting international experiences of power trading is to argue the significance to the study within the SADC region. It also allows lessons to be learnt from past experience on power trading in different countries. Regulatory frameworks differ for various power trading agreements between nations. This literature review assists in understanding the politics behind power trading agreements in different global regions.

2.2 History of Power Trading

It is necessary for this study to firstly define the word "trading" before discussing the historical background of global electricity trading. Shahidehpour and Alomoush (2001:223) define trading as an activity in which transactions take place directly between an organiser, a marketplace and an exchange. Electricity trading involves two main elements, physical trading and financial trading. Physical trading concerns balancing supply against demand, where price would be either determined in advance of trading, during, or after. Most commonly, a price is fixed in advance before a buyer signs a contract. In financial trading, contracts take place between traders as agreements to provide certainty for traders. Accordingly, trading is conducted on energy spot markets or fixed financial markets. For example, the New York Mercantile Exchange (NYMEX) and the Chicago Board of Trade (CBOT) (Shahidehpour and Alomoush: 2001). In the case of developing countries, specifically throughout Africa, the trading of power is organised between two countries. Shahidehpour and Alomoush (2001:226) present a framework in which energy trading may take place. The elements are:

- Good design;
- Effective rules;
- Independent administration;
- Adequate standards for market participants;

- Comprehensive trading opportunities, and
- Availability of market information.

Historically, power trading agreements began when small independent power producers considered the reliability of energy (electricity). The situations resulted in attempts to group or pool them to ensure a reliable supply to customers, because of the maintenance or other reasons would not be able to physically ensure a given level of supply without maintaining surplus capacity. Subsequently, this pooling was scaled up and extended to regional, inter-regional, and international systems. The first recorded international interconnection was a tie line between Canada and the United States of America (US) in 1901 while, in 1929, it extended in Europe, between Germany and Austria (Charpentier and Schenk, 1995:1).

Currently, a number of regional interconnection systems are in operation in:

- Western Europe. Examples include: the Union for the Co-ordination of Power and Transmission (UCPTE), comprise Austria, Belgium, France, Germany, Italy, Luxembourg, the Netherlands, Spain, Portugal, Switzerland, plus other new EU members followed by;
- Scandinavian countries, which include Finland, Sweden, Norway and Denmark;
- England and Wales;
- Central Europe (CENTREL),
- Eastern Europe (UPS). Beyond Europe examples of such systems there is also other electricity market in other continent such as;
- North America (the three US network-East, West and Texas, and four Canadian networks);
- Central and South America;
- SAPP; in the Southern African region; and
- The Asian power pool (Charpentier and Schenk: 1995). There are also other systems, which can be considered in terms of power trading worldwide.

In terms of developing electricity trade worldwide, the reform of the electricity supply industry play a major role. This transformation took place within the power sector in different countries because the electricity sector is labour-intensive.

An imperative element concerning power trading is economic growth within different global regions. This forces governments to develop and expand electricity markets. Currently, every region on the African continent has developed regional zones for power trading such as a co-operative pool to sustain energy security within the region.

2.2.1 Power Trading Models

There are several market structures used worldwide for electricity trading. These are:

2.2.1.1 Poolco Model

As defined by Shahidehpour and Alomoush (2001:5), a 'poolco' is defined as a centralised marketplace which clears the market for buyer and sellers; where electric power sellers/buyer submit bids and prices to a pool for the amounts of energy they are willing to sell or buy. In addition, vendors within a power market compete for the right to supply electricity to the grid, not to specific customers.

2.2.1.2 Bilateral Contract Model

This is defined by Shahidehpour and Alomoush (2001:4) as a negotiable agreement on the delivery and receipt of power between two traders, (which could be two countries). These contracts have set terms and conditions of agreement, independent of the independent system operator (ISO). In this model, the ISO verifies that sufficient transmission capacity exists to complete any transactions and to maintain transmission security. In this model the two parties are flexible as trading parties, specifying desired contract terms. This type of contract does have disadvantages in terms of high costs during negotiation and compilation of contracts, as well as the risk of the counterparts' creditworthiness. For example, the bilateral contract between two countries, such as Botswana and South Africa, experiences such difficulties.

2.2.1.3 Hybrid Model

The hybrid model is a combination of the two previous models (poolco and the bilateral), where the utilisation of a poolco is unnecessary and any buyer is allowed to negotiate a power supply agreement directly with suppliers or to choose to accept power at the spot market price (Shahidehpour and Alomoush, 2001:4). An advantage of this model is that a consumer enjoys flexibility to choose a supplier and a price, so can be particularly flexible.

There is also a model which is applied to international power markets across the world. The following markets are:

- The single buyer model;
- The third party or open access model and,
- The spot market or wholesale market (power pool model).

2.2.1.4 The Single Buyer Model

Within a single buyer market, a single entity for example Zimbabwe Electricity Supply Authority (ZESA) buys power from producers on a contractual basis. This approach does not require a radical separation of integrated utilities or significant power sector reform. A long-term contract can be structured as an independent power producer (IPP) contract, providing separate payments for capacity and energy to compensate producers who maintain high levels of plant availability. This model provides limited advantages for competition, since the sale tends to be based on a long-term contract. This may also lead to inefficiencies in investment, such as repetition in transmission (Croussilat, 1998:3). When there is more competition within a single buyer model there is a need for vertical or horizontal separation on generation, transmission and distribution. The vertical separation of power generation has attempted to make competition easier between power a generator, which again makes it easy to identify the price of transmission, as well as the cost of the grid.

2.2.1.5 The Open Access Model

This model allows a power generator to connect directly to a transmission line, which, in turn, allows the generators to supply electricity directly to the distributor or to large bulk consumers. Croussilat (1998:3) argues access to transmission should be regulated and that pricing policies be competitive, transparent and efficient. Vertical separation of transmission avoids possible conflicts of interest arising from a transmission entity favouring its own generator sources. Under the open access model, most power trading remains based on long-term contracts, but short-term trade could occur, however, if countries enjoyed spare energy capacity.

2.2.1.6 The Spot Market or Power Pool

The spot market or power pool model, which is predominantly implemented on an international power market, is also used to form a regional power pool or wholesale market. It allows regional power producers to sell directly to any distributor or bulk consumer. Croussilat (1998:3) says this model requires a regulatory framework capable of guaranteeing a fair and efficient market, including mechanisms to facilitate and co-ordinate electricity trading. In addition, governments should ensure a small group of generators do not monopolise the market, thereby, inhibiting competitive power pooling.

The experience of these different models in Asian countries, especially in the Mekong (Vietnam) region, has allowed power trading. Most governments have opened the generation market door to IPP, which is seen as a positive element to attract investment to that particular energy sector (Crousilat, 1998:4).

In the next sections an overview of the experiences of international electricity trading countries is provided. It highlights different power trading markets around the world on a continental basis, and details the transformation of the relevant electricity sectors.

2.2.2. European Power Trading

2.2.2.1 United Kingdom (UK)

The UK encompasses England, Wales, Scotland and Northern Ireland. England and Wales represent one region; Scotland and Northern Ireland another. Regarding the electricity industries in particular, England and Wales are governed by one Act of Parliament. The Electricity Act which governs Scotland and Northern Ireland is, however, different (Shahidehpour and Alomoush, 2001:438). The English and Welsh governments wanted electricity generation and distribution to be competitive industries. In order to balance electricity supply and demand, the British government implemented a power pool, to act as a clearinghouse between suppliers of electricity and wholesale consumers of electricity (primarily regional electricity distribution companies).

The English power pool is open to all generators and consumers wishing to participate. The British government decided in April 1990, the Central Electricity Generating Board (CEGB) should become an independent body and the CEGB was divided into four: National Power Company (NPC), PowerGen Company (PGC), Nuclear Electric Company (NEC) and the National Grid Company (NGC). According to Kwoka (1997:2), the traditional industry was dismembered both vertically and horizontally. High voltage transmission assets were transferred to a new NGC, while coal and oil fire units were divided among two companies, NPC and PGC. The NEC retained control of nuclear units, while the British government's plan was to assign nuclear units to the NPC. That plan floundered in the face of investor concerns about nuclear safety and decommissioning costs.

English power trading began after the reform of the electricity sector following the election of a Conservative government led by Margaret Thatcher in 1979. According to Elecpool (www.elecpool.com), the introduction of power trading arrangements began on 27 March 2001, when the electricity pool of England and Wales ceased to be their wholesale market mechanism for trading electricity. The consequence of power trading in Britain was that electricity generation was privatised during the implementation of the England Electricity Act of 1989.

According to International Energy Agency (IEA, 2004:42), the industries were first restructured by government along functional lines. For example, the reform of the UK power sector, in particular, aimed to bring competition into the market. Figure 2.1 represents the current English and Welsh electricity markets.

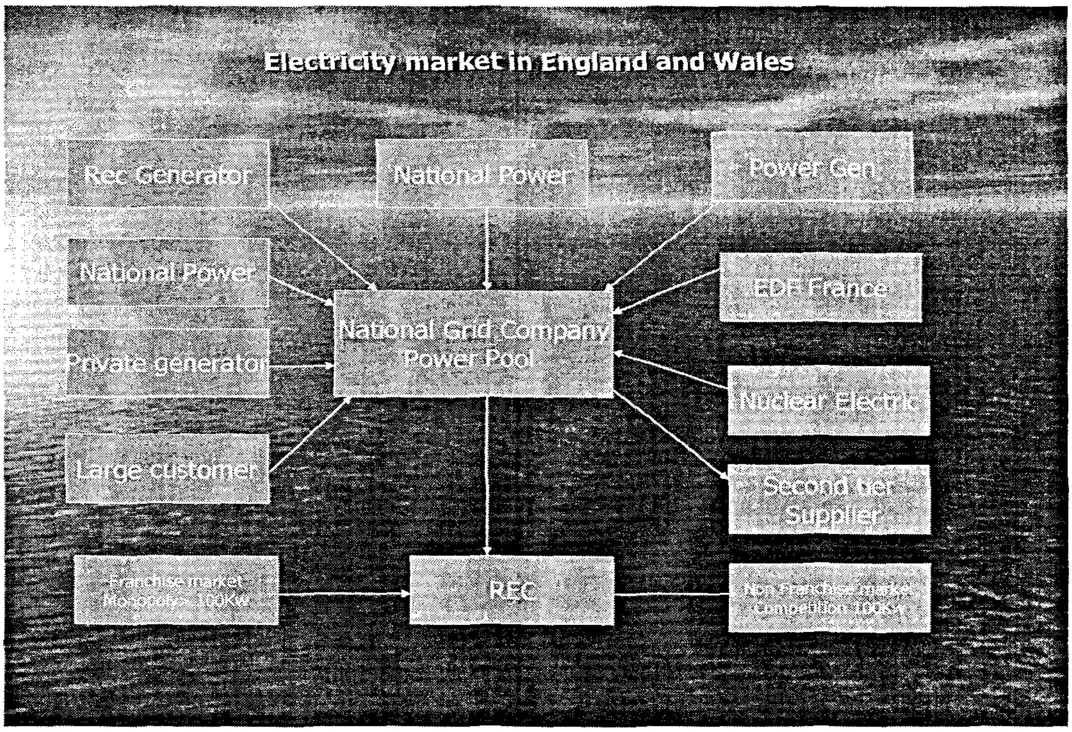

Figure 2. 1: Structure of the electricity industry in England and Wales (Shahidehpour and Alomoush: 2001)

Experience showed that the British and Welsh power markets had successes as well as failures in terms of government transformation (Kwoka: 1997:3). On one hand, transformation of the British power market worked, but it is also advisable to recognise that the British electricity market face difficulties. Kwoka (1997:3) also presents facts arising during the implementation of the power market. For example, the market power of generators resulted in unwarranted price increases, which happened in England and Wales. But, conversely, Kwako (1997) also says the initial specification of price caps allowed for substantial price and profit increases at the expense of consumers.

According to Thomas (2001:3), in 1997, the power pool, which was the spot market meant as the centre point of the wholesale market, provided the contract market with a significant proportion of power sales and price signals. It was judged by the regulator and government to have failed and was replaced by the New Electricity Trading Arrangement (NETA) in 2001. In the same context, the British government introduced a new energy Act in 2004 for the establishment of British Electricity Trading and Transmission Arrangement (BETTA). According to the British electricity utility market report (2006:66) in April 2005, the electricity wholesale market in Scotland operated under different arrangements from those in England and Wales. In addition, BETTA introduced a single wholesale electricity market for the Great Britain with a single transmission system operation National Grid, which works independent of electricity trading arrangement. The example of British electricity market was a positive lesson to learn from the UK experience for other countries. The applicability of the sector's transformation in the UK led to the establishment of power trading between other nations.

2.2.2.2 Scandinavia

The Scandinavian countries (Denmark, Sweden, Finland and Norway) developed their own power trading agreements. Carlsson (1999:1) argues Scandinavia, as part of Europe, has traded electricity for a decade producing the world's most developed international market for electricity. Ten years ago, the trading system changed radically, moving from a form of co-operation among the vertically integrated utilities in each country, under the Nordel Agreement, toward competitive market rules. Norway and Sweden established a common power market, Nord Pool, in 1996; Finland joined in June, 1998. Another reason for electricity trading in Scandinavia was encouragement for Nordel, established in 1960 to develop bilateral co-operation among the main electricity producers in each country. Nordel's aim was for each state to have sufficient generating capacity, leading to self-sufficiency.

2.2.2.3 Central Europe

The EU has considered open access and free transit in electricity networks. It is not only a time-honoured agreement between utilities to supply emergency power, but also a systematic trade of electricity on a competitive basis across Europe (Charpentier and Schenk, 1995:6). The first experience of electricity trading was demonstrated in the transformation of the UK electricity sector.

Because of annual increases in demand since 1999, the EU has developed a large energy market in Europe. The objective was to create a major power pool competition within the energy sector of member countries before 2008.

Rider (1999:64) argues national and industry boundaries had become less relevant in the energy sector, cross-border electricity trading became more common, with a greater effect on profitability. Rider (1999:65) continues that the electricity market was a volatile commodity throughout the EU. This was a different market and the political conditions presented an exceptional challenge to both industry and EU members.

2.2.2.4 Structure of Power Trading

There are several power pools for electricity trading across Europe:

- NordPool, launched in 1996;
- European Energy Exchange (EEX) merged with the old LPX in 2002;
- UK Power Exchange (UK PX) launched in June 2000;
- Amsterdam Power Exchange (APX) launched in May 1999;
- Powernext launched in November 2001; followed by
- Spanish Pool, launched January 1998; and
- Energy Exchange Austria (EXAA) launched in March 2002.

Power trading in Europe has been summarised in Figure 2.2. The first group of countries (Greece, Slovakia, France, Italy, Luxembourg and Ireland) represent state companies with electricity companies under government control. In the Netherlands, generation is parastatal. There are also companies, with limited private ownership in some European countries such as Poland, Austria, Hungary, Spain, Portugal, Switzerland, the Czech Republic, Belgium, Germany and Denmark. In addition, there are companies, which have been liberalised before being privatised. For example, the UK, electricity companies were privatised (Shahidehpour and Alomoush, 2001:4).

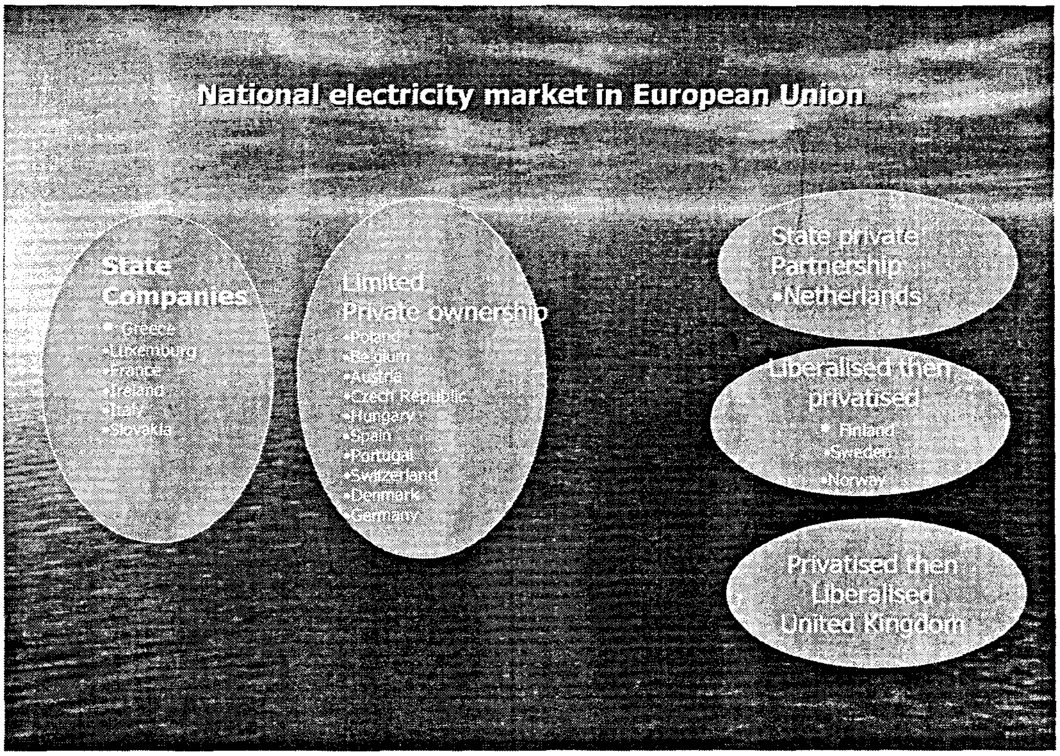

Figure 2. 2: European Electricity Market (Shahidehpour and Almoush: 2001)

The main aim of EU electricity growth was to move toward a single, sustainable European electricity market with different electricity companies (private and public) trading electricity in a single market (EU; 2005:2).

In the case of Eastern European countries, trade played a minor role and represented less than 10% of total electricity consumption in the region. Power trading concentrated on regional markets, which grew based on network connections. It was also driven by certain political alliances. For example, the central European countries (Poland, the Czech Republic, Hungary and Slovakia) combined as the Central Zone in Eastern Europe; Slovenia and Croatia were considered part of this zone (EU; 2005:5). In the case of power trading in South-East Europe (SEE), power trade was based firstly on bilateral trading between two countries. The European Union Commission EUC (2005:6) was of the view that energy trading should begin among members within controlled zone and cross borders. Markets increased on a voluntary basis, but there was little clarification on how the business partners (buyers and sellers) would structure contracts.
Members suggested the implementation of bilateral trade within the region should be based on further harmonisation of national market rules-including contract

notification and collaterals. Centralised bilateral clearing provided decreasing risk and financial guarantees for market participants, but at the same time it needed to be developed as a voluntary mechanism which market participants could choose (EUC; 2005:6).

Concerning the spot market, all countries within the SEE could organise themselves and try to provide services for all participants. This would ensure that there were not barriers for non-members hoping to enter the market. Additionally, the IEA (1999: 245) argued electricity market competition offered significant potential benefits through improved economic performance, lower prices and an expansion of choice, all available to consumers.

2.2.2.5 Factors Influencing Electricity Trading in Europe

Electricity trading in Europe developed because of industry reform throughout Europe. The reform also helped liberalise the European electricity sector. In the case of Nordel nations, the reform of that electricity sector began in 1990 with Norway, followed by Sweden in 1991 and Finland joined in 1995 (IEA, 2005:2).

The final Nordel country to change was Denmark, reform progressed slowly as the country used a different electricity structure. According to Wangesteen (2005:2), in the Scandinavian system there was only one market operator or power pool (Nord Pool) with five systems operators, Svenska Kraftnat in Sweden, Fingrid in Finland, Statnett in Norway, Eltra in western Denmark and Elkraft in eastern Denmark, with different regulatory agencies for each. Additionally, reform took place within the electricity sector, but a number of companies remained under government ownership. However, in Scandinavia the private sector was extensively involved in electricity production and distribution. According to the EU (1999:4), general economic conditions promoted reform; as a shortage of electricity infrastructure meant a bottleneck to development. Furthermore, because of experience with market reform initiatives in the UK, Chile, Argentina and number of US states, there was a change in the EU's attitude towards government involvement in the economy.

After the collapse of the Union of Soviet Socialist Republics (USSR) in 1991, Eastern Europe also experienced power sector transformation. Currently, Russia is one of the largest power producers in Eastern Europe, where the structure of electricity production is dominated by thermal power. According to Anatoly and Valentin (2004:2), 70% of installed capacity in Russia is in thermal power plants. The share of nuclear power plants is about 10%; hydropower plants contribute more than 20%. Following the collapse of the USSR in 1991, there was a major drop in the level of electricity production. The shortage of power was primarily at thermal power and nuclear power plants. At hydropower plants, an increase of output was realised between 1992 and 1994, followed by a decrease in 1995 because a shortage of water supplies (Anatoly and Valentin: 2004).

At the end of 1996, there were 56 Russian power stations with a capacity of 1000 megawatt (MW) or more, of which 24 held a capacity of 2000 MW (Anatoly and Valentin, 2004: 3). Of these, 36 were thermal, 13 were hydroelectric and seven were nuclear power plants. The biggest thermal power plant in Russia is Surgut Power Plant and has a capacity of 4800 MW. With all this capacity, power trading began and led to development and economic growth in Eastern European countries. It demonstrated that it was vital for the Russian power sector to develop co-operation with other UPS countries.

There was major work required in that region in order to restore the effective work of interconnected power systems of the Commonwealth of Independent States (CIS), Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova and Russia. The priority was the development of interconnection with power systems of other countries (non-CIS), to solve the problem of using a 220-750 kV line between CIS and Eastern Europe countries (Anatoly and Valentin, 2004:5). The implementation of this co-operative interconnection could also stabilise energy demands in other countries, as the case of Russian countries.

2.2.3 North American Power Trading

The description of power trading experienced in North America is divided into two different parts. This first focuses on the US, with a brief overview regarding power trading; with the second reviewing experiences in Canada. Cross-border electricity trade in North America offered an opportunity to optimise the use of generating resources, to the benefit of the US and Canadian markets. The differences with regards to energy sources, climates, and energy demand profile for the two countries to allow for efficient power flows from the US to Canada depending on market circumstances. The resultant regional market efficiency gain reduced an overall need for generating facilities, resulting in lower generation costs for consumers. Power trading in North America provided one of the most effective electricity markets in the world with combined private companies and public enterprises, selling electricity to local consumers (Egan; 2005:6).

2.2.3.1 United States of America

The US electricity industry was complex, since each federal state had its own structure in terms of power trading. Electricity was sold on the financial market and the price of electricity often fluctuated in terms of demand and supply. Shahidehpour and Alomoush (2001:104) argue that the New York restructuring proposal followed the characteristics of bilateral transactions, similar to those of a California model and the competitive energy pool models in the UK and Australia. In this type of model, the seller and buyer bid into a power exchange on energy. During the process, the companies agree on a price. According to Shahidehpour and Alomoush (2001:104), participants in this market trade through the Power Exchange (PX) or schedule transactions in a bilateral form. In both cases they also could bid on subsidiary services, such as community brokerage.

The North American electricity sector links Canada and the US. Power trading in that part of the world has been among the most integrated and reliable in the world, comprising a diversity of fuel sources, as well as extensive transmission interconnection, while two-way trading benefited both (Egan; 2005:2).

Both nations had developed strong bilateral co-operation within the energy sector over more than 30 years. The trade in electricity between Canada and the US had grown annually because of capacity demand in both countries. Moreover, Egan (2005:14) reported that integration between Canada and the US would increase as energy demand and trade continued to grow, making closer co-operation a necessity. Nevertheless, the markets and regulatory and administrative systems differed for each country, as will be explained.

2.2.3.2 Canada

An understanding of power trading in Canada can be demonstrated through the operation of the power pool of the Federal Government of Alberta. The reason for choosing Alberta is because of transformation progression of its electricity sector. The implementation of the Electric Energy Marketing Act (EEMA) in 1982 was established in Alberta. Its establishment was to reduce the average costs from different companies, Alberta Power Limited, Edmond Power and TransAlta Utilities in terms of power generation and transmission (Shahidehpour and Alomoush, 2001:422). The government of Alberta, with its diverse stakeholders, began to discuss how EEMA should change into a power pool.

The discussion was concluded with a recommendation in October 1994, followed by the implementation of legislation in 1995. The power pool of Alberta began operating in January 1996 (Shahidehpour and Alomoush, 2001:423). The Aberta pool power manages or controls the market for electricity that is bought and sold in the province of Alberta. Different IPP, marketers and importers separate entities in Alberta, sell energy via the pool. The power pool continue to demonstrate it is the distributors, retailers, marketers, direct access customers and exporters entities that buy energy via the pool. Since becoming operational, all energy trade has been conducted through the Alberta Power Pool.

The Alberta Power Pool has two main functions: To carry the operation of the energy market and the real time co-ordination of Alberta's Power Pool and to operate the market by receiving offers from market participants and then to establish an hourly market price for electricity by matching supply with demand.

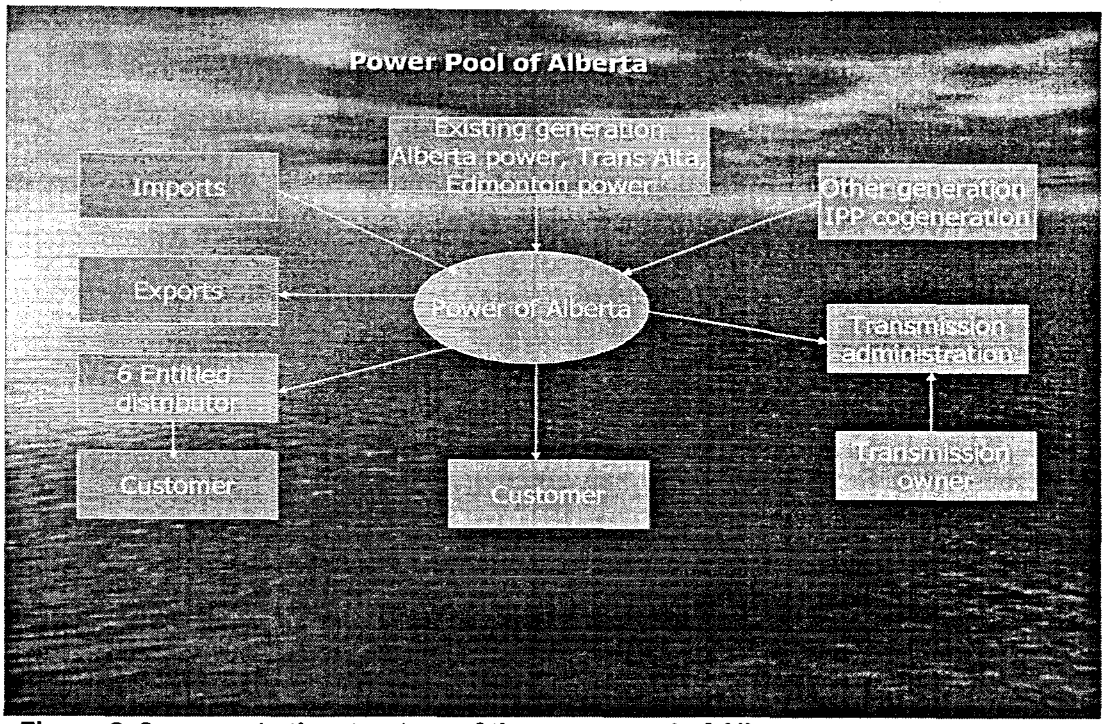

Figure 2. 3: presents the structure of the power pool of Alberta
(Source: Shahidehpour and Alomoush, 2001:429)

The Federal Government of Alberta established an independent power pool council, which accessed the operations of the Alberta Power Pool. The board was responsible for ensuring the pool operated as a fair, open-to-all and efficient electricity marketplace. The council also votes for the budget of the operations of the pool and appoints most senior administrators. The council controls an open access and non-discriminatory competitive market for energy and establishes an hourly market price at which all power is bought and sold. The pool determines and co-ordinates which units operate to produce electric power at any given time based on prices offered by the producer to sell (Shahidehpour & Alomoush, 2001:426). This power pool is different from the SAPP in terms of organisation and management, since the power pool in this region is controlled by 14 member states and managed by 10 people, appointed by the member states.

2.2.4 South America

The establishment of power trading in South American countries has benefited member countries, allowing an increasingly efficient supply to meet regional energy demand. The establishment of power trading in South America introduced competition in the electricity sector. The World Bank (2001:2) states that the increase of regional electricity markets demands that the national market be involved in interconnection and abide by sound market rules. Member countries should provide open, non-discriminatory access to transmission grids and allow for international exchanges.

To provide for economic dispatch, including any additional supply and demand from international interconnections, safety and quality of service criteria agreed upon under interconnection agreements is observed, while access to pertinent data is provided and legal compliance with agreements are ensured. This agreement is bound with all 10 countries, Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Paraguay, Peru, Uruguay and Venezuela (World Bank:2001). Furthermore, Rudnick (1998:1) argues that the electric energy sector in Latin America has experienced a profound transformation, without parallel worldwide.

New electricity regulation was implemented in Chile in 1982, Argentina in 1992, Peru in 1993, Bolivia and Columbia in 1994, and the Central American countries of Panama, El Salvador, Guatemala, Nicaragua, Costa Rica and Honduras in 1997. The remaining countries, which followed suit, were Brazil, Venezuela, and Ecuador who implemented electricity reforms after 1998.

The impact of power sector reform in different Latin American countries has introduced power trading to those parts. For example, there was power trading agreement between Chile and Peru, since Peru bought its electricity from Chile. There is also a power trading agreement between Argentina and Chile. Bolivia also exported electricity to Brazil, particularly during a period of low hydroelectric production in Brazil. A number of South American countries experience problematic electricity trading because of the size of the market.

Also, the legal definition of trading is not specified accurately. For example, Bolivia, Ecuador and Columbia power trading is not well defined by their governments (World Bank, 2001: 27).

2.2.5 Asia

The Asian experience of power trading differs from continents such as Europe and America because of different levels of development. Power trading development in Asian countries is linked to a shortage of electricity in countries such as India and Indonesia. Most countries face a shortage of power and there are daily blackouts in India and Indonesia. In the case of India, there has been an increase of electricity trading with neighbouring countries. It is argued by Mukhopadhyay, Dube and Soone (2006:4) that the Indian power sector bilateral energy market could be based on a long term, short term, day ahead or intra-day commitments. In conjunction with this, the growth of the electricity market is closely linked to the ability of the Asian power sector to expand along with the demand from different countries.

According to Sihag, Misra and Sharma (2004:54), a number of countries in Asia such as Indonesia, Malaysia, Singapore, the Philippines and Thailand has already introduced competition within the power market, whereas in countries such as Bangladesh, Bhutan, Nepal, Pakistan and Sri Lanka, transformation within the electricity sector is still in its early stages. The first experience of power trading in Asia was considered by the government of Thailand. It established different electricity trade agreements with neighbouring countries.

There is a bilateral agreement for power trading between Thailand and the Lao People Democratic (Lao PDR) and a memorandum of understanding (Mou) has been signed to supply Thailand with power. According to the National Energy Policy of Thailand (2000:14) two projects for which a power purchase agreement (PPA) have been signed and, which have been in operation, the Theun-Hin Bun project, which has a capacity of 187 MW, as well as the Houay-Ho projects, which has a capacity of 126 MW. In addition, there are also six other projects which the Lao PDR government has proposed for Thailand to consider.

Following a similar argument, the Thai Government has signed any other PPA with the Union of Myanmar Government; both countries will promote and co-operate in the power project development in Myanmar in order to sell 1500 MW of electricity to Thailand by 2010. In order to promote this project, the two governments have appointed a committee to implement the project and to negotiate, in detail, the principles agreed upon in the MOU (National energy policy of Thailand, 2000: 16). There is another agreement with the Republic of China for a supply of 3000 MW by 2017(National energy of Thailand: 2000). Regarding this project, both countries have appointed a working group to implement the project and to negotiate the power purchase agreement. The Thai government has established a power pool within the country to purchase electricity that allowed the government of Thailand to sign a power co-operation agreement with Cambodia in 2000; the two countries agreed to purchase power from the Thailand power pool.

Following these discussions, the Chinese electricity sector has become the second largest electricity industry in the world after the US, with a 322 GW installed capacity since 2000. China has been highly successful in developing its power infrastructure. The impact of this transformation may be attributed to two factors: structural reforms introducing new capital sources and high levels of domestic savings. Over the past five years, China has added 13 GW of new capacity and 30 000 km of transmission lines every year (IEA, 2003: 384). In 2004 China increased the capacity to 440 GWh, while the annual generation has reached 2180 TWh (Zhong and Ni, 2006: 44). As previously stated, China had already signed a power trading agreement with Thailand, (the bilateral contract will begin in 2017) within the country, the government has already established a electricity wholesale market (National energy of Thailand: 2000).

The Mekong region was influenced by the participation of IPP in that part of the world. The Mekong region derives its name from the river that runs through it and it includes countries such as: Cambodia, Lao People's Republic, Thailand, Vietnam, and parts of southern China. The initial attention was spread by private companies who sought to develop a cross-border trading agreement. Croussilat (1998:1) indicated experience in power trade zones in Europe and North America had demonstrated the benefits of fully-fledged trade.

Countries within the region should co-ordinate their electricity policies, operating protocols and network development (Croussilat; 1998:2). He further states that developing an international power market in the great Mekong region, would take time. That argument was based on the financial crisis in Asia and also on the long construction period when most benefits would accumulate only after 2010. That region shows, there is potential for the development of power trading. The industrialisation of China and other countries in the region will boost the demand of cross-border power trading (Croussilat; 1998:2).

2.2.5.1 Market barriers in Asian countries

There are different barriers within Asian countries which prevent a successful power pool in the Mekong region. The lesson from Asian countries may assist other different region in Africa continent who wants to develop power trading (Croussilat, 1998:5). The most important issues raised include the following:

2.2.5.1.1 Institutional and public policy

- **Leadership and priorities.** According to Crousillat (1998:5), only Loa PDR and Thailand rate cross-border trade highly. There is no authorities' regional group or agency which provides leadership for network development. Environmental issues should be addressed at a regional level to solve conflicts and to ensure others enjoy clean power.
- **Laws, regulations, and contracts.** Crousillat (1998:5) stated that in each country laws, regulations, and power purchase contracts include long-term provisions that hamper the move to more competitive markets. Provides the following example: a lack of flexibility to re-assign part of the generation purchased under a long-term power purchase agreement, will limit the scope to introduce more competition in future.
- **Transmission ownership.** There are a number of governments in the Mekong region who have not yet declared which agency or entity should be responsible for building and operating a transmission line.
- **Independent regulation.** A lack of independent regulatory agencies in the region increases the risk for developers of arbitrary tariff changes. In terms of power trading agreements, the region should have an independent

regulatory board to play the role of regulator. Each country in the region should suggest key personnel with knowledge of the electricity regulator field.

- **Open access rules.** Most governments have not established open access rules for transmission facilities. Consequently, where private developers built a transmission line to connect their plant to load serving points, it was unclear whether a second generator could be allowed to use the network (Croussilat, 1998:5).

2.2.5.1.2 Technical barriers

- **Network development.** It is indicated by Croussilat (1998:6) transmission construction should be co-ordinated to reduce the cost of long-term investment.
- Plans to develop project specific facilities to transmit output from one country to another were in place (Crousillat, 1998:6).
- **Transmission protocol.** Crousillat (1998:6) indicated there is no procedure to govern the operation of a regional transmission network. He argues that by saying one country might construct facilities to a standard lower than another. The situation could impose a reliability risk on a system with high standards.

2.2.5.1.3 Commercial and financial barriers

- **Country and cross-border risk.** The investment for power generation for export could be hampered by financiers' perception of risk related to country- specific issues or to the multinational character of projects. The nature and degree of risk varies by country in the case of African countries (civil war was a weakness and political instability). In addition, the most common is the financial weakness of a number of the public electricity companies (Croussilat; 1998:6).
- **Transmission tariffs.** It is specified transmission tariffs play a major role in financing the creation and expansion of a transmission network. In the case

of SADC countries the transmission tariffs should be reviewed among the member nations (SAPP: 2006).

Where cross-border transmission has been developed, costs are bundled into a delivery capacity and energy prices are at a remote point from the plant (Croussillat; 1998:7). The problems concerning power trading have been evaluated in the East Asian countries in the Mekong region. Similar barriers of this power market in East Asia can be found in another country outside Asia, namely Australia. In the case of Australia, the National Electricity Market (NEM) was established in 1998 and comprised the federal state of New South Wales (housing the capital Canberra), Victoria, Queensland and South Australia. According to IEA (2003:382), the NEM uses a regional model to approximate full nodal pricing. The electricity demand has been growing at 3.7% annually across the NEM since the opening of the market, with the highest growth rates recorded in Queensland at 12.3% and in South Australia at 9.4%.

Japan differs from Australia, since the private sector controls the electricity sector. In Japan, the generation capacity was around 262 GW in 2001, while most electricity was generated and supplied by 10 private-sector electricity companies which are presented in the following table (IEA; 2003:384).

Table 2. 1: Japanese power companies

Power Company	Total assets(US$million)	Capacity(MW)	Revenues(Million)
Tokyo	116 665	60 375	42 219
Kansai	57 971	35 585	20 723
Chubu	50 446	32 231	17 680
Kyushu	32 796	19 336	11 395
Tchoku	32 681	16 076	12 814
Chugoku	22 298	12 179	8 004
Hohuriku	12 534	6 759	3 971
Shikoku	11 750	6 877	4 550
Hkkaido	11 396	5 904	4 279
Okinawa	3 284	1 676	1 140
Total	351 821	196 998	126 775

Source: Federation of Electric Power Companies of Japan (2002)

Japan provides an interesting example in that there is no government involvement in power generation, transmission or distribution. The Japanese government retains significant influence, through its ability to issue administrative guidance, informal consultation on development and participation in import contract. The electricity sector investment in 2001 was approximately $22 billion, which was an estimated 0.5% of the Growth Domestic Product (GDP). The return from sales contributed to 2.7% of Japan GDP which demonstrates how the electricity sector itself can impact on the national treasury (IEA, 2003: 384)

2.2.6 Sub-Saharan Africa

A number of African countries continues to face difficulty in terms of power generation, transmission and distribution. In order to solve this problem, they signed bilateral agreements with neighbouring countries for energy supplies. Various agreements were developed through regional co-operation among countries for electricity. The result of such agreements was to solve individual problems of electricity sourcing each country had. The agreements between countries assisted to increase the size of the market in each region. This section highlights different power pools existing within African countries.

There are five power pools across the African continent, which are the Eastern African Power Pool, Southern African Power Pool, Central African Power Pool, Western African Power Pool and North African Power Pool. For the purpose of this research, only three power pools are explained in this chapter.

2.2.6.1 Eastern African Power Pool (EAPP)

The Eastern African Power Pool is comprised of Kenya, Uganda, Rwanda, Burundi, Ethiopia, DRC, Tanzania, Sudan and Somalia. Two countries of the SAPP (DRC and Tanzania) are also involved in the EAPP because they border eastern African countries. There is also a possibility for others to join in the future; Clark and Marks (1999:129) report that the member states of the East African co-operation movement proposed the terms of reference for an energy master plan. In addition, each country within the pool has its own IPP, while a feasibility study was conducted to investigate the regional potential. There is a transmission line (132kV) between Kenya and Uganda. Kenya buys 30 MW of electricity from Uganda and the power trading is a long-established agreement.

There is another transmission line of 132 kV from Uganda to Tanzania, which is due to be upgraded to provide a larger capacity. The involvement of Tanzania and the DRC will allow the EAPP to link up with SAPP (Clark and Marks; 1999:129). Table 2.3 indicates the export load of electricity and the forecasts from 1995 to 2020.

Table 2. 2: Maximum demand for exportation in MW by Uganda

Countries	Year1	Year 2	Year 3	Year 4	Year 5	Year 6
Kenya	1995	2000	2005	2010	2015	2020
Low	30	30	30	30	30	30
Base	30	60	60	60	60	60
High	30	80	80	80	80	80
Tanzania						
Low	5	5	8	10	10	10
Base	5	10	14	18	18	18
High	5	16	30	30	30	30
Rwanda						
Low	3	5	5	5	5	5
Base	3	20	20	20	20	20
High	3	20	20	20	20	20

Source: Government of Uganda (1999) Hydro-Power Development Master Plan

Ethiopia, as part of Eastern Africa, is seen as a potential key player in regional power development since its latent hydropower capacity is estimated at 30 000 MW. Ethiopia has the potential to export electricity to Sudan, which currently depends costly on oil-based power production (Clark and Marks, 1999:135). The development of a power pool in East Africa would involve the participation of IPPs in power generation. It is not clear at present if IPPs will participate in the pool or if they will sell electricity to the state company. There is also another element, to be considered no Memorandum of Understanding (MOU) has yet been signed by the various ministers of energy (Clark and Marks; 1999:135).

2.2.6.2 Central African Power Pool (CAPP)

CAPP was established on 12 April 2003. It is a special body of the Economic Community of Central African States (ECCAS), with its head office located in the Congo, at Brazzaville. The pool has double mandate, which is:

- Implementation of power policies; and
- Promotion of the electricity market and related services (Kalala, 2005:62).

There is large hydroelectric capacity in central African countries compared with other regions in Africa. There are two countries with huge hydro potential: the

DRC and Cameroon. According to Kalala (2005:62), to utilise the large hydropower potential in those countries within the region and beyond, there was a need to develop a system of interconnection between member states. Various national networks are required, along with an open market for electricity exchanges. Currently, there are few countries connected in the central African region. Governments in this region can develop this interconnection, since the applicability of power pools would be increasingly relevant as demand for power increases.

There were a growing number of states in the CAPP with the pool open to public utility, independent power producers, mixed enterprises involved in power generation, to the transmission and distribution of electricity within the region. The following countries are the members:

- Societe National d'Electricite of Cameroon ;
- Energie Centrafricaine (NERCA), Central African Republic;
- Societé National d'Electricite (SNE), Republic of Congo;
- Societé d'Energie et d'Eau du Gabon (SEEG);
- Sociedad de Electridad de Guinea Equatorial SA (SEGESA) from Equatorial Guinea;
- Societé National D'Electricite (SNEL) DRC;
- Empresa de Agua e Electricidad (EMA) Sao Tome and Principé; and
- Societé Tchadiene d'Eau et d'Energie (STEE) of Republic of Chad.

Countries interested to join are:

- Angola (Empresa National de l'Electridad (ENE) and Electridade de Luanda (EDEL);
- Burundi (REGIDESO) ; and
- Rwanda (Electrogaz).

Member states need to improve the energy infrastructure in their countries, as well as increase cross-border electrification programmes in remote areas.

Projects have been identified to achieve this but the implementation of such projects have not yet materialised as member states are awaiting budgets to be approved by the African Development Bank (ADB) (Kalala, 2005:62).

2.2.6.3 Southern African Power Pool (SAPP)

Most of the transactions taking place in the SADC electricity sector take place under the jurisdiction of the SAPP. The SAPP power pool was established in 1995 by SADC members to operate an electricity pooling system. The establishment of the SAPP increased trade in electricity between member states. Countries in the SAPP possess different types of energy sources within the region (SAPP, 2005:5).

Angola and Mozambique possess substantial hydropower potential, estimated at 16 000 MW and 12 500 MW, respectively. It was indicated that Zambia had 4 000 MW, Tanzania 6 000 MW and Zimbabwe 2 500 MW (Clark and Marks, 1999:136). This demonstrates South Africa as a major producer of electricity in the SADC with a nominal capacity of 42 011 MW (Eskom; 2006:174).

Since the fall of the Mobutu regime in the DRC, the production of electricity was estimated 2 550 MW, but the country had a potential of 100 000 MW, with the Inga Site alone possessing a potential 40 000 MW (SNEL; 2005:7). There was also the likelihood of increasing the DRC's current capacity as its hydropower and thermal plants undergo a programme of refurbishment (SNEL; 2005:7). Before the establishment of the SAPP there were electricity transactions in existence among SADC countries, such as the DRC supplying electricity to Zambia, Zimbabwe and Botswana during 1992 and 1993 when Zambia and Zimbabwe were short of energy after a prolonged drought. The transmission line linking the DRC and Zambia is necessary to promote the trade of energy in the SADC region and the position of the DRC is seen as strategic in terms of energy security within the SADC (SNEL; 2000:12).

Table 2. 3: Regional analysis for 2004 in the SADC

Utility	Country	Installed	Maximum	MD	Sales	Sales	Number of	Number of	Generation
		Capacity	Demand	Growth		Growth	Customers	Employees	Sent Out
		MW	MW	%	GWh	%			GWh
ENE	Angola	624	317	5.7	2	14.1	119 392	3 291	1 993
BPC	Botswana	132	393	9.2	2150	10	108 985	2 086	936
LEC	Lesotho	72	90	1.1	316	-3.6	42 390	454	429
ESCOM	Malawi	285	227	7	970	4	135 000	2 400	1 177
EDM	Mozambique	177	273	3	1 099	4.1	245 859	2 662	261
NamPower	Namibia	393	371	6.6	2 246	5.1	3 265	818	1 421
ESKOM	South Africa	42 011	30,154	0.97	187 003	3.3	3 505 039	28 938	210 112
SEB	Swaziland	51	171.5	7	831.6	13	45 300	724	991.2
TANESCO	Tanzania	591	506	6.5	2 625	1	485 661	4 296	3365
SNEL	DRC	2 550	991	0	4 381	0.4	301 478	5 462	5 907
ZESCO	Zambia	1 642	1 255	8.8	7 852	4.9	310 000	3 617	8 466
ZESA	Zimbabwe	1 990	2 007	-1	10 561	1.02	540 738	6 020	8 799

Source: SAPP (2004:4)

Climatic problems faced by other countries means the DRC could play a pivotal role of a supplier of electricity (Clark and Marks, 1999:136). Table 2.3 about presents the co-operation of electricity in the SAPP member states. The table illustrates the regional electricity analysis in 2004. Regional co-operation in energy increased in this part of the continent because of electricity demand, which grew because of the development of different industries within the region (Clark and Marks; 1999:139).

Clark and Marks (1999:139) argue that an industry which promotes cross-border power trading through institutions such as the SAPP is likely to lead to a thriving and more competitive power sector. Another element is major electrification; the majority of countries in the region rely on power co-operation to sustain demand. The impact of not having access to electricity has frustrated economic development within the region and impacted negatively on quality of life, living the majority of the population under the poverty line. For this reason, governments in the region began to introduce IPPs in order to solve the problems of energy supply capacity in the SADC.

The implementation of IPP in different countries within the region has influenced the trade in electricity. According to Engineering News (2005:1), South Africa has plans to expand its electricity supply with the establishment of new capacity in the form of independent power producers and by sourcing greater volumes of electricity supply within the region. The World Bank (2001:6) suggested an alternative trading arrangement to spot markets, such as that bilateral trading among multiple buyers and sellers should be considered, especially for the smaller power systems and as a transitional solution until the benefits of a spot market were considered to outweigh the risk. This suggestion on bilateral power trading was advised for developing countries as the majority of these countries had encountered substantial problems in restructuring their electricity industries. It was not considered acceptable for developing countries to move to spot markets for electricity while they still had problems with energy capacity in terms of satisfying demand. Spot markets were more appropriate in countries where power sector reform was firmly embedded.

The interconnection of the electricity distribution consider of using grid among SAPP member states was developed with the demand for electricity in different countries in mind. There was an existing interconnection between the DRC and Zambia, which transmitted electricity generated from Inga to southern African countries, passing through Zambia.

In addition, Zambia was also connected to Zimbabwe and, in that context, an electricity interconnection has existed traditionally between Namibia, Botswana, South Africa, Lesotho, Swaziland and Mozambique (IEA, 1996:81). There was a plan to extend the interconnection with other countries not yet connected such as Angola and Malawi. Zambia has signed a Memorandum of Understanding with Tanzania which would connect the two countries. Angola and Namibia has signed an agreement to connect transmission lines.

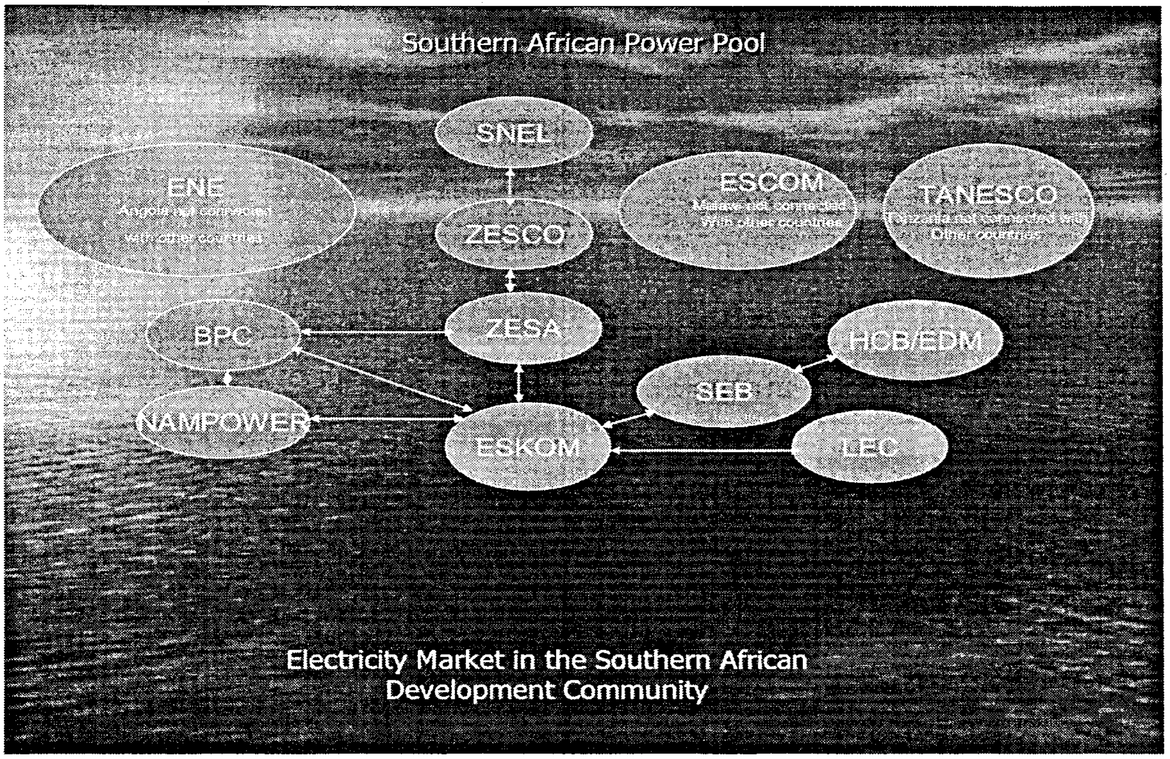

Figure 2. 4: presents the interconnection of the SADC countries.
(Source: SAPP annual review report: 2005)

There are three countries that are not connected: Tanzania, Malawi and Angola. These three countries have plans to construct electricity interconnections with other member countries within the region (SAPP: 2005). There are number of challenges to increase interconnection within member states which the SAPP countries need to attend to. These include:

- Reinforcement of the Zambia and DRC 220kV interconnector;
- Implementation of the Mozambique and Malawi 220 kV interconnector;
- Implementation of the Zambia and Tanzania 330kV interconnector;
- Implementation of the South Africa and Namibia 400kV interconnector, and
- Namibia and Angola 220kV interconnector, a project that is waiting to be implemented (SAPP: 1999).

The successful implementation of this project in the SADC should resolve the energy problems within the region. In addition, there is an additional need to develop electrical power infrastructure within the SADC zone. For example, in the DRC a number power of plants is already at a decommissioning stage. There are hydropower plants, as well as thermal power plants that should be refurbished since most of the turbines are overworked (SNEL; 2005:8). By implementing such changes the standard of living for many people, in DRC, will change for the better because every household would have access to electricity.

2.3 Theoretical framework of the study

The view of different authors informs the researcher's understanding of the area of study. As well as providing insight of selected normative criteria pertaining to the research. The research focuses on evaluating, and normative electricity trading among regional electricity companies, remaining under government control. Also highlighted in the research is that there is no stockbroker involvement in the trading of electricity in the region under study.

The above means that the majority of countries in the region do not use a third party company to sign a contract with other utilities. Only government utilities are involved in the power pool in the region. This situation has provided a different context and informs a different perspective to other power pools in developed countries. In this respect, the research evaluates the trading of electricity in the SADC region, although this study does not include the trading of electricity in all 14 countries of that region. The reason for this is that not all 14 countries are connected in terms of electricity transmission. Consequently, research took place on selected countries and also in the SAPP where a short-term electricity market exists. Despite this selective approach, the theoretical framework developed through the research will represent all the elements which represents power trading in different markets. The three countries selected have a bilateral contract on power trading for the past seven years.

The concept of a framework is defined by Schlager (1999:234), who argues that frameworks limit inquiry and direct the attention of the analyst or researcher to critical features of the social and physical landscape. Frameworks offer a base for investigation by specifying classes of variable and general relationships among them, that is, how the general classes of variables loosely fit together into coherent structures.

Frameworks organise inquiry but they cannot, in and of themselves, provide explanations for, or predict behaviour and outcomes. Explanation and prediction lie in the realm of theories and models. The presentation of the framework helps the research establish a future focus of electricity demand in this region. The intent behind developing this conceptual framework is that it could lead to new thinking around the applicability of power trading to the region under study to improve the effectiveness of the power trading process. This should take into consideration the entire process involved in the different contracts which governments sign with other governments (Schlager; 1999:234).

2.3.1 Critics on different electricity markets

According to Kwoka (1997:7) the transformation of the UK electricity market is closely linked to the privatisation of the electricity industry. The British Government wanted to transform their electricity sector by liberalising the sector. The transformation of the electricity industries during that time had a negative impact, leaving the electricity sector controlled by a few companies. It was also noted that during the transformation, the price of electricity increased. As a result of this and other unintended consequences, the British Government decided in 1997 to abandon the wholesale market design implemented in 1990, including the power pool (Kwoka; 1997:7). During that time no disasters occurred, but the following weak points were observed in the UK power pool:

- Poor design of the pool;
- High concentration in the generation market;
- Lack of consumer competition;
- Dominance in the wholesale market of transitional contract, increased nuclear output and new gas fire plants that were built by the retail supply companies; and
- Vertical integration of generation and retail supply (Thomas, 2001:3).

2.3.2 Poor design in UK

According to Thomas (2001:6) observation found that the UK model experienced design problems and solutions were supposed to be found. With this situation within the UK electricity market the regulator decided to suggest another type of market which could be used by several electricity companies. In 2001, the British Government introduced the New Electricity Trading Arrangement (NETA). A large number of electricity companies participated in NETA. In this new type of electricity market there was daily trading or a short-term energy market and bilateral contracts. The observation raised in this market was that there was not decrease in capacity within NETA. The lesson, which southern African countries could learn from here, is that the participation of many different companies is essential success of power trading parse.

2.6.4.3 Excess generation capacity in Nordic power pool

The establishment of the Nordic Power Pool was based on power stability within that region. The development of that market was based on bilateral co-operation between countries. After the liberalisation of the electricity sector, the entire electricity market was opened for competition. It is also necessary to state that each country in this section had liberalisation during different periods. The liberalisations of the Nordic Pool brought the participation of different electricity companies, while there was no phasing in of smaller consumers. The power pool was open to larger and smaller power producers within the Nordic countries. All the Nordic electricity markets had finally implemented electricity market reforms; Norway in 1991, Sweden in 1996, Finland in 1997 and, finally Denmark in 2002 (Carisson; 1999:3).

A key observation of this market is that the wholesale market represents the entire geographic area of these countries. Each participant in the market can buy power at approximately a similar price in that co-operative market. The only problem the Nordic power pool encountered was the dropping of water volume in the hydropower plant. This situation sometimes influences the increase of electricity price within the Nordic region, but a continuing supply is guaranteed (Carisson; 1999:3).

2.3.4 Competition in EU market

The observation from the European Union regarding the electricity market is different and the electricity trading is between private companies and state own enterprises. These markets are regulated by European Union policy.

2.3.5 Different industries involved in the electricity sector

The view raised in this research regards the electricity market in North America is different to that of other countries. This relates to the combination of the national utility and private companies that generate electricity. The development of the electricity market in North America was complex, against the background of different socio-cultural and economic environments and could take time for African countries to emulate. The lesson that can be drawn from the experience of different power pools across the world is to recommend a degree of transformation, which should take place within the SAPP.

2.4 Summary

The experiences of power trading globally demonstrate there is much to be learned from other countries who have already transformed their electricity sectors. The power pool market in the UK established after the transformation or restructuring of the electricity sector in 1990 is a case in point. After the privatisation of the electricity sector by the British Government, power trading began in Britain and Wales with the participation of different companies from Europe. The key lesson that can be drawn from the UK power pool is in relation to the transformation of their electricity industries.

In contrast to the British experience, the Nordic countries had established power pools in that region because each country wanted to be self-sufficient in terms of electricity production. The Nordic power pool initially involved vertically and horizontally integrated companies. Today the power pool has evolved to become competitive with the participation of independent power producers, as well as other utilities, albeit still under government control.

The remaining other power pools in Europe are controlled and located within different EU countries. A number of electricity companies remain under government control, but they have participated in different power pools within the EU zone. The development of power trading in the EU member states is because of an annual increase in energy demand within each country.

The best solution for each country was to introduce power trading with other members, which should gain positive profitability in terms of revenue.

Additionally, in Eastern Europe, power trading is limited between countries where there is network interconnection. As a result power trading plays a limited role within that region. The development of power trading is based on the political relations among countries.

An analysis of the North America energy trading environment is based on the cross-border trade between Canada and US. The differences in energy sources, climates, and energy demand profile for the two countries have allowed efficient power flows north to south based upon market circumstances. The South America experience in power trading has also increased owing to the transformation of the electricity sector, which commenced in the 1990s. It was demonstrated that there is a need to eliminate barriers hampering international energy trade. This helped to implement a regional market, could in turn, change regulations, institutions and technical requirements for each country. The degree of required changes would vary upon the status of development of really competitive markets in any particular country.

In this chapter it was demonstrated that energy trading within Asian countries differed from other continents, such as Europe and America because of the industrialisation of the west. The Asian case also differs from others reviewed because some Asian nations suffered from a shortage of electricity. The electricity market had already been established in nations such as Malaysia, Singapore, the Philippines, Indonesia and Thailand.

Different regions in Africa began to establish power pools for the energy security of their regions. By observing some of the pools in Africa, it becomes apparent that there are certain countries, which are members of different power pools because of the geographic position. SAPP is one pool, which reflects some criteria which should be carefully considered. Since it is based mostly on terms of bilateral agreements between two countries. This system allows short-term energy trading. Most countries do not, however, purchase electricity from SAPP.

Chapter Tree, an overview will be provided of selected public management policies relevant to energy needs in South Africa and selected countries of the SADC.

CHAPTER 3. PUBLIC MANAGEMENT POLICIES PERTAINING TO ENERGY NEEDS IN SOUTH AFRICA AND COUNTRIES OF THE SADC

3.1 Introduction

The previous chapter reviewed a literature survey of electricity trading on different continents. Each aspect covering electricity trading was discussed and explained. Chapter Three reviews the historical background of the South African energy sector under the Department of Minerals and Energy (DME) and the different organisations involved in the decision-making of the electricity sector in South Africa. Reference will also be made to background information on energy supply and usage in the DRC, and Zimbabwe electricity sector is also explained. A co-operation within the energy sector is based mostly on supply and demand as there are few SADC countries dependent on others for electricity supply.

3.2 Historical Overview of Electricity Supply in South Africa

Electricity distribution in South Africa began at the level of local municipalities. This began when diamonds were discovered in Kimberly with the first urban electric lights in the world being South Africa switched on in the mining town in 1882. According to De Villiers (1984:12), the Kimberly Municipality had established its own reticulation service in 1890, and this was followed by Johannesburg in 1891, Pretoria in 1892, Cape Town in 1895, Durban in 1897, East London in 1899 and Bloemfontein in 1900. The discovery of gold on the Witwatersrand, (now Gauteng province) in 1886, and the growth of mining industries during that time, created the demand for the generation of electricity on a large scale.

During the South African war also known as the Anglo-Boer War, (1899-1902), demand for electricity from the mining sector continued to increase. The majority of mining companies established IPPs in Kimberly and on the Witwatersrand. One of the biggest IPPs was the Victoria Falls Power Company, which was registered in October 1906. Three years later the company changed its name to the "Victoria Falls and Transvaal Power Company" (Horwitz, 1993:16).

Horwitz (1993:3) argues that the history of electricity in South Africa can be divided into four eras:

- 1906–1922: where the electricity industries comprised of a mixture of private companies and municipal enterprises;
- after 1922 when a statutory body was formed; namely the Electricity Supply Commission (Escom), which worked with private companies and municipalities;
- after 1948 Escom, took over the Victoria Falls and Transvaal Power Company. During this period, Escom began to monopolise the generation, transmission and distribution of electricity within the country; and
- subsequent to 1985 when Escom underwent a major transformation, vastly improving its capacity following a period of poor performance. In 1987 the Escom Act and the Electricity Act were promulgated and Escom's name was changed to Eskom to reflect the two official languages of that time.

3.2.1 Background of Electricity Legislation

The first Act dealing with electricity supply was the Municipality Corporation Lighting Law, Natal, and No 22 of 1891 (Morgan, 1993:3). Following the South African War, legislation was passed in the Transvaal, Cape Colony and the Orange Free State, subjecting the supply of electricity to local authorities and colonial administrators (Steyn, 1994:5). This situation remains partially as local authorities or municipalities still distributing electricity to consumers.

Under colonial rule, the Transvaal Government passed the Electricity Act of 1910, which effected the recommendations of the power companies' commission. The Act prescribed that an electricity undertaking could be established only under a licence issued by the Minister of Mines. It established a Power Undertakings Board consisting of public officials who acted in an advisory capacity to the minister. Municipalities were licenced and were thus not controlled by the board or the minister. All applications for licences were sent to the board to take a decision before advising the minister in terms of whether a licence should be granted (Horwitz, 1993:6).

It was specified in the 1910 Act that companies had to pay all consumers 25% of their surplus revenue at a pro rata rate of electricity consumption. This policy remained the accepted model of regulating licensed power companies in the Union of South Africa until the passing of the Electricity Act of 1922 (Steyn, 1994:4).

In 1957, the Electricity Act was translated into Afrikaans and included with all its amendments into a new Act, namely the Electricity Act, No. 40 of 1958. In addition, in 1971, the Electricity Amendments Act, No. 49 of 1971 allowed the establishment of a Capital Development Fund. It also allowed different regional undertakings to be connected, which allowed Escom power plants to be run as an integrated system (Steyn, 1994:5) and subsequently all Escom power plants were linked to the national grid in 1973 (Eskom, 1993:2). Eskom in 2006 has more than 238 000 km of power lines, of which 24 000 km form part of the national grid (Eskom: 2003).

The Electricity Act of 1958 was superseded by the Electricity Act of 1987. The new Act recognised the existence of the Electricity Board but the Electricity Supply Commission was changed into a body corporate known as Eskom, but controlled and managed by the Electricity Council and Management Board (Eskom, 1993:5).

3.2.2 Period of Power Trading with Other Countries in the SADC

The power trading agreement within the region was developed over two decades ago. For the last decade South Africa has been exporting electricity to neighbouring countries. This has had a financial impact on the production of electricity from Eskom. In addition, during that time Eskom had excess capacity, which placed South Africa in a strong position to export electricity (Eskom: 2003).

3.2.3 Regional Capacity Building Projects

There are a number of key, strategic energy projects, aimed at increasing the capacity of electricity supply in the SADC region. Two major projects are in the DRC, in Inga Falls; and in Mozambique, at Cahora Bassa. There are other electricity projects found in Angola and Namibia.

The two countries have signed a bilateral agreement for the co-operation of energy. The EIA (2003:5) states the two countries have been considering the development of a hydroelectric facility on the Kunene (Cunene) River, to provide electricity for both countries. Two possible sites for a dam emanated for hydro-electric generation, Baynes and Epupa Falls, are under consideration. Namibia favours Epupa, but Angola prefers the Baynes site as it would enable Angola to renovate and regulate the Gove Dam, situated on a tributary of the Kunene. The project would have a capacity of 350 MW (EIA, 2003:5).

In 2002 South Africa and Swaziland inaugurated the Maguga Dam, which is the fourth largest dam in the southern African region with hydro-electric capabilities. The Maguga dam supplies both countries with electricity and water. The dam reduced Swaziland's dependence on imported electricity from South Africa. The Maguga Dam supplies 50% of Swaziland's electricity, whereas previously, Swaziland imported 90% of its requirements from South Africa (EIA, 2003:5).

There is also a hydroelectric project at Kafue Gorge Lower (KGL) in the southern Zambia. Completion of this plant will deliver a capacity of 750 MW. The energy generated at KGL will be exported to Zimbabwe and Botswana. In 2000, the Malawi Government inaugurated the Kapichira Hydro-electric Plant, which should have been completed in 2003. The plant has a capacity of 64 MW (EIA, 2003: 6). The other two phases for the hydropower plants in Kapichira are not yet complete.

3.2.4 Regional Transmission Projects

The SADC region is connected through two different power transmission networks: the North Zone and the South Zones. The northern transmission network includes SNEL (DRC), ZESCO (Zambia) and ZESA (Zimbabwe). The southern network comprises Eskom (South Africa), BPC (Botswana) and Nampower (Namibia) (EIA, 2003:6). The positive impact of these transmission networks in the SADC countries is that it enables member countries to purchase electricity and to sell it to the public at lower rate. A number of countries in the SADC are not inter-connected, such as, Tanzania, Malawi and Angola (SAPP, 2002:6).

There is also a transmission network project currently under development between the DRC and Zambia intended to upgrade capacity, which would allow other SADC countries to tap energy from the Inga dam. According to EIA (2003: 5), Zambia's Copperbelt Energy Corporation (CEC) and DRC's will undertake the upgrading project that includes construction of a new 220-KV power line between Chingola in Zambia and Karavia near the southern DRC city of Lubumbashi. The current situation shows that both countries have already up-graded the transmission line.

Another transmission network project is being implemented between Zambia and Tanzania. The two countries are building a 700 km transmission network at an estimated cost of $153 million (EIA, 2003:6). The Zambia side stretches for 600 km, while the remaining 100 km is in Tanzania. The line is expected to have a capacity of up to 200 MW of power (EIA, 2003:6).

The South African Government has decided to undertake a feasibility study for the construction of a power transmission network to the value of $1 billion (Eskom, 2003: 23). The power transmission network will cross various countries including the DRC, Angola, Namibia and South Africa. The construction of this power transmission network will link Eskom directly to Inga. A memorandum of understanding, which outlines the scope of the project, has been signed between the members of SAPP (EIA, 2003: 6).

South Africa consumer more electricity in 2001, the total regional electricity consumption was 211, 9 billion Kwh. In addition South Africa consumed 181, 2 billion Kwh (85, 5%), Zimbabwe 9, 8 billion Kwh (4, 6%), Zambia 5, 5 billion Kwh (2, 6%) (Eskom, 2005:6). According to Eskom's annual report (2002:134) South Africa is a leader as far as the SADC power trading is concerned. Eskom supplies electricity to Zimbabwe, Swaziland, Namibia, Botswana and Lesotho. The majority of these countries depend on South Africa for their monthly power supplies. In addition, the South African Government has a bilateral agreement with the DRC and Mozambique to import electricity for a specific weekly period. Most of this energy trading operates under bilateral agreements. This situation is likely to change in 2008 when South Africa is expected to encounters problems with meeting its own internal demand. As South Africa has to give priority to satisfying its growing internal demand it is anticipated that the energy security within the region will also begin to experience problems around 2008 (Kalala, 2005:11).

Table 3. 1: South Africa's (Eskom) sales to neighbouring countries 2002 in MW

Countries	2002	2001	2000
Botswana	1124	1183	986
Mozambique	3907	3899	1334
Namibia	598	578	640
Swaziland	799	639	115
Lesotho	16	40	12
Zambia	103	-	-
Zimbabwe	298	371	788
Short-term energy market	111	-	-

Source: Eskom, Annual Report (2002:134)

In 2003, five national electricity companies (Eskom, BPC, SNEL, ENE and Nampower) agreed to establish the Western corridor (Westco) Power Project. The implementation of this power project has been designed to provide the five national electricity companies (Angola, Namibia, DRC, Botswana and South Africa) with low cost electricity as well as an affordable and environmental friendly supply. This should ensure economic development in the region is not constrained by capacity shortages (IEA, 2004: 2).

According to an Eskom annual report, the first phase will cost US$4 billion (Eskom, 2005). This cost also includes the building of a 3 500 MW Inga III hydropower plant in the DRC, with interconnections for about 2000 km of power transmission lines, to supply the five Westcor countries. Eskom is a key supplier of energy within the region. Electricity interconnections exist between Namibia, Botswana, Zimbabwe, Mozambique, Swaziland and Lesotho (IEA, 1996:86). Table 3.1 depicts the trading of energy between Eskom and six neighbouring countries, in 2002. Since the construction of the Muela Hydropower Plant in Lesotho there has been a reduction in electricity imports.

3.2.5 Hierarchy of Electricity Legislation in South Africa

The South African constitution is the supreme law which protect all the decision government will take. According to Davidson and Mwakasonda (2004:17) the current institutional framework in South Africa electricity industry is based on the following major institutional development. These are:

Electricity Act, Act No 41 of 1987-Defining the structure, functions and responsibilities of the electricity Control Board assigning the sole right of electricity supply within municipal boundaries to local government authorities.

The Escom Act, Act No 40 of 1987 -Defining the responsibilities of Eskom

Electricity amendment Act, Act No 58 of 1989- Amending the electricity Act, 1987 to provide levy on electricity so that a licence shall not be required for the generation of electricity, and to provide for the transfer of servitudes on the transfer of undertakings; and other incidental matters.

Nuclear Energy Act, Act No 3 of 1993- Bringing all nuclear activities funded by the state under the control of the atomic energy, with specified exceptions.

Electricity Amendment Act, Act No 46 of 1994-Amending the electricity Act of 1987 to establish the National Electricity Regulator of South Africa, and to apply certain provisions of the Act to other institutions and bodies.

Electricity Amendment Act, Act No of 60 of 1995-Amending further the electricity Act of 1987 to establish the National Electricity Regulator of South Africa with the juristic authority to set up the office.

White Paper on Energy Policy, 1998-Clarifying government policy regarding the supply and consumption of energy for the next decade. Areas covered includes strengthens existing energy systems, development of underdeveloped systems and suggestions for changes in many areas. In addition, it addresses international trade and co-operation, capacity building, and the collection of adequate information.

Regulations to Electricity Act- Stating regulation of certain aspects of electricity services.

Promotion of access to information Act, Act No 2 of 2000- Setting constitutional right to access of information held by the state or another person for the exercise of protection of any right or to provide for matters connected therewith (Davidson and Mwakasonda: 2004).

In this context, in 2006 the South African parliament published the Electricity Regulation Amendment Bill. **To amend the Electricity Regulation Act 4, 2006**, so as to insert certain definition; to make certain textual corrections; to insert a new Chapter dealing with electricity reticulation by municipality; and to extend the Minister's power to make regulations; and to provide for matters connected therewith (Minister of Minerals and Energy, 2006:3).

3.3 Role of the South African Department of Minerals and Energy (DME)

The South African Government has made the DME responsible for different electricity policies and their implementation. According to a White Paper on Energy Policy for South Africa (1998:46), changes to the structured governance of the electricity industry will place large demands on the government in terms of policy leadership. A number of responsibilities concern the internal restructuring of the electricity industry. Additionally, the DME promotes nationwide electrification in previously disadvantaged communities.

3.3.1 Central Government Governance Structures

The DME is responsible for developing energy policy, framing legislation, the administration of regulatory control, the funding and management of national energy policy-oriented research and overall control of the Central Energy Fund (CEF), as well as the National Energy Regulator (Trollip, 1996:5). The DME has capacity to implement the following energy Acts:

- Central Energy Fund Act, Act No 38 of 1977,
- Petroleum Products Act, Act No 120 of 1977,
- Nuclear Energy Act, Act No 131 of 1987, and
- Electricity Act, Act No 41 of 1987 as amended.

The major focus of the research is on the electricity, Act 41 of 1987, as amended, since the research focuses on power trading in the SADC region. The structure outlined in Figure 3.1 demonstrates the functions of the minister and the chief directorate. Most functions are linked to the implementation of government policy with each directorate having its particular responsibility to implement government policy whereas parliament and its committees are responsible for energy legislation and the supervision of the executive arm of government. The executive consists of the cabinet, as well as the minister and his department, who are jointly responsible for formulating and implementing energy policy (White Paper on Energy Policy, 1998:99).

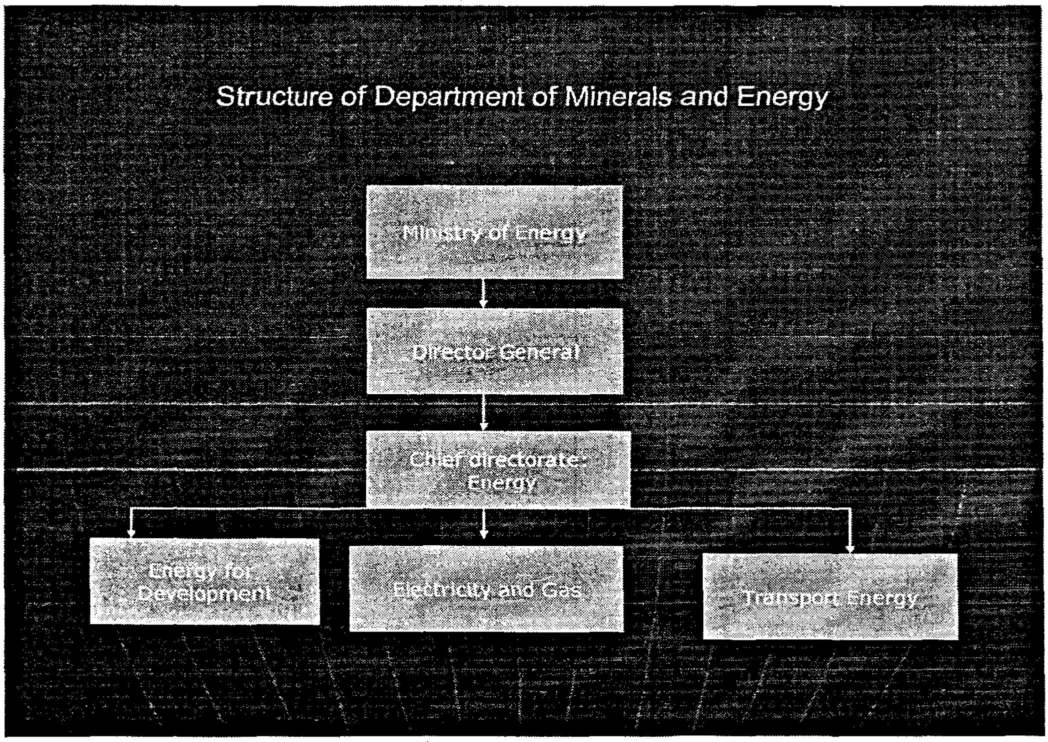

Figure 3. 1: The structure of the DME in South Africa.
(Trollip: 1996:10).

In addition to the above, other national departments also play a major role in the governance of the energy sector. Whilst the DME implements energy policy, Eskom, as national utility, reports to the Ministry of Public Enterprises. According to Trollip (1996:5), the DME, in a structural sense, has a clear administrative and policy-making responsibility and line of reporting. A strong (*de facto*) role in policy development is adopted by other government organisations, which are operated at central level.

3.3.2 Electricity Governance

According to Eskom's annual report (2003), the government's intention was to restructure the electricity supply industry by selling 30% of Eskom's generating plants without compromising South Africa's social and developmental goals.

According to Trollip (1996: 9) the Constitution of South Africa offers a framework for electricity governance, since it creates and allows a range of bodies to legislate, execute and adjudicate on electricity matters. The constitution also constructs a specific reference to electricity, as it provides for local government bodies to make provision for access to electricity. It does not allow local municipalities to supply electricity themselves. To a certain extent, the obligation to ensure access is determined by law.

The Constitutional Court and the judiciary are responsible for any problems concerning the position of the constitution on electricity, which would be referred to the Constitutional Court or Supreme Court. This will depend on the nature of the problem or dispute (Trollip, 1996:10).

Following the above statement Trollip (1996:10) argues that the legislature, together with the senate, forms the organisation where laws, which deal with electricity, are amended. Two parliament committees in particular, are concerned with electricity matters; Minerals and Energy Affairs, and the Committee of Public Enterprises. Electricity generations, following legislation, fall within the ambit of three pieces of legislation:

- The Electricity Act, Act No 41 of 1987, as amended, which creates and empowers the National Energy Regulator;
- The Eskom Act, Act No 40 of 1987, in terms of which Eskom was established and its supervisory body, the Electricity Council, and;
- The Local Government Transition Act, Act No 209 of 1993, as amended, which provides for the restructuring of local government and various other matters relating to electricity provision (DMEAa, 1995:25).

The National Energy Regulator of South Africa (NERSA) was established under the Electricity Act 41 of 1987, as amended in 1994 as, by statute of the government to determine the prices and conditions under which electricity should be supplied by licence, in South Africa (NERSA, 2004:1). The key role of the NERSA is to implement government policy on the ESI. In addition, the NERSA was established to bring the private sector into the energy sector.

The NERSA is responsible for the licensing of electricity generators, transmission and distribution, as well as to oversee the restructuring of the ESI in South Africa, in accordance with existing legislation and the Energy Policy White Paper (NERSA, 2004). Under these statutes, the NERSA has licensed Eskom as the National Transmitter for South Africa. This transmission license requires Eskom to:

- Provide non-discriminatory access by dispatching generators centrally;
- Offer transmission services to parties that in a position to take supply directly off the transmission system; and
- Dispatch power stations, which participate in the national power pool, and organise the export and import of electricity to South Africa (NERSA, 2004:6).

According to NERSA (2004:6) the license arrangement of the transmission network is likely to change when transmission ownership moves to an independent state-owned company. Whereas the ownership should change the broad nature of the transmission, license requirements will not change. Currently, the South African government still not decided when the restructuring of Eskom will start.

In the above context the IEA (1996:130) states in terms of reporting, the national electricity utility (Eskom) reports to the Minister of Public Enterprises whereas the Minister of Minerals and Energy is responsible for policy-making and regulatory issues particularly to power generation. Eskom's governing body is the Electricity Council, a decision-making board with members representing particular interest groups. According to IEA (1996:31) board members are appointed by the Minister of Public Enterprises in consultation with Eskom. The organisation of a Electricity Council changed in 1995, along with a new Act, Act No 41 of 1987. In particular, the portfolios for the departments of Finance and Minerals and Energy were removed. The Electricity Council represents the management board of senior executive management for the day-to-day running of Eskom.

3.3.3 Electricity Tariffs in South Africa

During 1996, electricity tariffs in South Africa were low compared with other countries (IEA, 1996: 140). According to the DME, an electricity tariff is cheap because it is coal-based which is produced comparatively cheaply in South Africa. The over-capacity of the 1980's meant that Eskom invested little in the new plant and this enabled it to keep prices down, as well as relying on locally produced coal

Electricity tariffs are reviewed annually by the national energy regulator, in consultation with the generator of electricity (Eskom and municipalities). Davidson and Mwakasonda (2004:34) argued that, generally, Eskom tariffs were classified in accordance with other factors (Economic growth and social demand), while there are different charges and tariffs for urban and rural areas. Table 3.2 presents an example of the electricity tariffs of the Western Province. These tariffs were increased on 1July 2005 by the City of Cape Town. Each year the provincial government in collaboration with Eskom increase the price of electricity. These adjustments take into consideration the economic growth of the country (Department of electricity of the city of Cape Town, 2005:4).

Table 3. 2: Electricity tariffs in Western Cape Province

Categories	High consumption	Low consumption	Average tariffs in Rand
Domestic2		50 kWh	0.00
Domestic2		250 kWh	91.98
Domestic2		450kWh	183.96
Domestic1	500kWh		198.99
Domestic1	750kWh		293.40
Domestic1	1000 kWh		376.60

Source: City of Cape Town of South Africa (2005:4)

4.3.4 Major Players in the Energy Sector in South Africa

According to Eskom annual report (2005:5) 95% of the energy infrastructure is owned by the South African government through its parastatal, Eskom. It is one of the 11 largest utilities in the world and generates nearly all the electricity used in South Africa.

The generation capacity of Eskom is 42011 Megawatts (MW), a larger numbers (13 power plants) of which is primarily coal-fired 37678 MW. This includes one nuclear power station at Koeberg 1930 MW, two gas turbine facilities 342 MW, six conventional hydropower plants 661 MW and two hydroelectric pumped storage stations 1400 MW (Eskom, 2005:185). These electricity capacities still the same until 2007. In addition, South African municipalities own and operate 2436 MW of the generating capacity, of which 4 coal-fired stations, with a capacity of 1932 MW. Finally, 836 MW of generating capacity (3 coal-fired plants) are owned by the private sector (NERSA, 2003:12). Figure3.2 summarises the main players involved in power generation in South Africa.

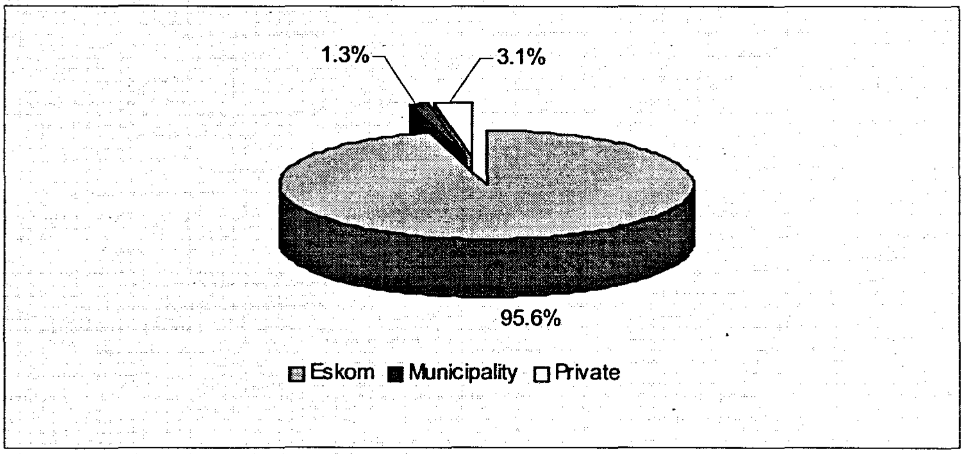

Figure 3. 2: Main power producers in South Africa
(source: Eskom, 2006:175)

3.3.5 Electricity Transmission in South Africa

The NERSA has licensed Eskom as the national transmitter in South Africa within the vertical integrated system. Based on that principle, Eskom has 353 097 km of the distribution lines to which the lines of local municipalities should be added (Eskom, 2006:176). Table3.3 indicates the Eskom transmission lines in South Africa.

Table 3. 3: Eskom's main transmission lines

Power line	2006	2005	change
Transmission power lines, km	27 406	27 169	237
765kV	1153	1153	-
533kV DC monopolar	1035	15318	-
400kV	15 691	7383	373
275 kV	7245	1336	138
220kV	1336	944	-
132 kV	946		2
Distribution power lines, km	43 330	42 988	342
165-132kV	22 142	21 801	341
88-33	21 188	21 187	1
Reticulation power lines, km			
22kV and lower	282 361	277 074	5 314
Total all power lines, km	353 097	347 204	5 893

Source: Eskom, (2006:141)

According to NERSA (2003:19), this licensing framework should change in future when the transmission network becomes an independent, state-owned company. Whilst the ownership will change, the broad natures of the transmission network will not (NERSA; 2004:19). The stipulation of the present version of the transmission license covers:

- Duties of license;
- Separate accounts for transmission business;
- Tariff approvals by the NERSA;
- Settlement of disputes;
- Equipment inspection;
- Provisions for modifying license; and
- Procedures for revocation of licenses (NERSA; 2004:19).

According to Davidson and Mwakasonda (2004:19) NERSA has issued a private company, (Motraco) a license to transmit electricity to Swaziland and Mozambique. The issue of this transmission license, however, is not an element for discussion in this research. This research is based on evaluating power trading in the three countries. Mozambique is not a country chosen to do an evaluation.

3.3.6 Distribution of Electricity in South Africa

According to NERSA (2003:26) Eskom is the main distributor of electricity in this country and its direct customers represents 55.1% of total consumption in South Africa. Its main consumers are domestic 49.3%, agriculture 79.2%, mining 58.9% and general 4.9%. Local authorities or municipalities and other providers contribute 44. 9% of the total energy consumed. The primarily supply the domestic market with 50.7%, agriculture 20.8% and the mining sector with 41.1% (NERSA, 2003). These figures represent the distribution of electricity within South Africa. The figure might change, because there are numerous new connections within South Africa, paving the way for renewable energy.

According to NERSA (2003:8) Electricity distribution in South Africa is structured at two levels: Eskom sales equals 60% of volume and serves 40% of the consumers, while municipalities account for the remaining 40% of electricity sales, and 60% of the total number of consumers. In 2000, the NERSA proposed that Eskom and the country's municipalities merge to form six Regional Electricity Distributors (REDs). The purpose of this plan was for Eskom and the municipalities to own shares in the new distributors, based on the assets contributed to the REDs by both parties (EAI; 2004:4).

In 2003, the government tabled a Bill to the effect that these REDs would be placed under the umbrella of newly-created government-controlled Electricity Distribution Industry (EDI) Holdings (NERSA, 2003:8). According to NERSA, the EDI will be a transitional entity with a life span of three to five years. When the transitional period ends, EDI will be dissolved, leaving a number of nominally independent REDS, with their shareholders being the government, and different municipalities which contributed net assets into REDS (NERSA; 2003:8). One of the first RED launched was in Cape Town in 2005 but the first experience collapsed because of bad planning by the government (Eberhard, 2006:1). The reason given is lack of financial capacity with the new company.

3.3.7 New Players in the Electricity Sector

In November 2001, AES, a US-based company and Global African Power Limited (GAP) their South African Black Economic Empowerment (BEE) partner agreed to acquire a 600MW coal-fired power plant, Kelvin, from the Johannesburg Municipal Council. AES Kelvin sells all the electric outputs to Johannesburg City Power. The procurement agreement of this power purchase has been last for 20 years (EIA, 2004:5) with a possibility of the South African government reviewing the contract after 20 years. The remains an opportunity for another company to operate the Pretoria power plants. The government should, however, first decide which company should win the bid to the rehabilitate the plant.

3.3.8 Challenges Facing the Energy Sector in South Africa

Eskom needs to expand its capacity before 2008 to try to respond to future demands. Currently, Eskom is able to meet electricity demands, but its reserves are being heavily depleted, particularly during winter, when demand is at its highest. Previously, Eskom was able to operate with reserves of up to 20% of normal electricity production. With increased industrialisation and domestic use, this reserve capacity has diminished about 5%, which is not sustainable (Eskom, 2001:53). Projections indicate that at this rate, by 2008, there could be an acute energy crisis in South Africa. As part of the attempts to avert this looming crisis there is a need to develop a new model for power trading in the SADC region.

3.4 Democratic Republic of the Congo

According to the Central Intelligence Agency (CIA, 2006:4) The Democratic Republic of the Congo, formerly known Zaire (until 17 May 1997), is a nation in which monumental political, economical, social and administrative problems have occurred following independence. The DRC is potentially one of the wealthiest countries in Africa, but is presently regarded as an impoverished, development tragedy. In spite of being endowed with abundant natural resources, including copper, cobalt, gold, silver, tin, fertile soil and water, the DRC has failed to meet its promises to the Congolese People.

The DRC is the largest country in Sub-Saharan Africa after Sudan. About 80 % of its population of 45 million people live in rural areas. , The average density of its population is low at 15, 6 persons per km^2 and evenly distributed (CIA, 2006: 5). The population density in the forest areas is only one half the national averages.

According to Mutumbo (2005:1) the energy sector in the Democratic Republic of Congo has been controlled by the government for more than three decades. The Ministry of Energy and the Minister of Public Enterprise in the DRC control the electricity utilities. Section 3.4.1 outlines the historical context of the energy sector within the DRC.

3.4.1 Historical Overview of DRC Electricity Sector

According to Societe National D'Electricite annual report (SNEL, 2005:2) the DRC gained independence 30 June 1960, the electricity sector had been the responsibility of a state company Regideso, along with six other private utility companies, namely Cometrick, Forces de l'Est, Forces du Bas Congo, Societe Generale Congolaise des Forces Hydroelectrique (Sogefor), Societe Generale Africaine d'Electricité (Sogelec) and Cogelin. The electricity sector in the DRC is managed by (SNEL), established by presidential decree No 73/033 on 16 May 1970.

In the same context the SNEL annual report (2000:7) states that government issued SNEL an approval for the construction of the first phase of the Inga 1 hydropower. Prior to the establishment of SNEL, the government proclaimed presidential decree, No 67-391, on 23 September 1967, for the establishment of financial control as well as technical committee for the construction of the hydroelectric power station of Inga 1. This committee was replaced by SNEL and it becomes the national electricity company of DRC in 1970.

With the commissioning of the first phase of Inga 1 in 1972, SNEL became responsible for the generation, transmission and distribution of electricity across the country. It assumed responsibility from another state enterprise Regie de

Distribution des Eaux (Regideso), which today holds the responsibility for water distribution in the DRC (state company). Besides Regideso, the government nationalised six private companies, which distributed electricity around the country. At that time the government began a process of absorbing private utilities around the country into SNEL. This process ended in July 1974, when SNEL had achieved a monopoly on generation, transmission and distribution of electricity within the country (SNEL; 2000:7).

It is argued by SNEL annual report (2000:7) on 5 May 1978; the former president of Zaire, Joseph Mobutu SeSe SeKo signed a presidential decree, No 78/196, approving the status of SNEL. Since then, SNEL has operated as a state company under the legal framework of the Public Enterprise Act. The technical responsibility is controlled by the Ministry of Energy with financial responsibility controlled by the Ministry of Public Enterprises.

Within the DRC electricity sector there remains a number of micro-hydro and thermal plants which are privately controlled. These are partly owned by mining as well as other companies located in remote places in the country. Currently, a number of these are not in operation due to the closure of the businesses concerned or lack of parts and maintenance. Others electricity plants are being decommissioned. It means the operation period of the power plant is reached 25 years. The establishment of SNEL in the DRC is closely linked to the development policies adopted by the country, since SNEL took a decision to implement a development policy, which included skills development for staff. Initially, most senior staff were foreigners, specifically, from Belgium and France. The government changed the situation in 1989 allowing for Congolese to manage SNEL (SNEL; 2000:8).

3.4.2 Tariff Levels around the Country

According to SNEL (2005:19) the selling tariff for electricity in the DRC is around 6 cents in US dollars per KWh, while the bulk of electricity is sold to the mining company. Domestic consumers enjoyed the lowest tariff. This situation is because less than 10% of households across DRC have an access to electricity.

Other capacity has been export to other countries in Southern African region and also central African countries.

According to Journal le Potential (2005:1) the tariff of electricity in the DRC does have a socio-political basis, since the government continues to struggle to pay public officials a monthly salary. It remains, therefore, difficult for SNEL to increase its tariffs. Table3.4 illustrates the domestic tariffs, which were released by SNEL in August 2005.

Table 3. 4: Domestic electricity tariffs in DRC

Category	Kwh/ Month	Franc Congolese	US Dollars
Households A	300	1080	2,3
Households B	400	1440	2,8
Households C	600	3411	7
Households D	900	5116,50	10,2

Source: (Journal lePotential: 2005:1)

Journal Le potential (2005:1) states that there is no government subsidy for electricity tariffs in the DRC. Consumers have complained about the new tariffs, because the national utility charges arbitrarily due to a lack of meter boxes. Most of the large consumers such as Gecamines and Societe National de Chemin de Fer Congolaise (SNCC), pay a negotiated tariff. The reason for negotiating tariffs is that these companies are also public enterprises which purchase in bulk. The situation of non-payment of electricity bills by some households and government officials convinced senior management at SNEL to introduce a reduced tariff in 1996 on a bid to increase the recovery rate.

According to SNEL (2005:13) the electricity tariffs is set by a committee established by the government, namely the ministerial committee, which comprises the departments of finance, economy, energy, SNEL and the Federation Congolaise des Entripreses du Congo (FEC). The electricity tariffs proposed by SNEL take into consideration the economic situation of the country, since there is no regulatory body in existence in the DRC. According to (Mbala; 2005:1), most government department do not pay electricity bills. In addition, senior public officials also do not want to pay. The recovery rate on exporting electricity is generally good.

3.4.3 Industry Development and the Energy Sector

SNEL annual report (2005:3) argues that the commission for the construction of Inga 2, established in 1982 portrayed Inga 2 as essentially an economic development project for the country, providing energy infrastructure to the mining sector in Katanga Province, as well as the energy intensive industries in Kinshasa and other provinces. The projection for demand for energy the government adopted at the time was over-optimistic as with the supply situation in the country, there was no need for the second phase. Total consumption including exports, was only around 30% of total capacity providing plenty of scope for any increases in the electricity consumption over time in the DRC (SNEL: 2005).

In addition to the above SNEL annual report (2005:19) there is also a problem facing the utility concerning the loss of electricity during transmission. The operating technical losses are high at SNEL, while the recovery rate is extremely low. Technical losses in 2003/2004 were as much as 37, 4% to 41 50%, even before the poor recovery billing rate was taken into account.

In addition SNEL (2000:14) states that the consumption of electricity across the DRC decreased for more than two decades. This situation is due to the political and economic problems of the country. DRC for example, in 1994 SNEL lost $788 million, mainly a result of the devaluation of the new Zaire (name of the currency during that time). This was a result of the negative trend prevalent in the Congolese economy, during Mobutu's regime. This consequence was also because of a high inflation rate and devaluation.

3.4.4 Demand for Electricity around the Country

According to SNEL, about 8% to 10% of the DRC population has access to electricity. This figure should be changing because there are large numbers of new connections across the country. In 1995 SNEL presented a report on its number of registered consumers as 221 000. This number was meaningless compared to the population figure at that time, which was around 45 million. For example, the number of consumers under SNEL in around Kinshasa was about 150 000, while illegal connections in the same area have been estimated in the order of 70 000 to 80 000 (SNEL: 2005). The number did not reflect the reality, because Kinshasa has about eight million people. Therefore, more than half-a-million households do have access to electricity within Kinshasa alone. In most Kinshasa suburbs consumers are, however, experiencing power failures.

Another reason for lower energy consumption in the DRC was the lack of electrification programmes. For more than two decades the government did not implement electrification programmes for this reason, more than 45 million Congolese do not have access to electricity. The major consumers of electricity in the DRC are located in only three provinces, namely Kinshasa (the capital), and the Bas Congo and Katanga Provinces, which hosts the mining companies. Together these three provinces account for 75% of all electricity distributed in the DRC. It remains difficult to provide an accurate figure of electrified households, because of clandestine electrification takes place around the country. The government and the utility company (SNEL) do not have any mechanisms in place to rectify this situation (SNEL: 2005).

According to Journal le potential (2006:2) the large amount of electricity consumed in Katanga Province can be attributed to the mining companies. The largest being Gecamine Exploitation, Tenke Fungurume Mining, Envil Mining, Ruashi Mining, Feza Mining, Chemaf and Malta Forrest. Part of the population lives in the company compounds and as a result has access to a reliable supply of electricity. In other areas, only households that can afford to pay the connection fee to SNEL have access to electricity. In Bas Congo electricity access is high because of an electrification programme started in that province in 1975.

Additionally, both Inga 1 and Inga 2 are located in the province, which gives it a clear advantage over other provinces in terms of broad access to electricity. There are many informal connections nationwide that have a negative impact on the national utility. There is a need for consumers to change their behaviour with regard to informal connections. As part of this there is a need for the government to introduce a cheaper tariff to allow more people to access electricity formally.

Table3.5 presents all the hydropower within the country. The presentation of this table is to show how much hydro potential the DRC has and to show the potential for the government to implement a successful policy to improve electrification.

Table 3. 5: Generation Capacity of hydropower in the DRC

Power Plant	SNEL	Mining Company	Installed Capacity MW
Inga 1	SNEL		351,0
Inga 2	SNEL		1424,0
Zongo	SNEL		75,0
Sanga	SNEL		12,0
Mpozo	SNEL		2.2
Mwadingusha	SNEL		70.5
Koni	SNEL		42,0
Nseke	SNEL		108,0
Kiyimbi	SNEL		262,0
Kilubi	SNEL		28.2
Lungudi	SNEL		9.9
Ruzizi 1	SNEL		28.2
Ruzizi 2	SNEL		26.6
Tshopo	SNEL		18.8
Mobayi	SNEL		10.5
Budana		Kilomoto	13.8
Nzoro		Kilomoto	1.4
Soleniama 1		Kilomoto	13.5
Soleniama 2		Kilomoto	1.6
Ambwe/Kailo		Sominki	2.2
Belia		Sominki	2.2
Mangembe		Sominki	1.8
Lulingu		Sominki	0.7
Lutshurukuru		Sominki	5.1
Moga		Sominki	0.4
Tshala&Lubilanji1		Miba	8.6
Piana Mwanga		Congo Etain	29.5
Total			2551.3

Source: SNEL (2005:20)

Table 3. 6: Thermal power plants in DRC

	1980		2005	
Site of plants per province	**Number of plants**	**Capacity (MW)**	**Number of plants**	**Capacity (MW) and Type of plant**
Bas Congo				
1. Muanda	2	2.550	3	1.600 (Gas plant)
2. Lukala	2	0.310	1	0.176
3. Tshela	2	0.350	2	0.350
4. Lemba	1	1.300		Connected to the national grid
5. Bomba	5	4.500		Connected to the national grid
Bandundu				
6. Kikwit	4	0.960	2	0.800
7. Inongo	2	0.280	1	0.176
8. Bandundu	2	0.750		Connected to the national grid .
Kasai Occidental				
9. Kananga	4	4.160	3	2.696
10. Mweka	2	0.350	2	0.350
Kasai Oriental				
11. Mbuji Mayi	4	12.800	1	0.600 (partially Connected to the national grid
12. Lusambo	2	0.590	2	0.590
13. Kabinda	2	0.550	2	0.550
Equateur				
14. Mbandaka	4	4.300	3	2.290
15. Basankusu	2	0.260	2	0.260
16. Boende	2	0.350	2	0.350
17. Bumba	3	0.800	1	0.400
18. Lisala	6	1.360	6	1.360
19. Gemena	4	1.150	4	1.150
20. Libenge	2	0.800	2	0.800
21. Zongo	1	0.300	1	0.120 Connected to the national grid
22.Gbadolite	4	1.180	-	-
Maniema				
23. Kindu	3	1.650	1	0.600
24. Kasongo	2	0.520	2	0.520
Katanga				
25. Kabalo	2	0.350	2	0.350
26. Kongolo	3	0.850	1	0.250
27. Kamina	3	0.840	-	Connected to the national grid
28. Kaniama	3	0.510	3	0.510
29. Kasenga	2	0.230	-	Connected to the national grid
Nord Kivu				
30. Goma	4	2.400	-	Connected to the national grid
31. Butembo	1	0.280	1	0.280 - not running
32. Kisangani	4	12.800	4	Not running
33. Buta	3	0.640	3	0.640
Total	92	61.640	54	30.568 MW

Source: SNEL (2005:21)

According to SNEL (2005:48) table 3.5, the DRC has several hydropower stations across the country, even though a number of these do not produce at full capacity. There are others also that require refurbishment.

A negative aspect is that most of the hydropower plants do not contribute to the electrification of rural areas within the DRC. Many rural households, therefore, do not have access to electricity. The benefit of having access to electricity is that it contributes to the socio-economic development of those communities. The large number of existing hydropower stations and potential assets should make it possible for the government to implement a successful policy. The application of the policy would improve electrification and offer far greater access throughout the country. With foreign investment, the DRC even has the potential to expand and export electricity to neighbouring countries, including South Africa (SNEL: 2005).

During the civil war (1997-2002) some thermal power plants could not operate properly due to a lack of fuel and engine parts from the SNEL Head Office in Kinshasa. Today following the peace process, some thermal plants have become operational again, but access to electricity in the DRC remains problematic. Despite it being almost two decades since the previous government, the Mobutu regime in 1988, took a decision to electrify urban and rural areas across the country (SNEL; 2000:10).

This decision called the *'Plan Directeur de SNEL'*, not yet been implemented. The failure of implementing this policy has left millions without access to electricity. For example, in Equatorial Province, the thermal power plant does not generate electricity, citizens complain daily. As there was no electricity in that province, medical staff at hospitals has to use candles. This is how serious the situation is in a country that has an excess capacity to generate electricity and an even greater potential capacity (SNEL; 2000:10).

3.4.5 Transmission Network in the DRC

The main transmission network and sub-transmission network is 50 kV to 500 kV over a distance of 5 350 km of lines and comprises 64 major transmission substations. The details of the transmission network are summarised in Table 3.7.

Table 3. 7: The DRC transmission network and sub transmission

Areas	500KV	220KV	132KV	120KV	70KV	50KV	Total
Kinshasa		121.6			80.0		201.6
Bas-Congo		263.6	185.8		164.5		613.4
Katanga		827.0		1198.7		144.4	2170.1
Tanganika			120.0				120.0
Kivu					260.0		260.0
Inga Shaba	1700	267.0					1967.0
Equateur			22.5				22.5
Total	**1700**	**1479.2**	**327.8**	**1198.7**	**504.5**	**144.4**	**5354,6**

Source: SNEL (2000:24)

There have been 3000 km of transmission networks since 1970, including the transmission line of 1700 km Inga–Shaba Direct Current (DC) line. From Sadelec and MEPC's (2000:230) point of view, the SNEL transmission network is in an acceptable condition.

In the above statement in the SNEL annual report (2005:18), there are two main network systems, which connect the Bas Congo, Kinshasa and Katanga over a distance of 1700 km. The Inga Shaba network a 500kV (DC) line, was commissioned in 1982. There are two single pole lines on two parallel rows of 38 metre high steel towers. The network has a capacity of 1120 MW but is limited to 500 MW due to the poles. The 220kV Luano in Katanga Province's (DC) line that interconnects the DRC to Zambia can transit only 230 MW. In 1996 the three utilities, namely SNEL, ZESCO (Zambia) and Eskom, met in an attempt to upgrade the line. The DRC transmission network is also connected with several neighbouring countries, such as Congo Brazzaville, Central Africa Republic, Angola, Zambia, Rwanda and Burundi. In terms of power trading, the interconnections to Zambia in the SADC zone, as well as Congo Brazzaville in the west, are also important for the DRC government in terms of revenue.

3.4.6 Distribution Network

The distribution network throughout the country was increased from 2 700 km in 1974 to 10 800 km by 1994. Throughout most provinces the network systems are old and normally overloaded due to the increase of new informal connections.

SNEL (2000:30) reports that in Kinshasa, where 70% of SNEL's consumers are located, the distribution network is in urgent need of rehabilitation and upgrading to respond to growing consumer demand. In addition, SNEL continues to use most substations installed by Belgium in 1950 and 1960, all of which are overloaded. Illegal connections have also contributed to deterioration of these substations and technical and operational conditions have worsened.

3.4.7 Power Trading with Other Countries

The exporting of electricity in the DRC can be divided into two different zones. The first is to the SADC on the DC interconnection in Katanga Province, where a total of 200 MW is exported through Zambia and Zimbabwe. There is also a project which aims to reinforce the Kolwezi and Luano DC transmission networks in order to upgrade capacity allowing lager exports from the DRC to SADC countries such as Zambia, Zimbabwe and South Africa (SNEL, 2000:26). A second zone is in Congo Brazzaville. SNEL has supplied Brazzaville with electricity since 1950. The network lines of 30 kV are on upgraded from the original 6.6 kV line from Kinshasa to Brazzaville built in 1953, which was reinforced in 1988. The interconnection supplier accounts for nearly one-third of electricity consumed in Congo Brazzaville. The transfer capacity of the interconnection is 200 MW, however, the maximum load transfer is set at 45 MW. SNEL is conducting a study to evaluate the possibility of constructing a new line from Inga to Congo, Brazzaville, at Pointe Noire (second biggest city in Congo) and Cabinda in Angola (SNEL;2005 15).

3.4.8 Challenges Facing the Energy Sector in the DRC

There is much work to be done by the DRC government, to transform the energy sector of the country. Different hydropower plants and thermal plants across the country do not generate electricity to their full capacity. There is a need for the government to inject funding or to request the private sector to participate in the electricity sector possibly through public private partnerships particularly in provinces where hydroelectric plants require refurbishment (SNEL; 2005:15).

3.5 Overview of Zimbabwe

Zimbabwe, within the Southern African region, possesses great economic potential. This landlocked country of about 391 000 km^2 lies between South Africa, Mozambique, Malawi, Botswana and Zambia. Zimbabwe was granted independence from Britain in 1980, with relative political stability until 2002. In 2006, Zimbabwe had 12 236,805 million inhabitants, it is estimated that in 2007 the population could be at about 12 311,143 million people. The gross domestic product (GDP) in 2006 is estimate at -\$25.05 billion. The GDP per capita in 2006 is estimated at -\$2,000, and unemployment in 2005 was estimated at 80% (CIA, 2006:3).

3.5.1 Historical Overview of the Electricity Sector in Zimbabwe

The electricity supply industry in Zimbabwe began in 1897 with the creation of the Bulawayo Electricity Company, followed by another company, Salisbury Electrical Company. At the same time the municipality in Harare constructed coal-powered station because of an increasing demand for energy. This situation arose with the development of the mining industry in Zimbabwe (Sadelec and MEPC, 2000:235). The first Electricity Act in Zimbabwe was promulgated on 01 July 1936, which established the Electricity Supply Commission (ESC) to control power stations in Gweru, Mutare and Kadoma, as well as a responsibility to supply electricity to the mines and surrounding areas. A major task of the ESC was to create a new facility for the supply of electricity within the country.

Following this statement SADELEC and MEPC (2000:336) states that in 1940, the colonial power (Britain) added another coal power station at Gwanda, Munyati and Zvishavane. At this time the idea of harnessing the Zambezi River was conceived and the damming of this river began in 1955. In the 1960s, Queen Elizabeth II of England, publicly commissioned the Kariba Hydropower Station to be built by the Federation of Rhodesia and Nyasaland in order to serve the Northern Rhodesia (Zambia), as well as Southern Rhodesia (Zimbabwe).

According to Mangwengwende (2002:947) at the same time, the construction of the commissioned transmission network yielded a capacity of 330KV, linking the towns of Kitwe in the Copperbelt of Zambia to Bulawayo in Zimbabwe. When Kariba was commissioned, the management of the dam was handed over to the Federal Power Board, which disbanded in 1964 and was replaced by the Central African Power Corporation "CAPCO" (Mangwengwende, 2002:947).

It was further argued by (Kayo, 2002:959) after five years of independence, in 1985, the government decided to establish a new Electricity Act, No 6 of April 1985. The Zimbabwe Electricity Supply Authority (ZESA) was created as a vertically integrated parastatal under the umbrella of the Ministry of Transport and Energy. ZESA was responsible for the generation, transmission, distribution and supply of electricity throughout Zimbabwe. This situation empowered the Zimbabwean government with strong control over electricity production. The establishment of ZESA was based on a merger of the Zimbabwean share of Capco, the ESC and the electricity departments of four municipalities. ZESA maintained a monopoly in terms of electricity production, as well as distribution within the country.

According to ZESA annual report (2004:9) in 1995 the government of Zimbabwe applied to change ZESA into a public company, a process that was completed in June 1997. The government had decided to offer ZESA two options as either a non-profit organisation or a commercial company subject to tax. ZESA opted for the second model and accepted to pay tax. However, those taxes would be used to contribute to the electrification programme across the country.

The creation of ZESA was to control the generation, transmission and distribution of electricity across the country. In 2002, the government decided to disband ZESA. The Electricity Act of 2002 (Chapter 13:19) implemented a decision to disband ZESA and changing its structure from a vertically integrated entity into three successor companies.; the Zimbabwe Power Company (ZPC), Zimbabwe Transmission Company (ZTC) and Zimbabwe Electricity Distribution Company "ZEDC" (Zimbabwe Electricity Regulator Commission, 2006:2). Furthermore, ZESA remained as a holding company with three regulated subsidiaries entities.

Using the same Electricity Act of 2002 (Chapter 13:19), the Zimbabwean government decided to establish a Zimbabwe Electricity Regulator Commission (ZERC) in 2005. This entity regulated electricity tariffs, provide licenses and promote and implement competition to all companies in the energy sector.

According to the Zimbabwe Government (2006), this reform of the electricity sector, which had begun in 2002 with the creation of three subsidiary companies, was unsuccessful. Therefore, it was decided to close ZPC, ZTC and ZEDC mainly because of negative cash flow (ZERC: 2006) which reached a stage where these companies were unable to pay their workers.

3.5.2 Electricity Tariffs in Zimbabwe

The electricity tariffs in Zimbabwe are divided into different categories of household (Table 3.8). The electricity tariff in Zimbabwe has increased by 30% since 1997. Brown (2004:1223) argues the financial institutions suggested higher tariffs on electricity as a means to fund the investment needed to increase efficiency, for which there was a higher demand.

The Zimbabwean Government did much to improve energy demand within the country, especially during this period of socio-economic instability. The government has final control on setting tariff levels and at the same time the government rejected tariffs recommended by external consultants (Davidson and Mwakasonda; 2004:38). The problem of tariffs in Zimbabwe's electricity sector did not help the ZESA to increase its financial capital. According to Mangwengwende (2002: 947), it has been proven that the decision taken by Zimbabwe on tariffs setting was fundamentally flawed. Considering the existence of formula policy on tariff-settings they tended to be increased only in response to actual economic crisis. Today, ZESA cannot purchase electricity outside the country because of financial constraints within the organisation. The table 3.8 show an example of electricity tariffs in Zimbabwe.

Table 3. 8: Electricity tariffs for domestic sector in Zimbabwe

Consumption block	Tariffs/ kWh(Zb$)	Tariffs/kWh(US$)
2001		
Up to 50 kWh	0.99	0.018
Up to 300kWh	1.10	0.020
Up to 1000 kWh	3.09	0.056
Above 1 000 kWh	3.21	0.058
October 2002		
Up to 50 kWh	2.78	0.050
Up to 300kWh	3.06	0.055
Up 1000 kWh	7.18	0.130
Above 1000 kWh	7.45	0.135
November 2003		
Up to kWh	5.48	0.007
Up to 300kWh	6.01	0.007
Up to 1000 kWh	14.09	0.017
Above 1000 kWh	14.60	0.018

Source: adapted from Dube, 2003

3.5.3 Electricity Generation in Zimbabwe

Power in Zimbabwe is generated by hydropower and thermal power plants around the country. Table 3.9 presents different power plants and their locations in Zimbabwe.

Table 3. 9: Generation capacities in Zimbabwe

Areas	Types	Capacity in MW
Hwange	Thermal	920
Harare	Old thermal	135
Munyati	Old thermal	120
Bulawayo	Old thermal	120
Kariba South	Hydropower	666
Total	6	1965

Source: ZESA (2004)

According to Kayo (2002:961) the Hwange Thermal Power Plant was commissioned in 1983 (4x 120 MW units) and in 1987 (2x220 MW units). There is the possibility for rehabilitation and expansion of the plant.

The thermal power plants in Harare, Munyati and Bulawayo have been operating for more than 40 years, and their capacity has consequently declined with age. Two of these three coal power plants have been refurbished. The capacity of the power station in Harare is 80 MW and in Munyati 40 MW. The Bulawayo coal power station was not refurbished because of its inefficient water supply.

In the above context Kayo (2002) argues that the hydropower station of Kariba South consists of six units, each with a capacity of 111MW. In 1993, after a feasibility study, it was recommended the plant should upgrade each unit to 125 MW which would increase capacity from 666 MW to 750 MW. Zimbabwe and Zambia together decided to build a second hydropower plant at Kariba. The Zambian Government, decided to withdraw from the construction plan because there was no need for them to invest in a second Kariba. Whereas a large of the demand arose on the Zimbabwean side of the Kariba and was needed to satisfy the demands of industry.

3.5.4 Transmission Network

ZESA annual report (2000b:7) the National Utility (ZESA) controls the electricity transmission network in Zimbabwe. Electricity is transported to a bulk supply point through a meshed transmission network, which consists mainly of 3 500 km of 330 kV transmission line. The electricity is delivered to different load centres through a sub-transmission system, which consists of 1280 kV of 132 kV line, 2150 km of 88kV line and 185 km of 66 kV line. The blend of voltage standards was inherited from the development of the electricity supply industry in Zimbabwe. The electricity network around Zimbabwe is presented with a voltage of 220 kV and above, while the sub-transmission network system protects voltages between 66kv and 132 kV.

3.5.5 Distribution Systems

The levels of voltages for distribution in Zimbabwe are divided into three different categories, namely 11 kV, 33 kV and 380 kV. There is a 22 kV in the west of the country, but this system is limited. The development of the higher voltage sub-transmission network was determined by the location of initial power stations, mining companies and local consumers (ZESA, 2000b). Also, the sub-transmission and distribution systems were increased to meet the electricity load at different locations. There is interconnection between South Africa and Mozambique, which helps Zimbabwe to import electricity from both countries, which also serves to improve the security of energy supply.

3.5.6 Challenges Facing the Energy sector in Zimbabwe

The energy sector in Zimbabwe is experiencing difficulty because of the country's political and economic instability. The Zimbabwean Government needs to refurbish some of its power plants which would partly solve its energy problems. For example the Hwange Thermal Plant, constructed at a cost of $Z 230m in 1989, accounts for 930MW of the national generating capacity (Brown, 2004:1224). Yet in the past few years, the performance of Hwange has been disappointing because of a design fault and a shortage of spares. The Zimbabwean Government needs to pursue foreign investment in order to attract international companies to inject funds into its energy sector. Due to observing the political and economic situation in Zimbabwe, public and private partnership could play an important role to improve the energy sector in Zimbabwe.

3.6 Summary

Each of the three countries presented in this chapter has its own problems. In the case of South Africa, there is a major industrialisation and the electrification programme for disadvantaged communities, taking place across the country. Following several years of strong economic growth, the demand for energy has rapidly increased and the national utility aims at increasing its capacity of supply to satisfy the demand before 2008.

In the DRC the government still has to do much to transform its electricity sector. There is an excess capacity, but the national utility is not managed well because of political interference. A numbers of hydropower and thermal plants across the country need refurbishing or upgrading to increase capacity.

More can be done by the DRC Government to implement a policy for the electricity sector including establishing a regulator. The national utility earns revenue only from exporting electricity to other African countries and this situation needs to change.

The Zimbabwean energy situation is poor primarily because of political instability leading to a disastrous economy. Demand for energy is high, but Zimbabwe has to import electricity from the DRC, Mozambique and South Africa. There is a need for the Zimbabwean government to consider investment to attract international companies to inject funds into the energy sector.

The following chapter will explain the management of energy supply and demand in the Southern African Development Community. The memorandum of understanding for the member countries will be presented in this chapter.

CHAPTER 4. MANAGEMENT OF ENERGY SUPPLY AND DEMAND IN THE SADC

4.1 Introduction

In the previous chapter the energy sector in selected countries was explained. The energy supply and demand for the chosen countries illustrated the need of each country in terms of energy demand. This chapter analyses the framework agreement utilised to manage the electricity supply and demand within SADC countries. This framework does not have the status of law, but is a documented understanding shared by different countries for solving the problem of energy supply and demand within the region. The supply and demand of electricity in the countries of this study within the SADC region differ greatly as has been evidenced in Chapter Three and depends mostly on the economic development and growth of the country, as well as national capacity in terms of electricity demand.

In order to understand the problem of power trading in the SADC region, it is imperative to analyse the agreement document or 'memorandum of understanding', signed by the various governments and the electricity companies within the region. This agreement established and provides the framework for the operation of the SAPP. The research will review the agreement document signed by the different governments and the national utility for the implementation of power trading within the SAPP. A key problem has arisen for the researcher to consult a revised Memorandum of Understanding which was endorsed in (2006) by the fourteen Ministers of Energy for SADC. It's an official government document which each minister of energy keep. There are, points that have occurred with regards to the transformation within the SAPP, which the minister of energy should change [Personal interview with the co-ordinating manager Dr Musaba of the SAPP in Harare: 2006].

4.2 Governance Structure of the SAPP

The implementation of the electricity market within the region was driven by the trading of electricity. Governments realised there was a need for the entire region to reform the electricity market into a 'power pool', which would mean that countries should begin to buy electricity (SAPP, 2004:5). According to the SAPP annual reviewed report April (1999:1) the benefits of a power pool included reduce the cost to build new power plants and to use the capacity in the neighbouring countries in the SADC. The implementation of the power pool has impacted significantly on the level of interconnection across the region.

The rationale for the agreement was defined in the agreement as allowing member states to co-ordinate the planning and operation of their systems while maintaining reliability, autonomy and self sufficiency (Donal, Charpentier and Minogue, 1998:2). With this measure in place no country should face complaints about the scarcity of power. Governments are still trying to improve different mechanisms, which could change the electricity market in the SADC.

Four agreement documents form the basis for the governing body for the electricity market in the SAPP. These documents are:

- The "inter-government memorandum of understanding(IGMOU)";
- The "inter-utility memorandum of understanding(IUMOU)";
- The "agreement between operating members(ABOM);and
- The "operating guidelines (OG)."

Currently, member states have reviewed legal documents with further amendments, which could allow other partners, who are not members of the SAPP, to participate in the pool. According to the rules of the organisation as defined in the framework documents, each country is expected to follow the governance structure of the power pool. The four documents will be dealt with in turn below.

4. 2. 1 Inter-Government Memorandum of Understanding (1995)

This document was signed by either the Head of State or the Ministry of Energy for each government. All agreements in terms of power trading in the SADC member countries should be endorsed by a Ministry of Energy. According to SAPP (1995:5), SADC ministers and officials are responsible for policy matters, normally under their control in terms of the national administrative and legislative mechanisms that regulated relations between government and its respective national utility. The legal document protects each government, which has accepted the participation of the national utility, in the power pool. This power pool is a co-operative pool to help countries solve the problem of electricity demand within each country. Since the inception of the SAPP there has been a suggestion raised by the co-ordination centre, with the member states which is that the situation under which the pool now functions has significantly changed, warranting a review of SAPP governance, as well as membership criteria (SAPP, 2005:6).

According to Musaba (2006:1) the amendment of the IGMOU and the IUMOU are expected to address the reforms described by the 2006 SADC report. In addition, the report suggested the admission of new members into the SAPP such as an IPPs based in the region. In addition, the revised document suggests the implementation of power sector reform in various SADC countries. The revised document also tried to suggest new policies and measures for members, to allow private companies involved in the electricity sector to participate in the power pool.

Musaba (2006:1) argues that a number of the governments are delaying the restructuring of the electricity sector for a variety of reasons. For example, the electrification programme in DR Congo is still lags. In the process of restructuring, a power utility may have a negative impact on an electrification programme in other countries where most of the population does not have access to electricity.

The reason for these changes in the SADC was because member states realised there is a problem in terms of capacity. Most countries were weak in terms of building a new plant. Another important element was the possibility that, the region could face a shortage of power by 2008. It has also been evaluated that the investment capacity in this sector is weak across the region (Musaba, 2006:1).

In order to promote these arguments, the SAPP (2005:5) pointed out that in the past 10 years, electricity demand in the SADC region had increased at a rate of 3% annually. However, there has not been a parallel increase of investment in power generation during the same period within the region.

The reduction of excess capacity within the SADC region was because of huge demand within different economy sector.

Consequently, excess generating capacity has been gradually diminishing. A continuing reduction in the excess generation capacity would impact negatively on member's economies. Potential investors would also be cautious before investing in areas where there were power issues.

Figure4.1 illustrates the new governance structure of the SAPP in this region, which represents the revised governing body of the power trading in the SAPP region.

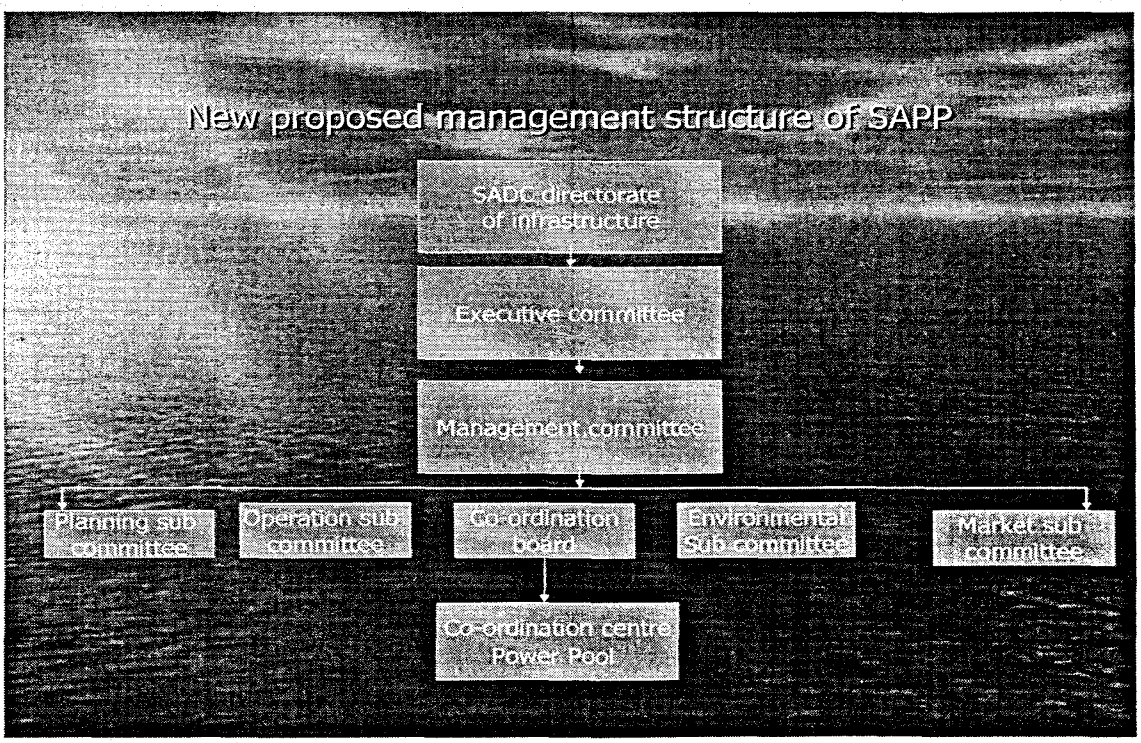

Figure 4. 1: The new proposed management structure of the SAPP.
(SAPP: 2005)

The revised structure was implemented through a policy-making procedure within the SAPP in 2005, which assessed the needs for policy change within the organisation. The policy revisions came into being through an analysis of the progress made by the pool since the commencement of the SAPP in May 1995. The change proposed by policy-makers within the SAPP was to review the governmental protocol, which concerned the participation of other private companies within the pool. Currently, the response from the member states remains unknown.

The SADC ministers of energy approved the new management structure of the SAPP on 26 February 2006. The signing of the new structure of the SAPP changed the reporting organization within the power pool. The new structure removed the Technical Administrative Unity (TAU) of the SADC, which had been attached to the executive committee (SAPP; 2005:10).

According to the SAPP annual report (2005:10) the working structure is controlled by the SADC directorate where all 14 ministers met and discussed the way forward. The executive committee and management were represented by 12 chief executive officers (CEOs) of the various national utilities in the SADC.

The SAPP annual report (2005:11) argues that the remaining sub-committees are run by different members of the power utilities of the region, depending on their position within the SAPP. The co-ordination centre manages the power pool and reports on the operations of the pool on monthly basis to the management committee. The centre has also produced weekly reports on the electricity capacity within the sub-region, as well as the trading capacity.

The co-ordination centre is financially supported by annual contributions from the member states and international donor funding. In comparison, other power pools, around the world had their own financial income "based on levy trades"; an example being the Alberta power pool in Canada.

According to Musaba (2006:1) the SAPP power pool established the Short-Term Energy Market (STEM) in 2001. The creation of the STEM provides the basis for this study's analysis of the trading of energy in the countries under study. All the national utilities that have an excess capacity are obliged to notify the power pool a day in advance. To understand how the STEM operates it is worthwhile to look at an example of the trading of electricity which occurred in January 2006.

SAPP's monthly report, reported the energy trade for the short-term energy market for January 2006 amounted to 6.6 GWh at a cost of $ 90.000 (SAPP, 2006:2). This figure is probably the lowest volume of energy that have been traded in this power pool. The average price for power trading ranged from US$ cent 0.88 to 1.79 KWh and the average exchange rate was US$ 1.00 to the Zimbabwean dollar 6.110. The flow of trading in this power pool will be presented during the discussion of the results of this research. This example is to illustrate how member states acquire power at the SAPP.

The SAPP wanted to introduce another type of market, the Day-head Market Development. This type of market is used in the EU, Canadian and US electricity markets. Nord Pool ASA (NP) of Norway won the tender for the supply, installation and implementation of the SAPP trading platform in November 2006. The executive committee of the SAPP approved the contract in 2005 to allow the SAPP and NP to deliver the SAPP trading platform. These two types of markets will grow with time because the region still faces a power shortage. The success of these different types of market will need other new players in the SADC to increase capacity.

4. 2. 2 Inter-Utility Memorandum of Understanding

The IUMOU for the SAPP was endorsed by all the CEOs of the various electricity companies of the SADC countries. The MOU allowed for the formation of the executive committee for the management of the SAPP. No private company were involved in the executive committee of the SAPP; the majority of the power utilities in this region remaining under government monopoly. The SAPP (1995:5) has reported that the committee should act as the board of the pool, its duties are described in article 10. Each CEO shall continue to report to his own controlling body and the creation of the SAPP shall in no way alter or change this relationship. In terms of bilateral agreement between two countries, the member states which form the pool decided that the old agreement remain in place until the end of the contract and allows for the possibility for the renewal of these bilateral contracts.

4.3 Managing the Energy Supply and Demand

The problem of managing energy supply and demand for selected SADC countries does tend to be framed in terms of political and economic stability. With political and economic stability within a country the generation of electricity should also be stable.

In the absence of political and economic stability, there is a danger of ineffective electricity generation. This means that the stability of a country could open doors for others in the region to trade electricity. This depends on when another does not have enough electricity to supply within the country.

This can be demonstrated through the example of Angola which has opened electricity trading with the DR Congo (Mbala: 2005). The DR Congo supplies electricity to one Angola city. There is also the case in South Africa where the end of apartheid meant an opportunity for the South African Government to sign bilateral contracts in terms of power trading with others.

The political and economic stability in the DRC should allow the construction of a larger hydropower capacity of 100 000 MW. This will be one of the lowest-priced electric energy outlets in Africa. The DRC electricity sector has experienced several problems since the democratic process began in 1990 (SNEL, 2000:12). The country has a huge potential for electricity generation in hydropower. There is a guarantee from the government and various donors to develop the biggest hydropower plant in Africa, at Inga.

The main goal, to manage energy supply and demand has to achieve a healthy stability of electricity generation and distribution in each country of the SADC. It has been disclosed in a SAPP 2005 report that most countries in the region suffered shortage of energy capacity. This demonstrates a lack of effective planning in most SADC countries. Effective planning should facilitate an increase in power generation, but this has not been forthcoming.

The supplies of electricity in the selected countries differ vastly in terms of generation capacity. The biggest producer in this sub region is South Africa, with a generation capacity of 43 018 MW with different types of power generation (NERSA, 2003:12). Following an analysis, the generation capacity of South Africa has been flat without the construction of any new power plants for 15 years. In 2007, the countries have begun to face new problems in terms of the management of power.

It means that when there is economic growth, each country should be prepared for effective planning in terms of the supply and demand. When the security of supply for South Africa was analysed, it disclosed the government and Eskom should have planned a new power plant six years ago in accordance with the International Energy Agency (IEA, 2002:14).

In 2007, there is no new power plant in place to resolve the energy crisis within South Africa. Because of a lack of planning and management at government level, the electricity situation within South Africa has now become a major problem. This experience goes to show the advisability for any government to have an effective management plan regarding the electricity security within the country.

In Zimbabwe, where there is currently substantial political and economic instability, the energy situation is even more problematic because 41% of their electricity is imported (ZESA, 2001:4). The Zimbabwean Government has been unable to solve the problem of poor service delivery within the electricity sector. This problem is however, a microcosm of the political and economic instability. There is a possibility that the Zimbabwe Government might resolve the electricity crisis in future, but this will depend mostly on stabilisation of the economy and the political situation.

4.3.1 Problem of supply in the three countries

Every government has a responsibility to ensure that energy demand and supply remains stable. When the supply of electricity is unstable the economy is threatened. This chapter has attempted to analyse the role of government in the three countries of this study. Each government regulates and plans the management of supply and demand of electricity. In each country the electricity sector is controlled by a state company, which means the three electricity companies have a national monopoly in the sector. However, it does not mean that all three countries supply electricity in the same manner.

There is a vast difference in terms of the service delivery of power supply and demand. The World Bank (1997:45) has reported that an efficient government was an important factor for the provision of effective services and the rules and institutions that allowed markets to flourish and people to lead healthier, happier lives. It was observed that the suppliers of electricity in the three countries were mainly in the large cities. However, service delivery differs vastly from one country to another. From an energy analysis point of view, South Africa has the most accessible electricity in the region having increased to 72% of the population nationwide (DME; 2006:2). Demand for energy in South Africa is growing year on year mainly because the country's economy has grown rapidly for the last 14 years. The critical problem for South Africa relies mostly in the security of supply. It is in this area where there is a lack of co-ordination to resolve the immediate problem of energy demand.

Fulfilling demand in the other two countries (DR Congo and Zimbabwe) remains problematic. Their governments have promised to deliver by supplying electricity to all communities, but deficiencies remain.

In the case of South Africa, there is sufficient capacity, however, by 2007 and 2008, the country is expected to encounter demand problems. During late 2005 and the first quarter of 2006, systematic electricity supply shortages began to surface in certain provinces. The government therefore, made provision for the construction of new power plants.

The problem observed in the South African electricity sector was that for the past 15 years no new constructions of power plants had taken place in South Africa.

On 16 February 2006, after the presentation of the national budget, the National Energy Regulator of South Africa declared an increase in electricity tariffs by 5.1% for 2006,and that in 2007 the electricity again increased by 6% and will rise by 14% in 2008 (NERSA:2006). NERSA allowed the increase in tariffs to assist the national utility to raise funds for the construction new generating capacity. It was also observed that Eskom was reaching its peak. The South African government is looking at a possibility to build a larger electricity capacity to solve the electricity within the country.

Zimbabwe's electricity sector faced a problem in regard to the demand and supply. A large demand for electricity, primarily from residential areas (59%), followed by industry (18%), agriculture (13%), commerce (7%) and that mining sector with 3% (ZESA; 2000b:8). The supply capacity of the Zimbabwe electricity industry was insufficient to satisfy internal demand. The Zimbabwean Government does plan to build a power plant, but faces severe economic constraints.

For five years the Zimbabwean government has also faced the problem of payment. When there is no payment, supplies from other countries cease. As a result, the importation of electricity from (Mozambique, South Africa, DR Congo and Zambia) neighbouring countries remained problematic because of the nation's economic situation.

The supply of electricity in the DRC is also problematic because of the failure of many of the operational hydropower and thermal plants to operate at full capacity. The generation of electricity within the DRC is only 50% of the total installed capacity. Demand is low because of the closure of most of the mining companies in the Katanga Province. According to SNEL's annual report (2005:15), the technical problems in the various generating plants (in 2005 to 2007 there is a lack of maintenance and spare parts) limits the national utility ability to produce to its full capacity and, therefore, to respond to demand.

The DRC government plans to refurbish Inga 1 and Inga 2 with the assistance of the World Bank (Journal Le Potential, 2006:1).

4.3.2 Risk Relating to the Problem of Supply

The shortage of power within any country could have a negative response from investors. At this point, this situation could be illustrated by the cancellation of investments in South Africa. The Business Times (2006:1) has stated international investors cancelled negotiations with the South African Government for future investments in South Africa because of the ongoing power crisis within the country.

The cancellation of investment from a Russian company came after the power failures of the Koeberg nuclear power station in the Western Cape. The consequence of investors retreating from negotiations with the South Africa government was because of a lack of energy security in terms of supply within the country. The same situation also applies to other countries on the African continent.

4.4 Government strategies in terms of security of supply

Policy decisions on the security of supply in the electricity sector are imperative for any modern economy. The SADC countries are part of a global economy which should also be considered a factor in increasing the power generating capacity within the region. The increase of power generating capacity in the region will need such a policy, which has implications for the transformation of the electricity sector. Furthermore, the EU (2005:10) argues that, currently, whilst there have been calls for the governments to make public their policies regarding security of supply there is no need for a uniform generation adequacy approach. When the SADC countries were evaluated, security of supply was still problematic as most were seen as being too weak to implement policy.

All three countries in this study are experiencing some difficulties in satisfying domestic demand. It was observed from the governments' strategies in these countries that they were too weak in terms of policy applicability of new infrastructure, to satisfy the demand. However, government strategies differ from one country to another. Each government gives a priority to the electricity sector. For example for the DRC government the main concern was refurbishment of the different hydro plants across the country.

International experience shows the government should monitor input fuel diversity and estimate the extent to which the security of supply is insured by the market. If remedial action is needed, measures at economy-wide or energy market level are potentially more effective (IEA, 2004:15).

The government's role is also to assess the capacity of supply, which should respond to future demands. In the SADC countries, there is large potential capacity, which could be developed. The IEA (2002:40) reported that the local self-sufficiency goal should be dismissed. However, where interconnections are congested or system dispatch occurs at regional levels, a consideration of reserves in particular areas, might still be necessary.

There is a large potential for electricity generation in the SADC countries. The governments of the region should collaborate to sustain the problem of supply in the region. All three countries within this study are trying to resolve their internal electricity capacity. There are projects which can be applied for the region, but, this does not seen to be a priority.

The EU experience shows government plays a substantial role in determining the framework for investment and monitoring (IEA, 2002:37). In this context, the government could prevent any problem which might arise in the electricity sector.

There is also the possibility for a government to set a clear policy for the security of supply and demand before any problem arises within the industry. It was demonstrated that there are other roles governments can take, and which are occasionally adopted. This includes setting above market standards for the security of supply, promoting investment through capacity payment, setting price caps, promoting technology choices for power generation and subsidising investment, in particular, technologies (IEA, 2002:15).

In this study little of this European experience could be applied in these three countries. There is a need for the countries to apply a strong policy concerning planning and forecasting procedure which should provide information to a senior policy maker. This could be a means for different governments to prevent problems which could arise in the future. This might also help in terms of investment in the electricity industry.

The problem facing most of these countries is that their entire investment policy is decided by central governments. There are no foreign investments which focus on the electricity sector in these countries in terms of the construction of new power plants and yet the IEA (1999:85) observes that the strained public resources cannot cope with looming electricity capacity needs, especially in developing countries where increases in demands are the greatest.

4.4.1 Government Role on Investment

This study has revealed that the electricity sector still controlled by the central government. Private sector participation in the electricity industry is limited in the region. The investment in electricity capacity in these countries is therefore discussed at government level. Senior policy makers have discussed a possibility for implementation of new infrastructure but there is no private sector involvement to suggest the construction of new power plants. This decision is taken by the central government in collaboration with its national utility. the IEA (1999: 15) said that ensuring sufficient investments in electricity supply was part of the larger issue of ensuring adequate energy investments in general. This statement was presented during a G 8 ministerial meeting in Moscow on 1 April 1998. The case in most developed countries is different, since in most such nations the electricity sector was already liberalised.

In addition, investments regarding the electricity sector are decided primarily by private companies who supply electricity to consumers. To some extent, the possibility of countries raising sufficient capital for their energy investment should depend on regulatory policies. This, in turn, crucially affects the rate of economic growth and living standards in those countries (IEA, 1999:16).

In the case of this study, governments decide for any investments in the electricity sector. The economic situation on each country plays a major role regarding the investment of new infrastructure within the electricity sector. Another aspect, to be taken into consideration, was political stability, crucial for a government to decide on investments in a particular sector.

Before any investment in a power sector, government should debate the type of fuel to be used for the new plant. Regarding the case of this study there is a different fuel used in each of the SADC countries. The type of fuel will help the government decide what type of plants should be built. However, the fuel type will not be a discussion point for this research. It is mentioned only to demonstrate to the reader of the kind of factors governments should consider before taking any decision concerning the investment in a new power plant.

4.4.2 Repower Old Plants

There are also other possibilities government could use instead of investing in new plants. Governments could refurbish old facilities to increase effectiveness. This also minimises the use of investment capital. The EIA (1999:31) defines repowering as the replacement of a significant portion of the plant to improve its performance and reduce costs. Old facilities are typically dispatched infrequently because of high marginal operating costs, or operational constraints. This technique has already been applied in Zimbabwe to one of their thermal power plants. The performance of that plant was poor compared to a new coal power plant. The South African Government also want to repower old thermal power plants to respond to demands for electricity.

The problem is to review the performance of those mothballed thermal plants. It is argued that the repowering of old plants can sometimes provide new capacity at lower cost and, in this manner, take advantage of existing investments in infrastructure, staff and fuel supply (IEA:1999). Concerning the case of South

Africa, the government had already planned construction of new infrastructure power plants in different provinces, specifically in the Eastern Cape and Western Cape Province (DME; 2006:1). The Western Cape Province began to face major problems with electricity demand. The South African government has already budgeted the construction of new electricity plant. The problem was when they would be operational, as in 2007 there has been no sign of any construction.

In terms of repowering old hydropower and thermal plants, the DRC government has already applied for a loan from the World Bank to refurbish different power plants. According to Maggs (2006:64), this could change, with plans afoot to implement the regional and domestic power market development project. There is a $ 450 million initiative that will include a $ 200 million investment to rehabilitate the facilities at Inga in order to boost its operational capacity from 1350 MW. Moreover, the process of refurbishment is under development in collaboration with World Bank.

As there is a lack of maintenance and a shortage of spare parts from the Congolese national utility, and real demand from local customers and industries within the DRC, the government has begun to consider a possibility of responding to that demand. Repowering would assist the DRC government to increase capacity.

This potentially opens the door to foreign investment. It appears that international investors prefer to buy an existing plant, even one that is unprofitable. This is a new strategy for investors who want to invest in the energy sector, particularly in developing countries, where political and economic stability was considered a major problem. This is because there is less risk for investment and the capital costs are reduced. The investor refurbishes the plants and increases capacity. Such a strategy is good for the host government and for the investors.

The IEA (1999:68) argued that investment in the electricity sector offered a range of socio-economic benefits for the region and also for the countries that invested. The benefits include job creation, increases in tax revenue, competitiveness, and in the infrastructure. There was also a transfer of modern technology and managerial techniques, improved efficiency and an ability to relocate government spending. Should the SADC countries in this study apply this strategy it could provide the means to resolve management of supply and demand within the region. It was also stated by the IEA that the projection of electricity investment needs depends, to a large extent, on the projection of supply and demand (IEA: 1999). The best strategy for the SADC region is to focus on the economic growth of each country.

When there was uncertainty in economic growth it was difficult to have strong management in terms of security of supply and demand as observed by the situation in Zimbabwe. In this region, a better management of supply and demand in the electricity sector will be determined by the economic growth for each particular country.

4.5 Summary

The problem of the management of energy supply and demand for the three SADC countries under study should be viewed firstly in terms of political and economic stability. The stability of a country played a major role in the management of supply and demand of electricity. Governments should make sure that there was sufficient electricity capacity to satisfy demand.

The observation that emerges from this chapter is that most of these countries do not have sound planning in terms of security of supply. When there was economic growth, the supply of electricity should grow. Even though economic improvement had been observed in South Africa, there was no evidence of good planning for the supply and demand of electricity.

In the next chapter a SWOT analysis of the selected electricity companies will be presented. This analysis will clarify the problem each selected country face within the electricity company.

CHAPTER 5. SWOT ANALYSIS OF SELECTED ELECTRICITY COMPANIES OF THE SADC

5.1 Introduction

The previous chapter analysed the creation of the SAPP and its rationale to ensure sufficient electricity capacity across the region. It was observed that political and economic stability played a major role in electricity generation. This chapter analyses and builds on this by applying SWOT analysis techniques to each selected electricity company. The analysis was evaluated through personal interviews conducted in the Democratic Republic of Congo, South Africa and Zimbabwe. A representation from SAPP was also interviewed.

5.2 Evaluation techniques

The SWOT analysis techniques were applied to primary data collected through personal interviews with senior executives in the Ministry of Energy and Electricity companies, (DRC and Zimbabwe). In South Africa the senior manager at Eskom referred the researcher to their annual report, but it did not provide the data required. Professor Trevor Gaunt, the Head of the Department of Electrical Engineering at University of Cape Town's Faculty of Engineering, was approached since he had participated in a number of research projects at Eskom (September,2006:1). The reason for the approach adopted was to understand the situation within each company. This evaluation also provides data on the differences in performance and the circumstances within each electricity company.

There are different methods of evaluation techniques in management, including cost benefit analyses, value chain analysis, resource-based views and SWOT analysis, which was used, to translate Strengths, Weaknesses, Opportunities and Threats (Pearce and Robinson, 1999:168).

According to Pearce and Robinson (1999:170), SWOT analysis is an easy technique through which managers creates a quick overview of a company's strategic situation. It is based on the assumption that an effective strategy derives from a sound fit between a firm's internal capabilities ("strengths and weakness") and external situation ("opportunity and threats"). This technique is the best, because the decision maker or policy maker could use it to change the vision of company.

Management application of this technique was based on an analysis of the internal and external factors influencing a company. The evaluation techniques within these three utilities and SAPP differ, but some of the elements would arise in each electricity companies in each country. Furthermore, based on this analysis, the researcher could be in a position to compare the strengths and weaknesses of each company.

It is argued by Ehlers and Lazenby (2004:62) that it was not only an organisation's ability to transform that would make it successful but also managers ability to view an organisation as a bundle of resources, capabilities and core competencies to be used to create an exclusive position in the market. This could mean one organisation may have access to resources and management capabilities other organisations did not have. With these resources, one particular organisation may have the capacity to satisfy the demands of the external environment that another did not.

5.3 SWOT Analysis of SNEL

Face-to-face interviews took place in November 2005 with a director from the DRC electricity sector (SNEL) as well as the director in charge of the department of electricity in the Ministry of Energy in Kinshasa. This granted an opportunity to understand the problems at SNEL. During the interviews, with Mr Mbala directed the researcher to consult SNEL, annual reports, which helped the researcher to understand the crisis that the electricity company faced. The evaluation technique for SNEL was based on the internal strengths and weaknesses of the company, as well as opportunity and threats facing it from the external environment. According to Pearce and Robinson (1999:159), a SWOT framework provides an organised basis for insightful discussion and information sharing, which could improve quality of choice and decisions, which managers subsequently made.

Based on the above factors, a better understanding of SNEL was assessed for future improvement of the company. Tables 5.1 and 5.2 show the internal and external factors, which affect the electricity company.

Table 5. 1: Internal utility factors of SNEL

Strengths	Weakness
• National monopoly in distribution • Public enterprise • Leadership and management skills • Exports electricity within SADC and other countries • 15 hydropower plants across the country • 33 thermal plants • Numbers of trained engineers • Infrastructure still in good condition.	• Weak organisational structure • Weak finance and poor cash flaw • Weak revenue on tariffs • Low number of customers • Staff not motivated • Lack of spare parts • Excessive debt with international institutions • Difficulty to pay salaries • Lack internal funding for investments • Political interference on tariffs • Lots of technical engineers going abroad (brain drain)

Source: Personal interview with Mr Mbala senior director at SNEL: 2005

5.3.1 Strengths of SNEL

Primary data collected during this investigation indicated the electricity company in the DRC still had positive factors which may be beneficial for the country. The utility has the national monopoly in the distribution of electricity within the country which places the national utility in a strong position in terms of electricity distribution in the DRC.

According to Mutombo (interview: 2005) senior government official from the Ministry of Energy and SNEL, the company is under government control, which ensures SNEL's responsibility to distribute to customers nationwide. In addition, the government had appointed senior directors capable of managing the national utility. It was reported during interviews that there were competent leadership and management skills at SNEL.

SNEL is a major exporter of electricity to other countries in the central African region and to southern African countries. The export of power to seven countries on the African continent indicates the utility is in a strong position in terms of power trading.

Cross-border electricity trading with other countries allowed the local utility to increase profits for both itself and the national treasury (interview with Mutombo; 2005:1).

It was also argued by Mbala (interview: 2005), that another element, which characterised the strength of the DRC electricity sector, was its mix of power generation. The country had two different types of electricity generation hydropower and thermal generation. On the one hand, the largest capacity within the country was from its hydro plants, which represented 95% of electricity produced, and which was only a fraction of the country's potential. On the other hand, there were thermal plants in some provinces with limited capacity. It was also disclosed during the interviews that the electricity company possessed a number of trained engineers. Most were trained outside the country and had extensive experience working for an electricity company. This helped the utility to ensure some of the hydropower and thermal plants were running today. In addition, SNEL maintained electricity infrastructure in fairly good order, although some plants require refurbishment (interview with Mbala: 2005).

5.3.2 Weaknesses of SNEL

Simply presenting the strengths of SNEL does not mean that the utility is a viable entity. For 35 years, the national utility has suffered from a negative cash flow. SNEL recognises in its 2005 annual report (2005:19) that the financial performance of the utility was not good due to a lower number of customers around the country. For example, there were only 276 431 (0, 03%) domestic customers in Kinshasa, (a city of 8 million inhabitants), with access to electricity (SNEL; 2005:12).

For the past 10 years the sale of electricity in MW within the country was low. In 2003 SNEL sold 64% of electricity produced and in 2004 the utility sold 63%, owing to its poor performance of its electrification programme (SNEL; 2005:15). According to SNEL's database, less than 10% of the population has access to electricity.

In addition, SNEL (2005:30) says that there are also losses of electricity on the distribution side. From 2000 to 2005, SNEL recorded more than 30% of its electricity had been lost in distribution.

In 2004, the company recorded a loss of 41% and in 2003 a loss of 37.4% was recorded (SNEL, 2005:30). Although there is a possibility for re-establishing the national utility by meeting international, technical and commercial requirements, this should be done by a responsible government, avoiding political interference.

During the interviews with Mr Mbala (interview: 2005) director of transmission at SNEL blamed the low tariffs for the failure. In that the tariffs of electricity did not reflect the cost of production. In addition, consumers find it difficult to pay electricity bills, which adversely affected the company's income. The financial problems of the firm de-motivated many of the staff. Table 5.2 shows the external utility factors, which influence SNEL.

Table5. 2: External factors influencing SNEL

Opportunities	**Threats**
• New hydropower plants • Electrify many households • Possibility for investment in electricity sector • Possibility to implement public - private partnerships	• Privatisation of the company • Fear of new competitors • Possible civil war may disturb electricity generation and distribution • Political situation of the country

Source: Interview with Mr Mbala (SNEL: 2005) and Mr Mutombo director at (Ministry of energy 2005)

5.3.3 Opportunities for SNEL

According to the chief executive officer, Mr Alphonse Muyumba (2005:1) opportunities in the DRC's electricity sector are a major factor in the development of the economy. There are several possibilities for the construction of new hydropower plants at different sites, which would increase capacity and double the export of electricity to other countries. The electrification programme within the country should also increase. The electrification of households remained a major challenge facing for SNEL and the government.

New investment in the electricity sector could bring opportunities for the transfer of new technologies to the electricity sector. Since several sites are still operating on the basis of old technology. This provides an opportunity for Public Private Partnership (PPP), the new DRC government to introduce PPP for the rehabilitation of different hydropower and thermal plants. It would be positive for the new government to realise that PPP would not mean privatisation of government assets (Muyumba: 2005).

5.3.4 Threats to SNEL

According to SNEL (2005:6) a significant element, considered as a threat, is the political situation in the country. Civil war was a negative factor for those running the electricity company. The rebellion which lasted from 1998 until 2001 did not assist the national utility in terms of generation. Over that period SNEL could not recover all its internal revenues. Financial control of the company could not be conducted properly as other provinces could not report to head office. Some provinces could also not access electricity because of the war. Although the situation has stabilised, the history of political instability and its future possibility remains a major threat.

5. 4 SWOT Analysis of ZESA

A personal interview was conducted in Harare on 21 August 2006 with Munodawafa, the Director of Power in the Ministry of Energy and Power, while a study-group discussion in 2006 with (Dr Chidzonga, Magombo and Machimbzofa) was held with the Zimbabwean Regulator Commission which provided the basis of the SWOT analysis in ZESA. The opinion raised by senior government officials provides insight into the critical problems faced by the Electricity Company of Zimbabwe. An economic policy review by the Zimbabwe Reserve Bank in 2006 highlighted the difficulties of the electricity sector. Currently, ZESA faces a financial crisis which places the utility in an untenable position. Unbundling ZESA would not help the company become more effective. Instead, the company has increased its internal and external debts. Table 5.3 presents the strengths and weaknesses of ZESA, while Table 5.4 shows the opportunities and threats to the company.

Table 5. 3: Internal utility factors of ZESA

Strengths	Weaknesses
• Strategic geographical position in SAPP grid • Public Enterprise • Strong transmission grid • Exports electricity only during off-peak in South Africa and Namibia • Generation mix • National monopoly • Competent employees • Good infrastructure	• Low tariff structure • Old plants need refurbishment • Technology out of date • Inadequate generation • Bad cash flow • Lack of financial resources • Lack of spare parts • Brain drain

Source: Munodawafa, Beta, Dihwa, Magombo, Chidzonga and Machimbidzofa (ZESA, ZERC and Ministry of Power: 2006)

5.4.1 Strengths of ZESA

It was argued by Beta and Dihwa (interview: 2006) that Zimbabwe's electricity supply authority is experiencing a critical situation since the company operates at only 50% of its capacity. Considering the strength factors of ZESA, the utility is located in a strategic position regarding the transmission of electricity in the region. The Southern African Power Pool is located in Harare, which allows ZESA to buy electricity from the power pool. Another important fact is that ZESA is a public enterprise. This helped the utility to survive and avoid closure. It was disclosed ZESA had a strong network system in the region, which justified the location of the SAPP Co-ordination Centre in Harare (interview with Beta and Dihwa: 2006).

Following the above argument, Beta and Dihwa (interview: 2006) revealed that ZESA did not just import power from other SADC countries, but also exported electricity to South Africa and Namibia during off-peak periods, which allowed the utility to earn foreign currency. In addition, the utility had a strong position in terms of power generation. There was mixed generation within the country; in the north, ZESA had hydropower at Kariba, which it shared with Zambia, whilst in the south, electricity was generated by using coal. The generation mix placed ZESA in a strong position, as they did not rely on one type of fuel for generation.

According to the ZESA annual report (2005:5) the electricity company is a public enterprise entity, with a national monopoly in electricity generation, transmission and distribution.
The company is operated by a competent technical staff who had been trained abroad. The electricity infrastructure remained in good condition, ZESA tries to generate between 700 to 1200 MW daily, but peak time demand was about 2200.

5.4.2 Weaknesses of ZESA

According to Munodawafa (interview: 2006) the deficiency of power in the national utility has a negative effect on the Zimbabwean economy and reflects negatively on the effectiveness of other sectors within the economy. In the same context Munodawafa (interview: 2006) revealed that, ZESA's debt stood at millions of US dollars. ZESA, as a national utility, owes money to banks, and other creditors outside the country. Government officials expected, the national utility to recover. The company is pleading with its government to review the electricity tariffs structure, which could help ZESA to pay its debts and try to refurbish other plants. Currently, the tariffs charged by ZESA do not correspond to the cost of electricity obtained from outside the country. The government has decided ZESA should charge local consumers lower tariffs than the cost of electricity. This statement was confirmed by Chidzonga, Machimbidzofa and Magombo during the discussion group with regulator. The financial situation was one of major concern for the utility. This situation impacted on a group of employees who were moving abroad. The brain drain has also affected the electricity company. There was a need for a fresh solution in the short term, before the Zimbabwe electricity sector could collapse (interview with Munodawafa: 2006).

The interview with Beta and Dihwa at ZESA (2006) revealed that there is only one coal powered station, which operates at low capacity. Hwange Power Station has an installed capacity of 740 MW only produceed 300 MW per day. Three small coal plants, in Harare, Bulawayo and Sanyati, have been shut down because of coal shortages. A senior manager at ZESA indicated some electricity generation plants in Zimbabwe continued to use old technology. There was need for change in ZESA in terms of introducing new technology to increase capacity. Table 5.4 highlights the external factors, which influence ZESA.

Table 5. 4: External factors of ZESA

Opportunities	Threats
• Expansion of transmission • Buying electricity from other utilities in SADC • Exploit other energy resources • Maximise geographical location to sell to SAPP • Need refurbishment for the existing infrastructure • Public private partnerships	• Political situation of the country • Privatisation of the utility • Power shortage • Economic embargo • Short rainy season leading to empty dawns.

Source: Interview with Beta and Dihwa, senior director at ZESA (2006)

5.4.3 Opportunities for ZESA

After analysing the internal factors in ZESA, there are still some opportunities that the company could use to change its future direction. Munodawafa (interview: 2006) revealed that ZESA has an opportunity to expand its transmission network into other countries such as Malawi. A government decision to expand the network could assist ZESA to export electricity to Malawi. The expansion of the transmission network would also be affected within the country, particularly in remote areas. In addition, there is the opportunity for ZESA to continue to buy electricity from other SADC countries although this does not guaranty stability to the electricity problem in the Zimbabwean economy.

According to a government official in the Ministry of Energy and Power, there were other opportunities for it to collaborate with ZESA to exploit other energy resources. There was a feasibility study for a local company in Bulawayo to extract uranium in order to develop the generation of electricity via the electricity route. There was also another study aimed at using biogas to generate electricity. This suggests that the Zimbabwean Government therefore does not only focus on using two types of fuel (hydro and coal) to generate electricity. But recognises that there are other resources that could be used to produce electricity (interview with Munodawafa: 2006).

Beta and Dihwa (interview: 2006) states that the government uses the strategic position of ZESA to sell electricity to the SAPP. Income growth in selling electricity into the SAPP could help finance the refurbishment of ZESA's plants. Without such refurbishments it would be difficult for ZESA to sell electricity to the SAPP on a continuing basis.

According to Munodawafa (interview: 2006) the Zimbabwean government has evaluated opportunities to develop electricity infrastructure under the present economic situation by utilising PPPs, which offer an avenue to fund major public sector capital projects. ZESA and the Ministry of Energy and Power have implemented a PPP model with a Chinese company to build a new power plant, which might had contribute to solving the energy crisis in Zimbabwe.

5.4.4 Threats to ZESA

The Reserve Bank of Zimbabwe annual report (2006:26) revealed that the economic embargo on Zimbabwe has had an unfavourable impact on the electricity sector and the economy in general. The economic embargo posed major threats to ZESA, because there had been little meaningful capital injection. Furthermore, the utility's problem was associated with the operation of old equipment. Refurbishment could be made to different coal power plants in Harare, Bulawayo and other towns. The shutting down of these different power plants was a major threat to ZESA and the country.

The internal political situation within the country was also a threat, which did not favour ZESA as a public enterprise company. The political decisions of the central government did not allow the electricity company to charge consumers correct and viable electricity tariffs. This is why the chairperson of ZESA wanted the government, in collaboration with the Zimbabwe Electricity Commission, to approve a cost-effective tariff regime for the parastatal. Without applying this policy the political situation remained a threat to transformation of the utility. It was observed that drought had also played an unfavourable role. As Zimbabwe is a water-scares nation. It has numerous seasonal rivers, particularly for hydropower plants, which depend on an abundant supply of water. The current drought threatened to cause a shortage of power generated at hydropower plants (interview with Beta and Dihwa: 2006).

According to Munodawafa (interview: 2006) the climatic situation of Zimbabwe was thus a threat for ZESA because a shortage of rain implied a shortage of power. The government was not talking about privatising ZESA, but this could happen if the government decided to privatise the electricity sector. At this stage, there was a need for an injection of capital within the company, which would solve the crisis in ZESA.

5.5 SWOT analysis of Eskom

The analysis of Eskom is based primarily on an interview conducted with the Head of the Electrical Engineering Department professor Trevor Gaunt, at the University of Cape Town who is also a senior consultant to Eskom. His involvement was at the recommendation of Eskom's senior manager in its department of marketing and trading who was unwilling to answer many of the questions posed and directed the researcher to consult the company's annual report. Nothing relevant to this research was found in the annual report, however, the Head of Department of Electrical Engineering at the University of Cape Town, obliged. Table 5.5 presents the internal factors at Eskom and Table 5.6 present the external factors, which affect Eskom.

Table 5. 5: Internal utility factors

Strengths	Weaknesses
• Range of power stations • Good understanding of cost of electricity • 30 years optimization of dispatch • Good staff and good software to analyse electricity problems	• Hedging plants • Demand of electricity is increasing every year internally

Source: Personal interview with Professor Trevor Gaunt (2006)

5.5.1 Strengths of Eskom

According to Gaunt (interview: 2006) the reason why South Africa is one of the largest generators of electricity on the African continent is its self-sustainable policy dating from the apartheid regime. Before the democratisation of this country in 1994, the apartheid regime built many coal power plants because of an abundant supply of coal. It has been argued that Eskom overspent on the provision of too much generation capacity in the 1980s when more than 30 coal power stations were built across the country to generate electricity. This argument, in 2007, cannot be accepted because Eskom's capacity has responded to the needs of the national economy. Also, Eskom is the leading utility that exports electricity to neighbouring countries (Boeije and Mkube, 2003:48).

In addition, Professor Gaunt (interview: 2006) said that there was a nuclear energy plant, which generated 7% of the country's electricity capacity. There were also other types of power generation including a small number of hydropower plants, gas plants and pump-storage. It was argued by professor Gaunt (interview: 2006) that another strong factor in Eskom's favour is that the company understands the costing of electricity well, compared to other utilities in this region. The tariffs at Eskom are among the cheapest in the world and compare favourably with other developed countries.

According to professor Gaunt (interview: 2006) the company has applied corporate governance with a strong management team, which understands the electricity market within and outside the country. In addition, the company has effective software packages to manage electricity demand. Furthermore, the South African electricity company (Eskom) has developed a strategy to start investing in other African countries and to implement some partnerships with other utilities. This utility is well managed and has applied a competent management strategy to expand Eskom beyond South Africa's border.

5.5.2 Weaknesses of Eskom

According to Professor Gaunt (interview: 2006), Eskom's generating capacity has reached its limit. As a result of the recent economic growth and the governments policy of electrification to previously un-serviced communities there has been an annual growing local demand for electricity. The South African Government has realised Eskom could face a shortage of electricity. Table 5.6 presents the external factors, affecting Eskom.

Table 5. 6: External Factors of Eskom

Opportunities	Threats
Possible growth into power trading with SADC member Invest elsewhere	Requirement to meet Kyoto protocol relating to emission for coal-based electricity generation. Possible decrease of electricity capacity.

Source: interview with professor Gaunt (2006)

5.5.3 Opportunities for Eskom

There is growing demand for electricity among different members within the SADC providing opportunity for Eskom to increase its electricity trading with other countries. Eskom supplies electricity to many countries bordering South Africa, as some do not generate sufficient electricity. The South African electricity company has taken advantage of this opportunity to increase exports to those countries. Furthermore, Eskom is considering constructing additional coal power plants to boost capacity. Eskom has also invested in other countries such as the DR Congo and Mozambique (interview with professor Gaunt: 2006).

5.5.4 Eskom Pollution Threats

Professor Gaunt (interview: 2006) said that Eskom electricity generation is based on coal, which makes Eskom one of the biggest polluters through emissions in Africa. It has been observed the increase of CO_2 emissions internally grow annually by 2% because of increasing energy demand.

According to IEA (1996:117), about 97.5% of South Africa CO_2 emissions are estimated to be from electricity production and consumption. Key sources of CO_2 in the energy sector are power generation (53% of total CO_2 emissions) particularly at Eskom's power plants. The South African government is struggling to meet the Kyoto Protocol requirements, although some electricity generation in other SADC countries use clean hydropower to generate electricity. Therefore, without changing from coal fired plants, CO_2 pollution will continue to rise in South Africa, and within the region.

5.6 SWOT analysis of the SAPP

A SWOT analysis relating to the SAPP is to evaluate the pool itself in terms of daily activities. The analysis for SAPP is based on the simple analysis of the activities of the co-ordination centre. During a visit to the Co-ordination Centre in Harare in August 2006, the head of management could not answer questions relating to a SWOT analysis of the power pool. The reason was that staff believed they were protecting their position. It was therefore, difficult for the researcher to establish the challenges facing the co-ordination centre in the region. Consequently the researcher had to rely on analysis of different annual reports from previous years to extract the following findings (interview with Musaba: 2006).

Table5. 7: Internal factors of SAPP

Strengths	Weaknesses
• Strategic position in the sub region • Good relationship with different utilities • Generate foreign currency for the utility • New model for trading electricity	• Shortage of electricity capacity • Few utilities are trading electricity • Network problems

Source: SAPP annual report: 1999, 2000, 2002, 2004 and 2005.

5.6.1 Strengths of the SAPP

According to the SAPP annual report (2004:4) the geographical position of Zimbabwe makes it suitable for the head office of the power pool to be in Harare. The co-ordination centre should be in a position to inform others of anything arising during electricity transmission. It was also noted the trading of electricity within the power pool depended on the trust among utilities. Most companies trading electricity through the SAPP began to generate foreign currency, more particularly US dollars. This business opportunity had helped the electricity companies participating in the pool to generate further income for the local utility. In addition (SAPP, 2005:13) states that, since the pool was established, there has been a new model developed for the sale of electricity. Today, electricity companies in this region trade electricity on the short-term energy market. There existed a possibility for another type of model which will be introduced in the pool by 2007, the new model called a day ahead market (SAPP, 2005:13).

5.6.2 Weaknesses of the SAPP

According to other SAPP annual reports (2002, 2004, 2005 and 2006), one weakness of the power pool in this region was the shortage of power. Most electricity trading was undertaken through a bilateral co-operation, which covered 90% of electricity traded in the region. It was also argued by SAPP (2006:10) a shortage of electricity prevented some countries from trading their electricity at the SAPP. The pool thus experienced a limited number of countries able to trade. Other elements, to be taken into consideration were some power plants and hydropower's' were being rehabilitated. This situation further limited the power pool to trade electricity. Network problems, for example grid failure in some countries, could weaken the trade of electricity for a longer period (SAPP; 2005:16).

Table 5. 8: External factors of SAPP

Opportunities	Threats
• Increase capacity in different countries • Bring in private partners	• ZESA economic situation is a problem to the SAPP

Source: SAPP annual reports: 2000, 2004 and 2005.

In the above context, SAPP (2006:5) reported that another case, which occurred in 2006 in the Katanga province of the DRC, was the transmission network collapsed because of vandalism, including the theft of 1800m of copper cable. This situation disturbed electricity trade between DRC, Zimbabwe and South Africa for more than two weeks. Table 5.8.1 presents the external factors, affecting the SAPP.

5.6.3 Opportunities of the SAPP

Musaba (interview: 2006) said that there is an opportunity to increase the trade in electricity among member countries, which could be improved by each increasing capacity. The construction of new hydropower plants, especially in countries containing many rivers, could boost the capacity of power in the SAPP. Other countries could use other types of fuel, such as gas, for the construction of electricity plants. The larger range of fuel types to generate electricity in the region would increase the capacity of energy trade. SAPP (2006:5) argues that another opportunity the SAPP was trying to encourage among its members was to bring on board private partners. The participation of private partners in the electricity sector in each country could be a solution to help increase capacity at the SAPP. This could include co-generation.

5.6.4 Threats to the SAPP

Beta and Dihwa (interview: 2006) the economic situation at ZESA could be a threat to SAPP because the utilities operate under financial constraint. This could result in ZESA not being able to carry out proper maintenance on the network. This situation is linked to the SAPP because the power pool is based in Harare. The pool used the ZESA network to transfer electricity trade in the region. The condition at ZESA is subject to the political and economic situation within the country. For example, any disturbance in the ZESA network could result in an interruption of electricity, arriving from Zambia and the DRC.

From the SWOT analysis it was observed that each company should make an effort to improve its own efficiency. The dissimilarity noted in this analysis suggests each government had a priority to implement a strong policy, which could help the public enterprise to reduce weaknesses. Without change or improvement, the threats and weaknesses for each public enterprise suggested a strong possibility that the region could in the future face some difficulties in power trading.

5.7 Summary

The SWOT analyses reported in this chapter prove there is a problem, which should be solved among different companies. Each observation highlights a need for responsible government to implement a strong policy for improvements at each utility. It shows the electricity sector in the DRC has a lot to do to transform the industry. The changes within SNEL could be undertaken in partnership. The motivation of employees will play a major role if any transformation should be successful in the electricity sector.

The situation in ZESA requires a strong commitment from Zimbabwean government to change the financial crisis within the ZESA and to allow the local utility to have cost reflective tariffs. Without government willingness, the electricity sector may collapse in the future. However, there is still hope from the government to assist the ZESA to operate effectively.

Considering the analysis of Eskom in South Africa, more should be done to increase the capacity of electricity to respond to future demands. The mix of different types of fuels will assist Eskom to generate more electricity in the future.

The evaluation regarding the SAPP will improve when most countries reduce their bilateral trade. The participation of private partners within the pool could be another element which members might consider. The analysis of different companies in this study will need a positive answer from the elected government. It shows that an already problem exists in each utility investigated in the research. The literature shows there is a possibility for each government to resolve the problem in the SWOT analyses.

The solution for this SWOT analysis in the selected countries could be a funding method. The private sector could become one of the partners government could consult to change the electricity problem within different countries.

Chapter Six will explore a funding mechanism the selected countries could use to transform the electricity sector.

CHAPTER 6. FUNDING THE ELECTRICITY SECTOR IN THE SADC

6.1 Introduction

The previous chapter discussed the SWOT analysis of the selected electricity companies of the study. A number of problems such as lack of the electricity within the country, and limited power plants that are generating electricity, were found during the analyses. Based on the different founding within each utility the study decided to suggest a funding method. This method of investment could help solve the problems within the electricity sector in the region and elsewhere in Africa. The suggestion of this funding mechanism is because of lack of funding in selected countries such as DRC and Zimbabwe. This mechanism is not new in the developed countries, but in the region this financial mechanism is new for many. The importance of this chapter is to analyse the benefits of PPPs in the electricity sector and to evaluate their importance in the Southern African Power Pool, particularly in the selected countries in this research.

There are many countries in the region facing the difficulty in supplying sufficient electricity internally. The implication of PPPs in the electricity sector in this region could be a positive solution for local power generation. The World Bank (2004:6) recognises the fact that the private sector can deliver efficient investments and improved services, and provided the correct business incentives and legal and regulatory arrangements were put in place in order to attract investment.

Private investment within the electricity sector in the developing countries peaked in 1997 and subsequently weakened to less than one sixth of the peak level (World Bank:2004). The World Bank also observed most electricity companies in the SADC region remained under government control. Private participation in the electricity sector was limited because most governments controlled the electricity sector. Zhang and Kumaraswamy (2001:351) argued there was a worldwide trend toward PPPs in government infrastructure development, which aimed to produce greater efficiency and synergy, increased benefit and reduced deficit, quicker market development, faster foreign investment in the country and permitted competition.

The relevance of the PPP model in present governments was to avoid market failure and government failure. Market failure meant incapacity or inefficiency and inequities in the distribution of market outcomes. This required government intervention through legal and other regulatory means.

On the other hand, government failure in terms of slow and ineffective decision making, derived externalities, unworkable organisational and institutional framework, lack of competition, monopoly, allocated inefficiency and dysfunction between output and payment, provides a rationale for private involvement (Walsh, 1995:5). Following the same argument, Miller, Garvin, Ibbs and Mahoney (2000:1) proceeded to list particular public and private strengths in this regard correctly formulated PPP could provide more efficient outcomes than in the public or private sectors alone.

This chapter highlights the impact a PPP model can bring to the electricity sector in the SADC region and to show governments the state gained by inviting the private sector on board. Today, there were no PPP models, applied to the electricity sector among the countries of this study. The analysis of this model could be important for any SADC government which would want to use PPP as a new tool for investment in the electricity sector.

Before explaining the model of PPP's in the electricity sector globally, it was important to define what PPP actually implied. Two definitions are addressed in this research. The first definition is that of the South African Government, which stems from the national treasury and a second, from the EU. The reason for choosing South Africa was there was no other country in the region with an established PPP framework.

6.1.1 South African National Treasury definitions

According to the National Treasury (2004:10), PPPs refer to a commercial transaction between an institution and the private sector in terms of which the private sector performs function a on behalf of the institution and/ or acquires the use of state property for its own commercial purpose and assumes substantial financial, technical and operational risks in connection with the performance of the institutional function and or use of state property. It receives benefits for the performance of the institutional function or from utilising the state property, either by way of:

(a) Consideration to be paid by the institution, which derives from revenue funds, or where the institution is a national government business enterprise or a provincial government business enterprise, from revenues such as institution;

or

(b) Charges or fees to be collected by the private party from users or customers of services provided to them; or a combination of such consideration and such charges or fees. This is the national treasury's definition in terms of PPPs in South Africa (National Treasury; 2004:11).

6.1.2 The European Union definition of PPP

According to an EU Green Paper (2004:3), the terms of the PPPs are not defined at community level. In general, the terms referred to a form of co-operation between public authorities and the world of business, aiming to ensure the funding, construction, renovation, management or maintenance of an infrastructure, or the provision of a service. The following elements normally characterise PPPs:

- The relatively long duration of the relationship, involving co-operation between the public partner and the private partners on different aspects of a planned project; and
- The method of funding the project, in part from the private sector, sometimes by means of complex arrangements between various players. Nonetheless, public funds, in some cases rather substantial, may be added to the private funds (EU Green Paper; 2004:3).

These two definitions differ. It was important for the study to define PPPs in other contexts. PPPs also mean a participation of a private sector undertaking a project on behalf of a government during a specific period. After completion, the government may retain the asset. Mostly, the contract between the host country and private investors could take between 10 and 30 years before a government could take over the asset from the private investors (Seader, 2004:2).

6.1.3 Different PPP projects

According to Panteleo, Rwelamila, Chege, Tjiamogale and Manchidi (2003:313) the case of South Africa, there were already PPP projects within different sectors. Local municipalities began to introduce PPPs. In the above situation had been tested in the construction industry in South Africa, for example, the construction of the National 1 and National 2 roads, as well as the building of a prison in the Free State province. There were also some PPP projects in water distribution and waste collection in provinces such as the Eastern Cape and KwaZulu Natal. The example of South Africa is to demonstrate there is probability for PPP and that it could be applicable in the electricity sector.

According to Panteleo Panteleo, Rwelamila, Chege, Tjiamogale and Manchidi (2003:313), the infrastructure backlog within the municipal sectors in South Africa, which includes upgrading, maintenance and rehabilitation, cannot be funded from the taxpayer. PPPs may, be considered as a possible solution to the problem. Partnerships with private investors could not only bring money, but also new technology to the country. Also, the necessity of a PPP was to improve the industrial sector development around the country.

In 2006, a number of governments cannot successfully deliver services such as water distribution, telecommunications, electricity and other infrastructure. Private companies are, enabled to do a number of service delivery on behalf of the government. "PPP appears today to be much more than a simple budget tool, but rather a real instrument for co-development, and an operational contribution to socio-economic growth in general. When project conceived from the outset, PPPs optimise the satisfaction of the three fundamental actors involved, namely the state, public authority, citizens and private operators" (SEFFI: 2001:4).

The above argument can be related to the applicability of the PPP project in the Eastern Cape where the council could not deliver water to the community. It signed a contract with a private company to supply water to communities. According to Niekerk, Ruiter, Mcwabeni, Kruger and Grinker (1999:55), it seems clear that the successful application of PPPs demands a relatively high level of administrative capacity from the structure which assumes overall contractual control of the process.

The implication of bringing PPPs into this region may have positive and negative impacts on the energy sector. On the one hand the presence of PPPs would bring competition into the energy sector within the country. This was a positive element concerning the development of industry and the expansion of infrastructure in this region.

On the other hand, the participation of PPPs in the SADC region could assist the different governments to invite the private sector to enter the power market, specifically, where there were problems concerning power generation. From the available data, all the selected countries in this study face problems in terms of power capacity. The involvement of a PPP model in the electricity sector could increase the capacity of power in the SADC.

There is also an analysis of PPP in the electricity sector globally which provides different views. Roger (1999:2) argues investment in electricity projects with PPPs whish total led about $ 2billion in 1990 peaked at about $ 46billion in 1997 before declining sharply to $ 27billion in 1998. During that time the electricity sector claimed 36% of cumulative assets for new infrastructures. Melissa and Tynan (2000:8) argue that most investments were in Latin America and Asian countries with few investments in the sub-Saharan countries. In addition, reported on PPPs in the infrastructure in low-income countries (LIC). The proportion of countries with at least one project was 81% higher among low-income than middle–income countries (MIC). As in developed countries, most of the investments were in telecommunications or energy projects (Melissa and Tynan; 2000:8).

The review of different infrastructure projects in LIC was also reviewed by Izaguire (2000:2) who explained 79 developing countries introduced PPPs in electricity sectors, accounting for $199billion in investment flow, which was 29% of the total investments. In Africa, each zone received 3%, in North Africa and the Middle East, and also sub-Saharan Africa, which received 3% of private participation in electricity. For example, sub-Saharan Africa amounted to $ 18billion for PPPs in energy infrastructure. Following the same argument, another analysis for sub-Saharan Africa, developed by Izaguire (2001:2), argued that, sub-Saharan Africa was the only region where private activity grew. Investment flows rose from $ 3.4billion in 2000 to $4.6billion in 2001, almost reaching the all-time high of $ 4.8billion in 1997. Most of this investment appeared to be focused only in the energy sector.

An examination completed by Izaguire of the World Bank did not specify the countries where private investments were allocated. Contrary to North African countries, investments dropped from $ 4.1billion in 2000 to $2.1billion in 2001 (Izaguire; 2002:2). The following year, in 2002, the situation differed as in the private participation in the infrastructure (PPI) in sub-Saharan African, since some investments collapsed. According to Izaguire (2002:3), in sub-Saharan Africa, investment flows fell, but only to $ 3.5 billion, as the third highest level for the region between 1990 and 2001. Most investments went to export the oriented gas pipeline between Mozambique and South Africa and to network the expansion of mobile operators. The energy company that invested in the gas pipeline was a South African company, namely Sasol Limited. The exploitation of gas in Mozambique by Sasol has a life expectancy of 25 years. Figure 6.1 presents the distribution of Public Private Infrastructure (PPI) in sub-Saharan Africa.

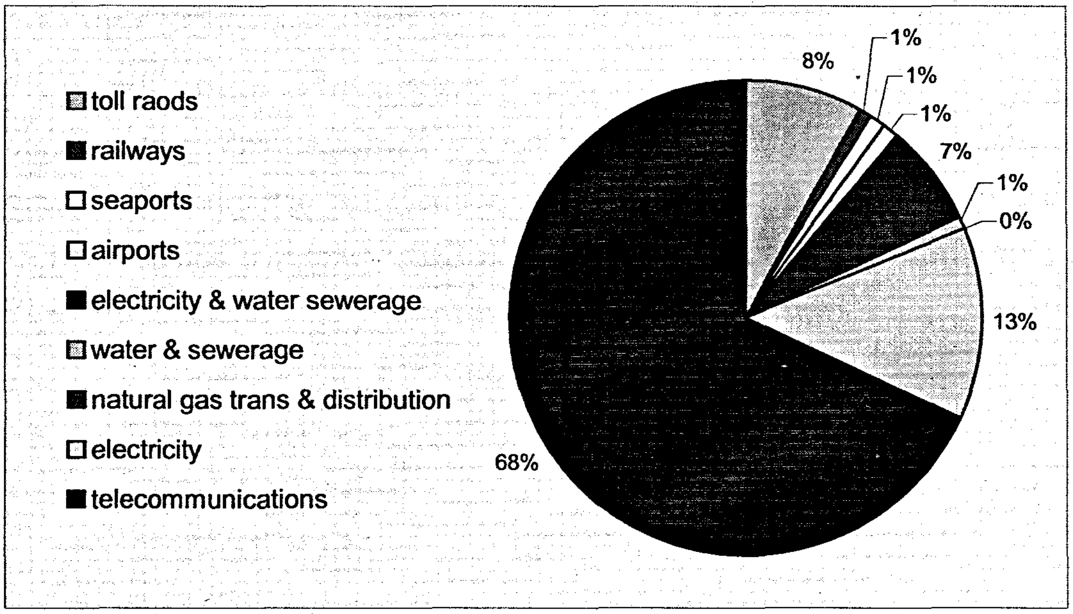

Figure 6. 1: PPI project on the African continent
(World Bank: 2001)

According to Figure 6.1, 22 countries in Sub-Saharan Africa introduced private participation in the electricity sector from 1990 to 2001. Most of these countries awarded 29 stand-alone electricity projects, as well as seven multi-utilities which involved electricity and water services (World Bank, 2001:2). It has been demonstrated energy sectors stand in second position in terms of private participation in sub-Saharan Africa from 1990 to 2001. In 1999 and 2000, private participation in energy infrastructure decreased, but the situation changed in 2001.

According to Izaguire (2002:4) PPI, in energy, took several different forms in sub-Saharan Africa. For example, vertically integrated electricity companies went to the private sector through concessions in six countries (Cameroon, Comoros, Gabon, Guinea, Guinea-Bissau and Mali), through divestitures in Cape Verde and Senegal, and through management or lease contracts in Chad, Namibia, Sao Tome and Principe. It demonstrated PPIs were much more involved in French-speaking countries within Africa.

6.2 Characteristics of PPPs

There are different characteristics to be taken into consideration for any PPP project. These characteristics are not uniform to all countries worldwide, because each government has its own reality.
Other countries may have different specifications in order for any PPP project to be implemented. These characteristic are:

- The importance of the services;
- commercial viability;
- value for money;
- innovation; and
- replication.

6.2.1 Significance of the services

According to Lewis (2000:2), a PPP project will be seen to contribute to the implementation of the functions of government or a public enterprise and to be an extension of services provided by a local authority. In this context, the government would evaluate benefits brought by private sector to the community. In terms of the electricity sector, the government will ensure the distribution of electricity was implemented in accordance with government policy.

6.2.2 Commercial viability

In terms of commercial viability the PPP project will convince a government that it had the potential to be viable and that the appropriate resources and management structures were in place to ensure the project could be delivered (Lewis, 2000:4). Government will evaluate the private company for its capacity to be able to implement the project. The project will then be awarded to the best candidate in the private sector.

6.2.3 Value for money

The project might offer good value for money, otherwise no private investor will want to invest. The project will offer the local authorities an opportunity to carry out its functions in a cost-effective manner through generating revenue or achieving cost saving. The proposal should demonstrate how value for money would be achieved, taking into account estimated costs, benefits and risks involved in undertaking the project (Lewis, 2000:4).

6.2.4 Innovation

According to Hardcastle, Akintoye, Silva, Melhado and Edwards (2005:9) the company bring new technology to the fore with the government in order to make a difference. For example, in the electricity sector, PPP models might introduce new technology in terms of power generation, such as a gas power plant. Each project should offer an innovative approach, which could assist the host government.

6.2.5 Replication

In the context of the above Hardcastle et al (2005:9) argue that the successful projects might attract attention from other countries. If a project was easily applied, there was a possibility for that project to receive funding from elsewhere. A successful construction of a hydropower plant in the DRC through private investment might lead to the same company to construct it elsewhere in the region. In addition, there were different PPP models around the world, to consider; however in this study, one model will be discussed.

6.3 PPP Models

There are different types of PPP models for which governments could apply to rehabilitate hydropower and thermal plants. It would be good for governments to realise PPPs did not mean a privatisation of government assets. Instead, PPPs sustain government budgeting to upgrade or rehabilitate power plants. Seader (2004:4) argues that, rather, partnership refers to an entire spectrum of relationships where private sector resources are used in the delivery of services or facilities for public use. The private sector could support the national utility to provide one or more of the following options:

- Project initiation and planning;
- designing a new project ;
- financing ;

- construction;
- ownership;
- operation; and
- revenue collection.

This chapter proposes to examine one PPP model which is a new project. The model, to be analysed, is Build Operate Transfer (BOT). The importance of BOT has already been applied to electricity sectors of different countries. However, BOT has not yet been applied to energy projects in the SADC region. As was discussed in Chapter three of this research, most governments control their energy sectors. There was a national monopoly in electricity sectors in the region of the selected countries of this study. To emphasise the role of PPPs was to evaluate the impact the private sector brought to the electricity sector in the region.

6.3.1 New Projects

There are different models for the new project:

- Build-Transfer (BT);
- Build-Lease-Transfer (BLT);
- Build-Operate-Transfer (BOT), and
- Build-Own-Operate-Transfer (BOOT).

The government should choose which model was suitable for the rehabilitation of the power plants. Furthermore, the importance of this research to apply the BOT model, should be appropriate in respect of the construction of new power, as well as for the refurbishment of old plants. The research analyses the impact of the BOT model in the electricity sector and any disadvantages this model may face. The research will also analyse the risk of BOT to the host country.

This PPP model gave a government a possibility or decision to turn over development and initial operation of what would typically be a public sector project to one which is private. Seader (2004:5) says the private sector contractor or a consortium of contractors finances a project, accomplishes the construction and operates the new facility for a specified length of time, after which it is expected to transfer ownership to the government, mostly at no cost. The prospective transfer to the host government happened by the end of the contract.

For example, the DRC government could use the BOT model to build a third phase of Inga. The BOT model was mostly advisable for different governments because it provided the host country with several options. They include:

- A capacity to reduce capital costs while still implementing a project at a time when it would not be able to provide the requisite funds, or could look to use its funds for other projects; and
- A chance to encourage outside investment and to introduce new or improved technology (Seader, 2004:5).

6.3.2 Build Operate Transfer

The role of public-private sector partners under the BOT contract is designed to bring private investment into the construction of new infrastructure plants. Under a BOT, the private sector financed built and operated a new infrastructure facility or system according to performance standards set by the government (Bennett, Peter and Brad, 1999: 2). In terms of a BOT, Shalakany (1996:174) argued the granting of a concession by the host government to a private company, was known as the concessionaire, and was responsible for financing, construction, operation and maintenance of the facility over the concession period, before transferring the fully operational facility to the government at no cost.

Moreover, the control of operations under a private company was long enough to realise a benefit, which spanned typically 10 to 25 years. When the contract expired the government became the owner of the infrastructure facilities and the regulator of the services (World Bank, 2001). Most of the BOT investment requires sizeable financial investment. Most governments prefer to use BOT for the construction of a specific infrastructure such as a new electricity power plant, tall road, prison, or water plant. Table 6.1 highlights different agreements in BOT projects for power supply contracts.

Table 6. 1: Different agreements in BOT in case of power plant projects

Number	Parties of agreement	Agreement description
1	Host government	Concession agreement
2	Project company	Investment agreement
3	Constructions contractors	Construction contract
4	Bank and lending institutions	Financing agreement
5	Equipment manufacturer	Supply agreement
6	Operator	Operating agreement
7	Developer	Power supply contract

Source: Journal of Management in Engineering (Askar and Gab-Allah, 2002:174)

The experience shows that BOT agreements tended to reduce market and credit risk for the private sector because the government was the only customer, thus reducing the risk associated with insufficient demand and an ability to pay. A number of private sector partners would avoid BOT arrangements where a government was unwilling to provide assurances the private sector investment would be paid back (Bennett, Peter and Brad, 1999:3). This model was used in different developing countries to build new infrastructure. The best example may be in a number of the French-speaking countries in sub-Saharan Africa.

In the above context, according to Bennett, Peter and Brad (1999: 4), BOT had weaknesses, which generally involved only one facility and limiting the private sector's ability to help optimise system-wide resources or efficiencies. BOTs can, however, provide a platform for increasing local capacity to operate infrastructure facilities. However, there was also a positive aspect of BOT, which provided incentive efficiency, since the companies needed to compete in order to win the contract. In addition, there were other BOT experiences around the world.

Comparable situations abroad show Asian governments have had difficulties to finance infrastructure projects, although they have encouraged private investors to invest in their countries. Robert and Anderson (2003:226) argue that, within the electricity sector, the typical cost of building a new power plant was about $1million per megawatt. It was prohibitive to finance a new 1000 MW power station, especially in cases where the public sector is subject to tight credit constraints as with state level governments in India or national treasuries such as in Vietnam or Pakistan (Robert and Anderson: 2003).

The same situation as explained above was found in other countries such as Thailand, Indonesia and the Philippines, which experienced economic growth in the 1980s. Most PPP projects in Asian countries were build own operate; build own transfer or an operating concession for a fixed period. Furthermore, SEFI (2001:12) argued that PPPs could be used for new projects and rehabilitation or maintenance projects. For example, the case of PPP projects in India was introduced for the construction of network transmission lines.

The Energy Information Administration (EIA, 2003:1) says India's power sector holds great potential for private sector participation and that this transmission project has been the first such endeavour in the developing countries of Asia in recent years. Its successful implementation under a public-private partnerships framework is likely to provide a model to attract much-needed private investments in the transmission network and could be further replicated in India and abroad. According to EIA (2003:1) the implementation of PPPs in India's energy sector came about through of a lack of adequate investment and a shortage of power supply. The electricity demand is projected to increase by a further 54% during the Ninth Plan Period, necessitating an increase to generate capacity by about 65% in order to meet additional demand.

The introduction of PPPs in the energy sector in selected countries in the SADC can be necessary because it may be the only way to provide the new energy infrastructure necessary to meet the demand of future development. Another reason is PPPs have the facility to bring foreign investment to a country. The government could benefit in terms of saving money, which could then be invested in new infrastructure. Another element to be learned for the interest of the SADC region was by analysing the importance of BOT in selected countries, showed that there was the possibility for the transfer of new technology in the energy sector in terms of power generation(interview with Munodawafa:2006).

6.3.2.1 Advantages and Disadvantages of BOT

The advantage of this model is to show how the host government in the SADC region could benefit. This model may not the best in the world, but it can assist government to implement new infrastructure for power plants without using national treasury savings. According to Askar and Gab-Allah (2002:174), the BOT approach can finance infrastructure projects and has many potential advantages. Example are:

- Technology transfer, training of local personnel, and the development of national capital markets (examples of other substantial benefits of BOT projects);
- The utilisation of private financing provides new sources of capital, which thus reduces public loans from the World Bank, IMF and improves the host government's credit rating;
- The allocation of project risk and the burden to the private sector that would otherwise have to be undertaken by the public sector; and
- In contrast to privatisation, the government's preservation of strategic control over the project, this is transferred back at the end of the contractual period (Askar and Gab-Allah, 2002:174).

Having described the advantages of BOT, there are also a number of disadvantages to this model. Tiong (1996:207) demonstrates that BOT projects could face problems and risk. Numbers of problems concern the promoters, but if it is taken into consideration that contractors and suppliers were shareholders and promoters, then the problems of BOT are also problems that face contractors, suppliers, and the promoter. The following are the difficulties of the BOT project:

- Lack of consistency and poor governmental management;
- unclear government criteria for project award;
- legal constraints in applying evaluation criteria; and
- problems of contract drafting.

The majority of these disadvantages occurred when a government did not have experience with BOT. In developing countries, especially in the sub-Saharan region, governments did not have strong managerial experience to deal with such a project. In order to avoid a problem, governments could hire an expert consultant to advise them on any BOT project within the country.

6.3.2.2 Government's role in BOT

The lack of public funds from governments to sponsor construction of new infrastructure projects (power plants) and the rehabilitation of existing facilities, coupled with the increased demands for capital from traditional alternative sources (example World Bank, International Monetary Fund, and Club de Paris), has contributed to the creation of alternative forms of project delivery (Zayed and Chang, 2002:7). The example of the new alternative model was BOT and other types of PPP models. Because of the increasing demand for public infrastructures and a shortage of public funds, many governments requested the private sector to finance some projects. This situation has become one of the best solutions for the construction of new project in each country. The implementation of BOT depended mostly on the legal framework of the country; some private investors sought to invest where there was sufficient risk security for their money (Zayed and Chang, 2002:7).

6.3.2.3 Legal Framework Foundation

The involvement of any company to participate in the project in each country needed a strong legal foundation from the host government. Without a proper policy in place, it became difficult for a BOT project to be implemented in that particular country. This is what was observed in South Africa, where the government had already established a legal document for any PPP. According to Zhang and Kumaraswamy (2001;356), the intention of a private company to participate in public concession infrastructure projects, depended mostly on the legal environment of the host country. A strong and good legislative framework provides a sound foundation for PPPs, upon which developers can structure a contractual vehicle compatible with the country's laws. Many countries had a general PPP law or regulation, or at least an official guideline; for example, the South African government's guidelines on PPPs.

6.3.2.4 Political Stability

The political instability of a country could be deterrent discouraging private partners to invest in that country. Political stability was a key element attracting private investors to a country. It gave the host an opportunity to develop a sound platform for investment across the country in different sectors. What the state should do was implement a policy, acceptable to both parties. One side will be the policy maker, which is the government and, on the other hand, would be the private sector. A good policy should bring an improved result when there was strong institution to implement the policy.

A World Bank development report (1997:19) pointed out, "where policy and programs are implemented more efficiently and where citizens and investors have greater certainty about government's future actions. Thus, good policies such as those being pursued more recently by many countries in Latin America and Africa would increase growth in income per capita by around 4% a year". If not, it will be difficult for a government to win investment in the country. Therefore, the state should maintain disciplined policies for economy stability, which would attract investors. It would open trading opportunities with foreign countries, as already experienced by some SADC nations (World Bank development report, 1997:19).

6.3.2.5 Macro Economy Stability

According to SADC MOU on macroeconomic convergence (2003:12) each government should be able to stabilise the economy of its country to allow more credibility to investors, such as in South Africa. Instability in a macro economy cannot improve the quality of services. It will also be difficult for a BOT project to be applied in that kind of environment.

SEFI argues (2001:6) that the aim of governments was to spend less, are one of the reasons for bringing the BOT into the electricity sector. This was the ideology of good governance in most democratic states. The focus was on the question of honesty, transparency, and ethical behaviour in government. This could be the change for the selected countries of the study. Provided they observed those principles. Most of BOT projects around the world take into consideration their stability, which ensured investors got back their investment during the concession period.

6.4 Risks of BOT

There are different risks when applying BOT in the electricity sector. This study chooses to discuss a limited number of these risks. This could be useful for this research in the SADC region. Zayed and Chang (2002:8) argue the classification of possible sources of risk was an essential area in the risk management process because it allowed project parties to identify the existence of uncertainty in the project and, hence, to analyse its potential impact and to consider appropriate strategy to alleviate its effect.

In terms of risk, when governments invite BOT projects, it is because governments prefer all risk rested with the investor. At times government and the private sector, wishing to develop government projects could share the risk. In the study four risks will be discussed:

- Political risk;
- regulatory risk;
- social risk; and
- environmental risk.

6.4.1 Political risk

Politically speaking, most governments should avoid placing any project at risk. However, according to Askar and Gab-Allah (2002:176), the average relative weight of BOT political risk factors were:

- Termination of concession by government: in this kind of situation there was no positive collaboration with the host government. There was the possibility any government could end a project or take over the project from the investors. Political change within the country could also impact negatively, perhaps causing a new government to terminate a contract. This situation could arise when there was evidence of corruption during the tender stage of the project.

- Increase in taxation: according to Shen, Lee and Zhang (1996:320), the Chinese government enforced its comprehensive taxation reform in 1996. As a consequence, new taxes were introduced, such as value added tax, business tax, enterprise income tax, individual income tax, and land value-added tax. The importance of these different taxes bringt investment into the country. However, the change of taxes could cause an investor to withdraw from the project during the negotiation of the project. If the government did not specify the increase in taxes, during project negotiations, other parties might not accept for the changes. This was the reason why this study provided the example of different types of taxes in China.

- Changes in law: changes in a country's law are specific to every country, especially with a change in government. There was a possibility for a government to change the law or to review. This was important for any development project in the country, since the host government should ensure a private partner was protected. For example, in the case of Brazil, Hardcastle et al (2005:9) say the lack flexibility in contracts reinforces the needs of a legal framework, to cope with existing procurement and fiscal law and provide judicial security to investors.

6.4.2 Regulatory Risk

According to Mohan and Kumaraswamy (2001:356) government should be able to establish a regulatory board to protect private investors. When there were no strong regulations in a country, there was a high risk to investors. Regulation frameworks should be improved in different sectors to offer protection for long-terms investors and local consumers.

6.4.3 Social risk

Neubourg and Weigand (2000:19) argue preventative strategies were aimed at avoiding risk by organising economic and social life, since the probability of contingency was reduced. Good governance of the physical environment, for example, macro economic stabilisation policies, sufficient regulation of the market and effective law enforcement were all examples of instruments to be used in that respect. In this context, the importance of the poor community in the BOT project should be emphasised. In many projects the risk was shared mostly between government and the private sector. In other projects the host government transferred most of the risk to the private sector because the host was not involved in the development of the infrastructure. At this level government should ensure also the consumer or the community was protected against investors.The government should establish a policy which protected poor communities especially in terms of having access to electricity provided by the private sector.

6.4.4 Environmental Risk

Environmental problems were a major focus for the development of the energy sector. Many countries considered the protection of the environment for future generations. The construction of new power plants might affect environmental areas which could impact on the removal of people to other areas. According to the IEA (1992:31), the environmental advantages of nuclear and hydropower over fossil fuels, may not be as explicit if broader environmental issues were not included in the analysis. These include safety risks, waste disposal and decommissioning problems in the case of nuclear plants, and questions such as the loss of forests, disruption of bio-systems, soil erosion and the silting of rivers and delta lands in the case of hydropower.

The importance of the argument raised here is to show there was a possibility for any environmental risk during construction of a new facility. The host government and private investors should assess procedures to check if there was no environmental risk. Furthermore, the IEA (1992:163) argued, in addition to this trend, was the fact some of the more pressing environmental problems were no longer local, regional or even national in their impact but had become trans-boundary in nature. In the case of this study, the development of a new electricity facility in the region would benefit not only one country, but also surrounding nations. It was also important to know what new facility's environmental impact could be on a region.

6.5 Significance of the BOT in the Southern African Power Pool

According to the World Bank (2004:4), it is now broadly recognised that pure public financing and provision have failed to adequately support economic and social development. Under the poor standards of governance found in most of the bank's clients, high opportunity costs have been imposed on society. Private investors have shown to be able to deliver efficient cash flow and improve service delivery to customers of the power sector, provided the correct business incentives were in place to attract investment.

A practical answer for these countries, therefore, could be public private partnerships that lie between these options. The involvement of the BOT model in the SAPP will be realised with the transformation of the electricity supply industry in the SADC. Most governments should play a role, opening doors to this kind of joint venture with private partners. Implementing BOT in the electricity sector would not mean a privatisation of government assets. Although a new technique, many developed countries had applied for the construction of new infrastructure in a particular sector of their society.

6.6 Summary

The importance of PPP in the electricity sector in the SADC region has not only important in the selected countries for this research, but for the entire region. The analysis discussed in this chapter shows demonstrated there was much to gain for the host government in using this model. Applying a BOT model to the electricity sector could increase the capacity of energy electricity in the SAPP, as well as encourage power trading. The analysis in this chapter is a proposition made for most of the countries in this region to change the picture of the electricity supply industry. The World Bank's analysis proved that there was a possibility for countries in this research to invite private partners into the electricity sector. A strong point for this argument is a government should be acutely aware of any the problems before discussing so that private parties might be informed.

The involvement of private partners could increase the output capacity in the SAPP. This would also assist the development of power trading in this region.

The next chapter will explain the method the researcher applied to investigate the evaluation of power trading in the selected countries of the SADC.

CHAPTER 7. RESEARCH METHODOLOGY

7.1 Introduction

This chapter explains a research methodology used to examine the evaluation of power trading in the selected countries in the Southern African Power Pool. It then justifies the choice of the case study research methodology before developing the research design which includes the framework. The chapter concludes by defining the boundaries of the case studies and the basis of case study selection. Followed by a discussion of data collection during the conduct of this research.

7.2 Theoretical Context

Scientific theories are necessary for the development of rationales and relational statements. The basic goal of science is to validate theory and to establish scientific validity (Leedy, 1985:27). To emphases that argument, the evidence of this study tests the hypotheses of the research. The focus of the study was based on the evaluation of power trading in selected countries in the SADC. The research was intended to apply the theory of public policy, mostly in the energy sector, for the benefit of different governments. This was confirmed by the research by showing the characteristic of typical public policy research. By undertaking an original problem through collecting and analysing empirical data collected exclusively for the purpose of solving that particular problem.

7.3 Quantitative and Qualitative Research approaches

There is a continuing and evolving debate pertaining to the application of research methods in social science research, which largely revolves around the application of quantitative and qualitative research methods. The words quantitative and qualitative are frequently used to identify different approaches to answering research questions (Paul, 1997:104). The reality is that different questions are present for different types of information. Depending on the types of questions, different research designs and methods will be more or less appropriate.

The need for selecting a quantitative research approach for this study derives from the development of the hypotheses that are subsequently tested. Quantitative studies include a substantial amount of data to provide direction for the research questions or hypotheses (Creswell, 1994: 22). These hypotheses emerged through the literature review. The data collected by using questionnaires or interviews represents the relationship between certain factors in the research domain to evaluate the hypotheses. In addition, statistical analysis of the data was used to produce research findings. In planning a quantitative study, literature is often used to introduce a problem (in the introduction) and the information given helps to compare results to be found in the study.

In contrast, qualitative research is often exploratory; used in an exploration of a subject area in which a limited amount of knowledge only exists. The main purpose is these situations are to collect and analyse data from which new knowledge can be induced. According to Fellows and Liu (1997:42), data collected in qualitative research tends to be complex. This often makes a meticulous analysis of data problematic. As an outcome, the objectivity of such data and analysis is often questioned. Qualitative research is, from time to time referred to as suggestion, which generates research. This derives from the fact that qualitative research often precedes quantitative research.

Qualitative research, in contrast to quantitative research, occurs within natural contexts and focuses attention on the perspectives of such studies (Leedy, 1985:108). Qualitative findings may be so specific and context- bound, that they do not apply in other contexts (Leedy; 1985:108). This research sought to increase the knowledge generated from different data collections from different countries. The experience of power trading was mainly advanced in developed countries. The evaluation of power trading used the methodology of questionnaires, which were applied in the sectors where fieldwork took place. The focus of fieldwork was based on three different governments, electricity companies for the selected countries and SAPP where the trading of electricity took place.

It was found there were weaknesses in the application of quantitative research based on the collection of data from the SADC region in that it was difficult to find all the data desirable for the purpose of this research. Documents were difficult to access because they were government documents. For example, the type of bilateral contract government signed with another country concerning power trading. The DRC government official stated that it would be impossible for the researcher to have a copy of that contract. In addition, there were also a revised document IGMOU and IUMOU for the member state and national utilities. For the success of this study, a triangulation method was used, which is a combination of quantitative and qualitative research.

7.4 Research Strategy

The purpose of using a triangulation method should not be confused with the research strategy in this study. Yin (2003:1) demonstrates a research strategy applied to case studies, which were used in a number of situations to add to knowledge of individual, group and organisation, social, political and other phenomena. There are three different research strategies outlined by Yin, which were considered in this research. These were experimental methods, surveys and case studies. Each of the three strategies encompasses both quantitative and qualitative methods which were then triangulated. Furthermore, for Yin (2003:5) the preference for a particular research strategy depends on the types of questions a researcher asks, the extent of control over the phenomenon under study and whether the phenomenon was historical or contemporary. Yin further states that, such strategies are advantageous when the research goal is to describe the incidence or prevalence of phenomena, or when the research goal is predictive about certain outcomes.

7.5 Case study design

Each form of study uses logic to follow to attend to the main objective of the research. According to Yin (2003:19) research design is the logic that links the data, to be collected, and from which a conclusion may be drawn. Each empirical study has an implicit, if not explicit, research design. Articulating theory about the study helped to operationalise case study designs and make them more explicit

(Yin, 2003:19). The logic in the research is located in the context of power trading in the SADC region but, there were factors to be understood, which it is suspected influences the trading of electricity in the SADC zone.

7.5.1 Research Framework

The research framework allows the researcher to clearly articulate the research aims to be achieved and how it will do this. The research sought to evaluate the potential of power in the SAPP (objective One). The aim of the research was to review the policy mechanism with regard to the participation of the private sector in the energy sector in the SADC (objective Two). The study also assessed the suitability of applying a PPP model in the electricity sector and highlighted the importance PPPs could bring to the energy sector in the region (Objectives Three and Four). This study evaluates the impact of power trading in the selected countries within the SADC, and also design and present a normative model to improve power trading in the SADC (Objective Five and Six). Lastly the study will provide recommendation to make better power trading amongst member states (objective Seven).

The research aimed to evaluate the impact power trading brings to the members of the SAPP. The participation of different methods and techniques, used in this study, contributed to the existing knowledge in the absence of any similar research to have been conducted before concerning evaluation power trading in this region. Through the assessment of the SAPP, the research contributes to long term planning around energy.

7.5.2 Case Study Boundaries

The research is focused on power trading in the SADC, and intended to evaluate the electricity market for the member states. There are 14 member states. This research has limited itself to evaluating the trading of power in three countries of the SADC who have key strategic roles to play in the SAPP and their relevance in terms of trading power within the region. The DRC is an exporter of electricity to SADC member states, whilst South Africa is also a larger exporter of electricity, but was also a larger importer of power.

Zimbabwe also plays a key role in importing electricity in the region and also exported to neighbouring countries.

The evaluation was made through SAPP, the organisation where the entire technical report concerning the sale of power was located, which was designed as a central body to co-ordinate the trading of power in the zone. The SAPP will clarify this research if the countries chosen bought and sold electricity through the power pool, or if their trading was mostly based on bilateral contracts. The data was collected in each ministry of energy for each country chosen for this research. Their respective national electricity companies were chosen for the collection of data and other clarification regarding the trading of power. Those entities represented the key venues, housing the information concerning the trading of power.

The time frame to evaluate the trading of power began when the short-term energy market became operational. The research analysed the trading of power for the past five years. It was also important to know the SAPP had been established for 11 years. It was difficult to conduct research outside the SAPP before this date because of the difficulties of data availability since most governments did not maintain records of power trading from before that time. Whereas the integrity of the SAPP data is relatively sound. And comprehensive, and provides an adequate time frame to identify any trends and articulate the phenomenon understudy.

7.5.3 Case Study Selection

The choice of case studies was a key component for this research design. The research decided to choose a single case study, and divided it into three sections. Each section represents a country where fieldwork took place. The first section was the DRC because the fieldwork began there; then South Africa and finally Zimbabwe and the SAPP. The purpose of single case study was because the trading of power was located in the Southern Africa Power Pool.

The selection of the designated countries provided a set of in-depth, understandings of electricity trading within the region. If the region had two power pools, then the researcher would have had to consider using two case studies. The particular relevance of the SAPP represented a major focal point for the achievement of power evaluation in the SADC.

The case study was chosen to collect information or data by selecting senior public officials from the ministry of energy in each country. The motive behind that decision was that a public official from each government represented the ministry. It was assessed senior public officials implemented government policies and made new recommendations within the ministry. These were the people this research targeted to obtain and collect government information. The problem of power trading was discussed at a high level with each government, hence, the target groups. Each country's electricity company played a major role in providing information concerning trading procedure. Each national utility was aware of procedure set by different countries concerning power trading.

The electricity sectors were better equipped than government officials to explain issues relating to cross-border transmission. In addition, the national utility was the major player for the trading of power, mostly on a cross-border transmission basis. The two parties or entities for each government were able to direct this research. Another reason this study decided to focus on those two types of entities (Ministry of Energy and Electricity Company) was because they had experience in issues concerning power trading. There were no other organisations with such a good understanding of power trading and all the data relating to the trading of power was located with these two classes of entities (Ministry of Energy and Electricity Company).

7.5.4 Data Collection

A number of different research techniques capable of being used for data collection were considered. In the face of various difficulties the researcher decided to use interview and documentations. The researcher applied triangulation techniques or multiple sources of evidence, to achieve the research's objectives.

It is argued by Yin (2003:98) that the most important advantage presented, by using multiple sources of evidence was the development of converging lines of inquiry. Yin (2003) also demonstrated that any finding in a case study was likely to be more convincing and accurate if based on several different sources of information, which followed a corroboratory mode. The applicability of different sources of evidence in this study was to realise the objectivity of the research. In addition, multiple sources of evidence assisted this research as a means to contributing towards scientific knowledge in the area of power trading.

7.5.5 Interview

Interviews are widely accepted tools used to obtain information and this method was used to acquire fieldwork information from senior public officials in the ministry of energy, as well as at electricity companies. The importance interviews in this context were that it created the possibility of direct communication with senior management who dealt with power trading in their respective companies. The direct communication would also provide insights for the researcher in relation to the evaluation of power trading.

The fieldwork was divided into three categories. Each section dealt with one particular category. The same type of questionnaires was given to the ministries in South African, Zimbabwe and to DRC. The researcher had direct communication with all the senior officials. Questionnaires were compiled and administered to senior officials (energy ministry) and to the directors from (SNEL, Eskom, ZESA and SAPP) that were involved in decision making relating to power trading. Most questionnaires were based on a Likert Scale, only few had open-ended questions. The aim of these questionnaires was to give each respondent an opportunity to provide the correct answers, and express opinions or views in relation to the trading of power. (See appendix A for a copy of the questionnaires used).

7.5.6 Documentation

Documentation, relating to power trading in the SADC is classified in different categories. The primary document used for the study to clarify the implementation of power trading was the SAPP report, as well as the SADC's annual report.

Other documents included annual reports from the different electricity companies such as SNEL, and Eskom. These two utilities' reports dealt explicitly with power export to other countries in Southern African countries. These documents provided data on the specific capacity imported by each country. A third document related to the power pool itself. A series of monthly reports on power trading within the pool is provided to members and observers of the power trading, providing updated information.

The monthly reports provide a way to analyse the performance of the different countries in terms of electricity trading in the power pool. In addition, other documentation was sourced on the international experience of power trading. Such documents provided the researcher with the underpinning knowledge on power trading. Other sources such as news and other media had published articles on power trading and other issues, relating to electricity problems in the region. However bilateral documentation generated by governments and utilities was difficult to access or to obtain since access was restricted to those documents by each country and these had to be omitted from the study.

7.6 Summary

The principle aim of the research was to study the evaluation of power trading in this region. Following from this is the aim to develop a detailed understanding of power trading in the SADC region as it has undergone economic transformation and as the demand for energy has grown annually in the region. The study assessed the trends in power trading within the region and evaluated the impact of such power trading on the future.

The researcher applied quantitative and qualitative methods to achieve positive results combining different techniques for the generation of knowledge in this study. The research design chosen was a case study of a power pool in the form of the SAPP where trading of power occurred. The selection of this case study comprised the purposive selection different countries engaged in electricity trading within the pool.

The main sources of data were the different organisations who were engaged in power trading. The fieldwork assisted the researcher to collect empirical data from different countries chosen in this research. Some documents, sensitive to government, could not be provided for this research. The data presented in the research, however, made it possible for the aims and objectives of the study to be achieved.

Chapter Eight focuses on the analyses and discussion of the data collected in the three selected countries of this study. The interpretation of the five years data collected in the SAPP will be analyse.

CHAPTER 8. ANALYSIS AND DISCUSSION OF RESULTS

8.1 Introduction

This chapter presents an analysis of the observations noted during the fieldwork and an analysis of the electricity trade history in the SADC over a five years period starting in January 2002 to December 2006. The fieldwork interviews were conducted in different countries for this study. It is important to emphasise this because this part of the research did not target a large sample of the population. Instead, the ministries of energy in each selected country and the electricity utilities were targeted. Besides the two government entities for each country, another organisation was interviewed, namely the Southern African Power Pool, as the central market for electricity trading in the region. In total, the survey sample comprised of offices of seven entities. Additional interviews were held with the National Energy Regulator of South Africa and the Zimbabwe Electricity Regulator Commission (ZERC). The DRC government does not currently have an independent electricity regulatory body. These two organisations do not export or import electricity in their own right.

The results of the data analysis were divided into two categories, qualitative and quantitative. Qualitative data represented the information collected during the interviews with senior government officials, as well as with the senior managers of electricity companies from the different countries in the study. Quantitative data emerged from five years of electricity trading. This data information process began in January 2002 and ended in December 2006.

The quantitative data was used to project estimates in the terms of electricity trading in the region. During the fieldwork, the researcher used various questionnaires to collect data. The measuring instrument, chosen, used the five point Likert Scale of Response and was employed in discussion with statisticians. According to this method, a person's attitude score is the sum of his individual ratings. The opinion per statement to be tested was rated on a five-point Likert

Scale and was adapted for the dependent variable statements, as follows: (Babbie, 1992:180).

Table 8. 1: response statement

Statement	Reply (code)
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

Source (Babbie, 1992:180)

Other types of questionnaires were open questions, which gave the interviewee an opportunity to explain some of their answers. Other types of questionnaires were used, which required "Yes" or "No" answers. Analyses of the results were divided into two categories. The first category was concerned with the qualitative results of the fieldwork within three different countries, the second category is based on quantitative data collected from the SAPP.

8.2 Qualitative data analysis

The results of the empirical survey conducted in this study do not represent the opinion of each government but represent the opinions of senior public official who responded to the questionnaires in as representatives of their respective ministry of energy and the electricity companies. Those responses were accepted for purpose of this research.

8.2.1 Interview with Government Officials and Senior Executives in Three Electricity Companies

An analysis of these results depends on the accuracy of the answers obtained from each government's Department of Energy and the Electricity Companies in the DRC, Zimbabwe and South Africa, respectively. The data was analysed using the software package SPSS 14 (2005). The results are a reflection of the answers of the respondents. The main questions were:

1. **What is your participation in the SAPP?**

Table 8. 2: Supply capacity in the SAPP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	14.3	20.0	20.0
	Agree	1	14.3	20.0	40.0
	Strongly Agree	3	42.9	60.0	100.0
	Total	5	71.4	100.0	
Missing	System	2	28.6		
Total		7	100.0		

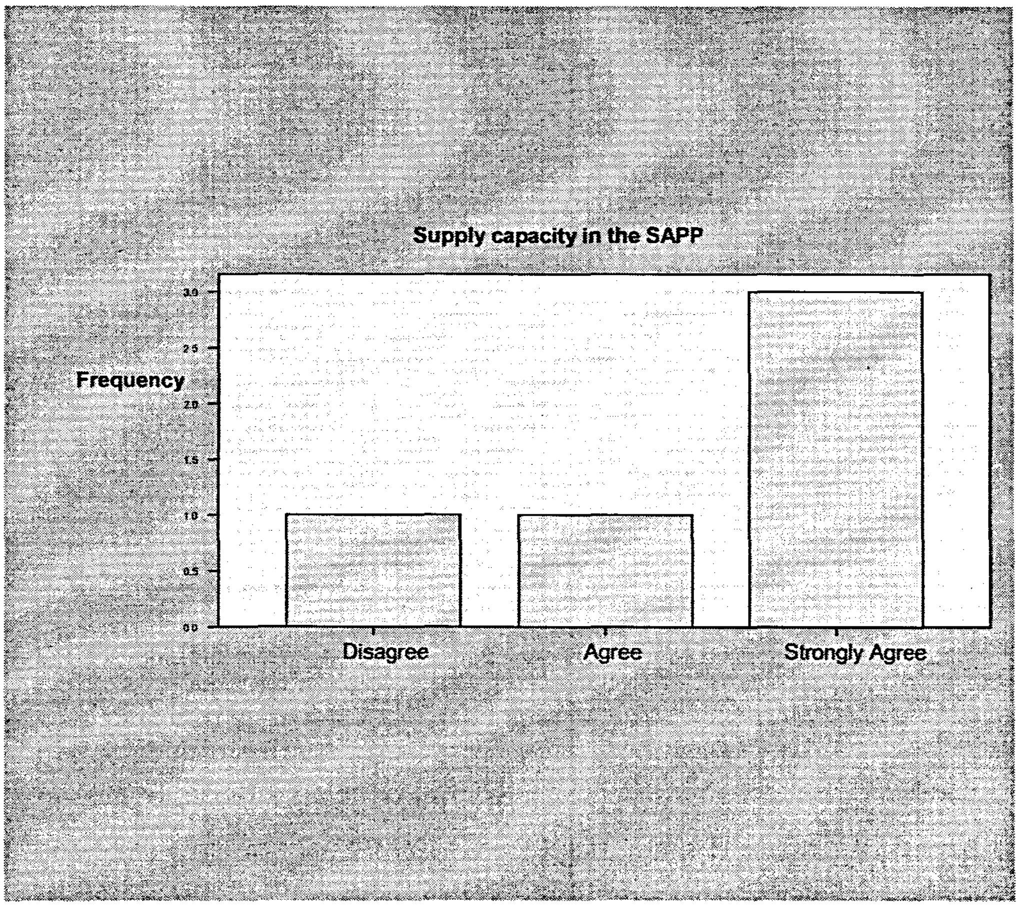

Figure 8. 1: Supply capacity

Table 8.1 and Figure 8.1 represents the views of the countries in the research. It was argued by the DRC government in order to supply capacity in the SAPP, it would be good for the stability of electricity production in the region. The DRC government further commented when one country could not generate electricity, another could supply electricity on trading terms. This was one of the reasons for the establishment of the SAPP in 1995.

Table 8. 3: We do not supply capacity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	50.0	75.0	75.0
	Agree	1	16.7	25.0	100.0
	Total	4	66.7	100.0	
Missing	System	2	33.3	.	
Total		6	100.0		

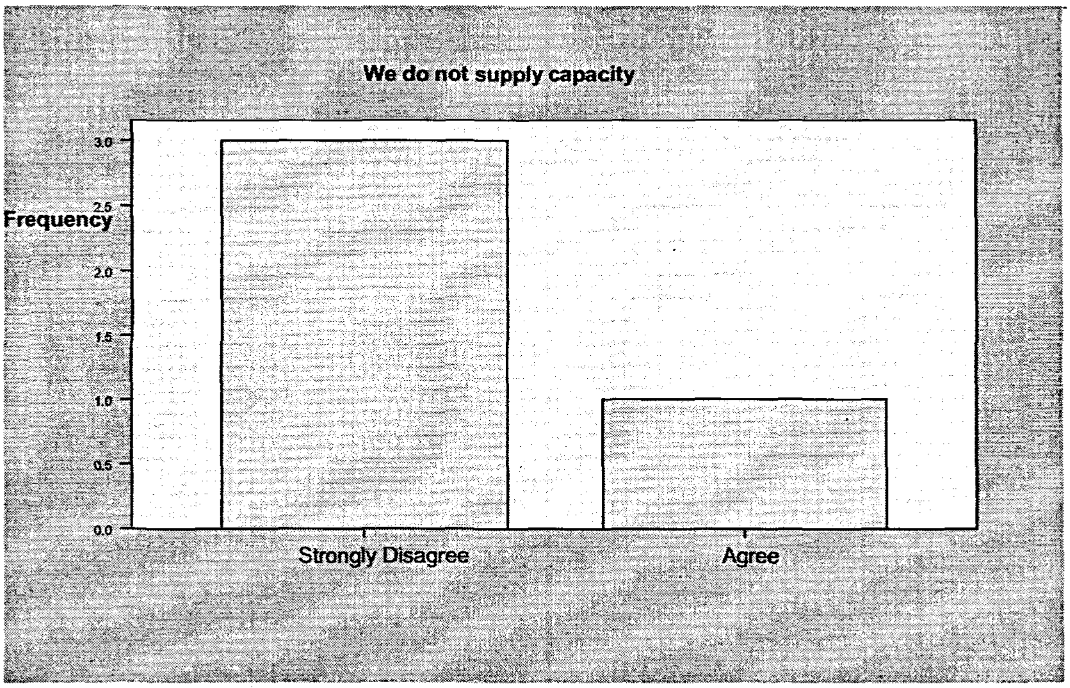

Figure 8. 2: We do not supply capacity

The respondents included ZESA, SNEL and the DRC Ministry of Energy responded as strongly disagreeing (75%). The Ministry of Energy and Power in Zimbabwe agreed with the statement (25%), reflecting the utility's financial constraints. The Department of Minerals and Energy in South Africa and Eskom chose not to respond. The senior executive did not want to respond because of the electricity is a sensitive problem in South Africa.

Table 8. 4: Participation is limited

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	50.0	60.0	60.0
	Agree	1	16.7	20.0	80.0
	Strongly Agree	1	16.7	20.0	100.0
	Total	5	83.3	100.0	
Missing	System	1	16.7		
Total		6	100.0		

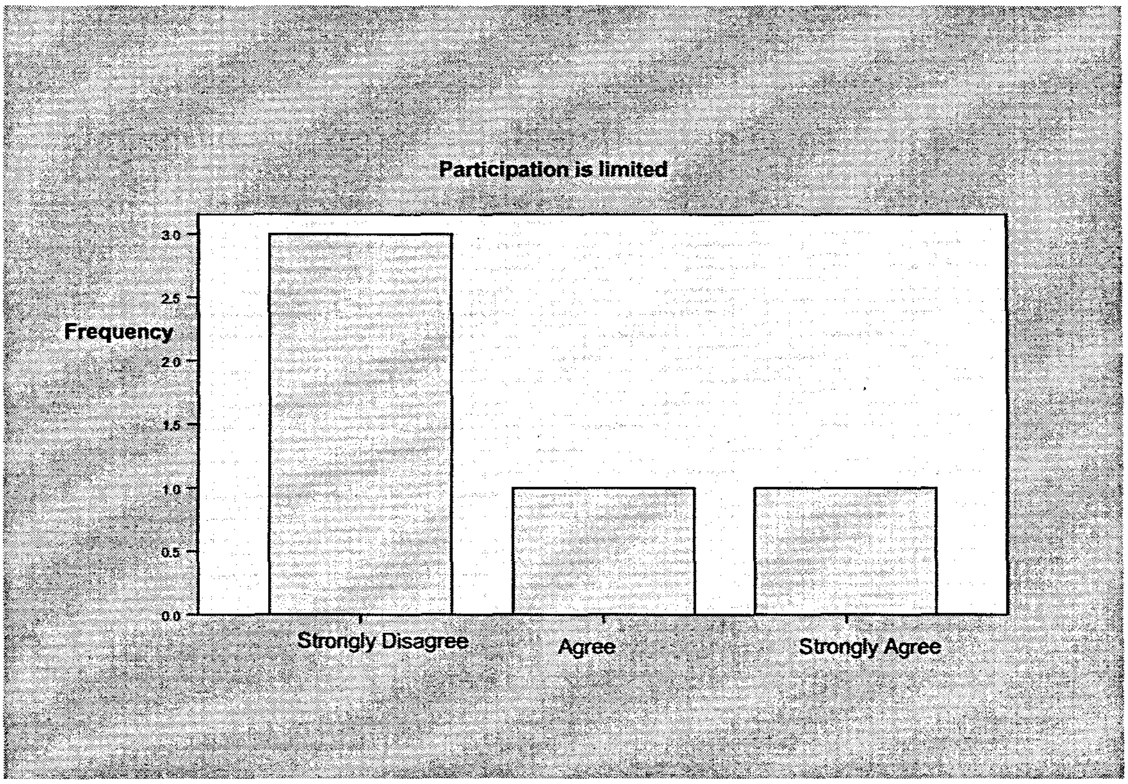

Figure 8. 3: Participation limited

Table 8.4 and Figure 8.3 indicates that ZESA, the Department of Power in Zimbabwe and the Department of Minerals and Energy in South Africa, strongly disagreed (60%) with the above statement. SNEL strongly agreed (20%) that their participation was limited because of internal reasons; the Department of Energy in the DRC agreed (20%) with that statement. The Department of Trade and Marketing at Eskom directed the researcher to consult their annual report, from which no response to the question could be determined.

2. How does your government benefit from the SAPP?

Table 8. 5: Selling electricity to the pool assists in obtaining foreign currency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undecided	1	16.7	16.7	16.7
	Agree	1	16.7	16.7	33.3
	Strongly Agree	4	66.7	66.7	100.0
	Total	6	100.0	100.0	

According to the electricity companies used in this study, all strongly agreed (66.7%) that selling electricity to the pool assisted them to obtain foreign currency for their companies. The DRC and the Zimbabwe Ministry of Power and Energy agreed (16.7%) that selling electricity assisted the utility to obtain foreign currency. The Department of Minerals and Energy in South Africa was undecided (16.7%) with regard to the statement. SNEL's senior executive considered it advantageous for the country to sell electricity to the pool, since it helped each local utility to re-orgarganise and refurbish different power plants.

Table 8. 6: There is no benefit for us

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	4	66.7	66.7	66.7
	Disagree	1	16.7	16.7	83.3
	Agree	1	16.7	16.7	100.0
	Total	6	100.0	100.0	

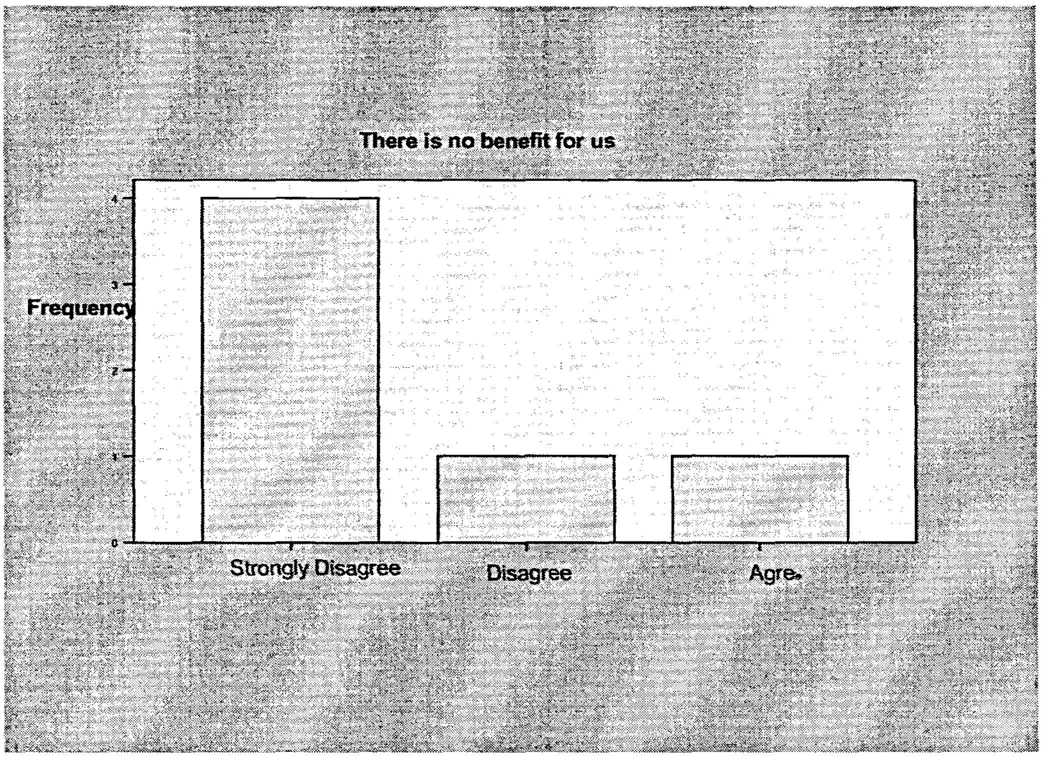

Figure 8. 4: There is no benefit for us

The Department of Energy in the DRC, SNEL, ZESA and the Department of Power strongly disagreed (66.7%) there was no benefit for them from the SAPP. Eskom disagreed (16.7%) with the statement, but the Department of Energy in South Africa agreed (16.7%). It was disclosed the SAPP was important to each of the member states within the region.

Table 8. 7: The SAPP is not important for our country

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	4	66.7	80.0	80.0
	Strongly Agree	1	16.7	20.0	100.0
	Total	5	83.3	100.0	
Missing	System	1	16.7		
Total		6	100.0		

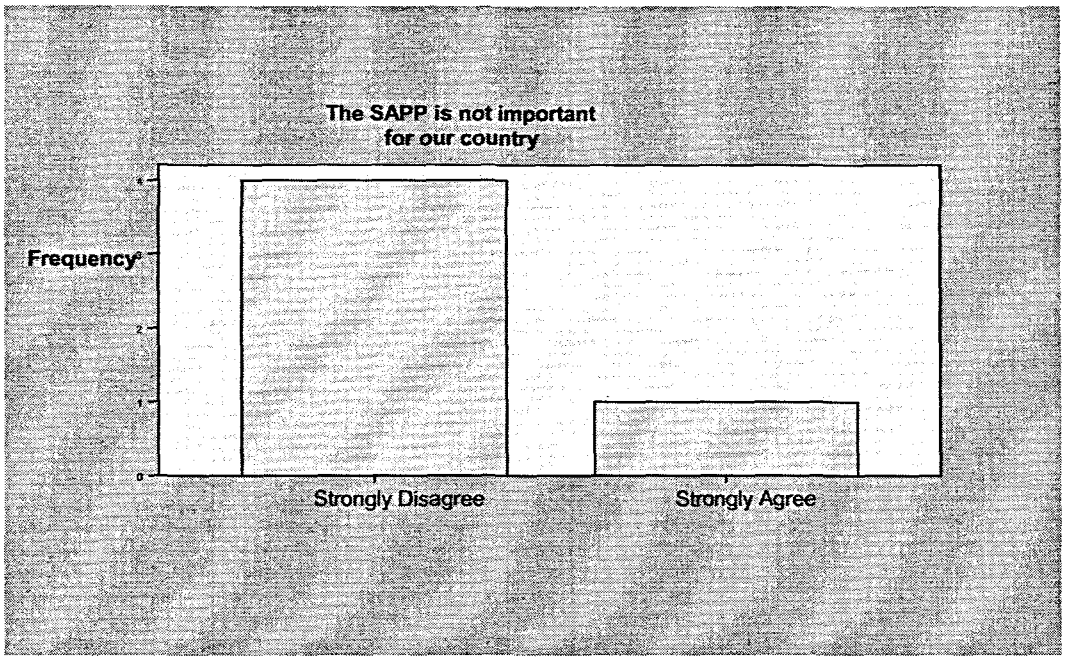

Figure 8. 5: The SAPP is not important for our country

Table 8.7 and Figure 8.5 show that ZESA, the Ministry of Power, Eskom and the DME strongly disagreed (80%) with the statement, SNEL strongly agreed (20%) with the statement. The SNEL strongly agreed with the statement because of internal capacity. However, the Department of Energy in the DRC agreed with the statement because the DRC did not import electricity.

3. Which department was involved in fixing the electricity tariffs through SAPP?

Table 8. 8: No Ministry involvement

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	16.7	16.7	16.7
	Disagree	2	33.3	33.3	50.0
	Agree	1	16.7	16.7	66.7
	Strongly Agree	2	33.3	33.3	100.0
	Total	6	100.0	100.0	

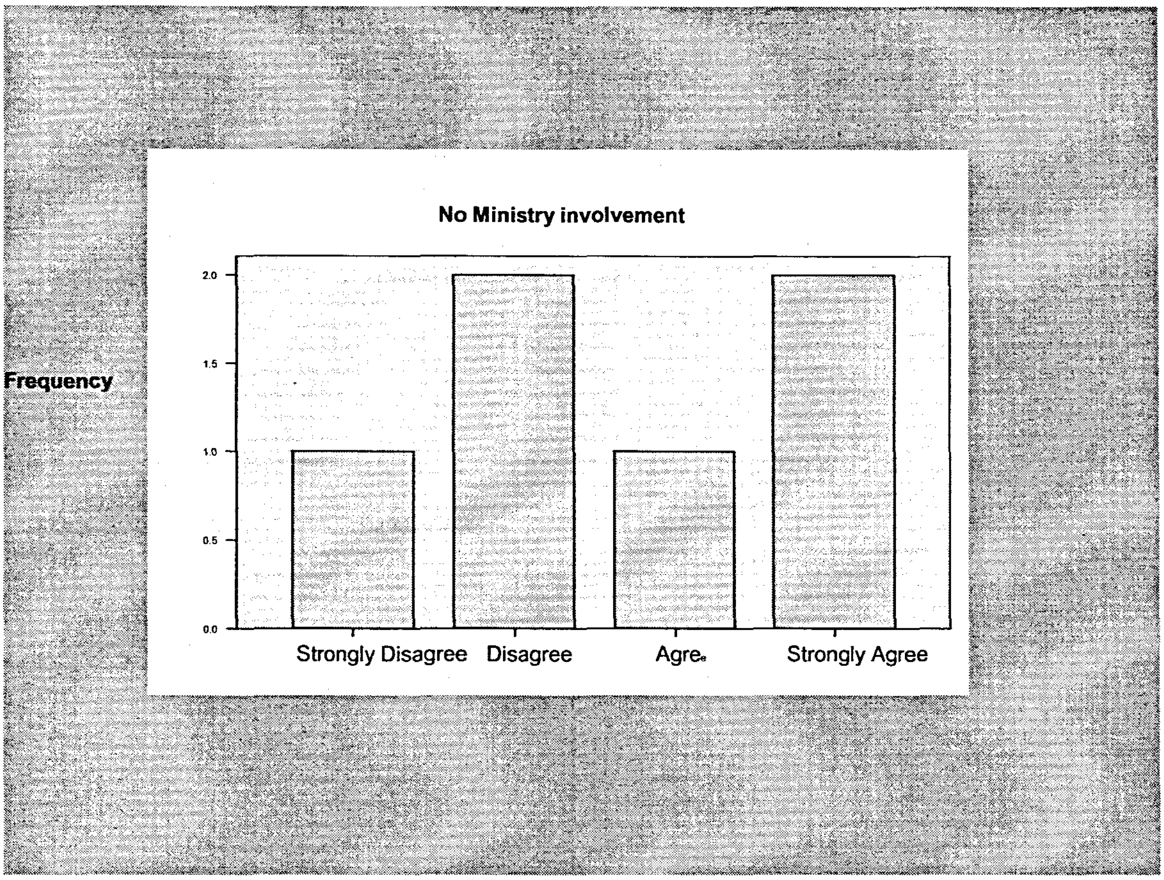

Figure 8. 6: No ministry involvement

Different views arose for this statement. Eskom and the DME in South Africa strongly agreed (33.3%) it was out of their government's control. SNEL and the Department of Energy in the DRC disagreed (33.3%). According to them, SNEL, their government ministry and other partners were involved in fixing tariffs. In Zimbabwe, the Ministry of Power agreed (16.7%) that the government did not fix the tariffs. According to the ministry, the Zimbabwe Electricity Regulatory Commission was involved. ZESA strongly disagreed (16.7%), saying it was Department of Transmission's division, decision.

Table 8. 9: **The pool is independent**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	16.7	16.7	16.7
	Agree	2	33.3	33.3	50.0
	Strongly Agree	3	50.0	50.0	100.0
	Total	6	100.0	100.0	

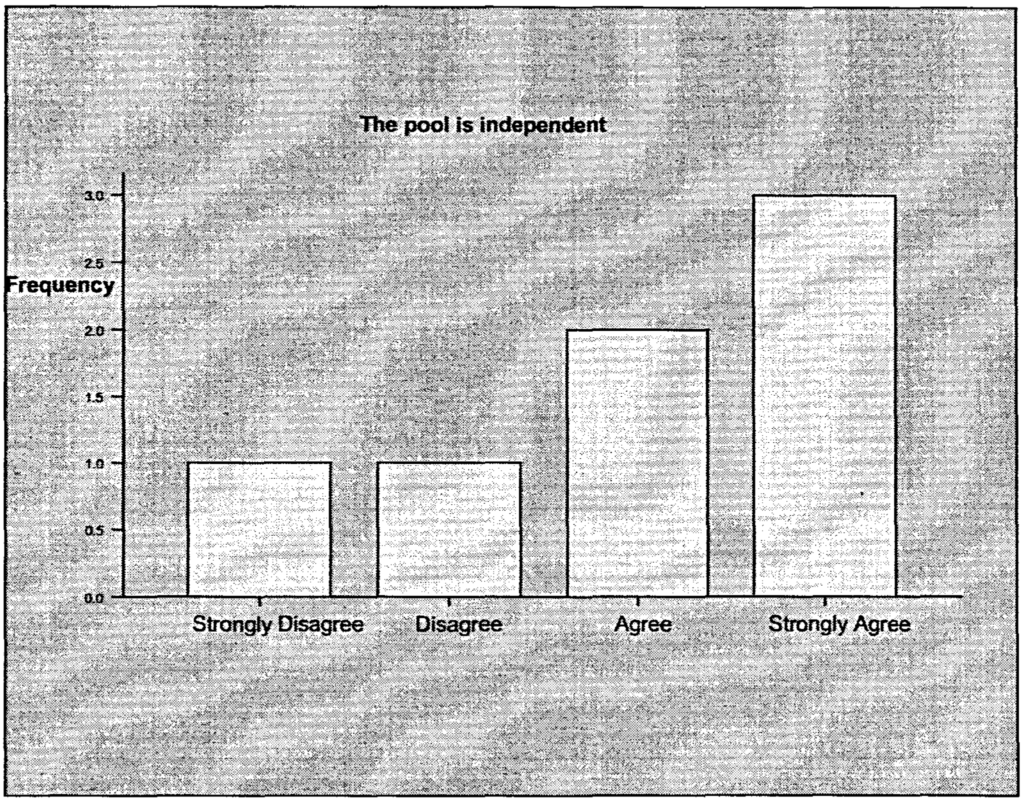

Figure 8. 7: **The pool is independent**

The table 8.9 and figure 8.7 show that ZESA, the Ministry of Power, SNEL and the SAPP headquarter in Harare strongly agreed (50%) that the power pool was uninvolved in the setting tariffs. The Department of Energy in the DRC disagreed (16.7%) with that statement. In South Africa, Eskom and the DME agreed (33.3%) that the pool was independent.

4. Were tariffs of exporting / importing electricity cheap compared with those charged to the local consumer?

Table 8. 10: The tariffs for exporting / importing electricity are cheap

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	42.9	42.9	42.9
	Disagree	1	14.3	14.3	57.1
	Undecided	1	14.3	14.3	71.4
	Strongly Agree	2	28.6	28.6	100.0
	Total	7	100.0	100.0	

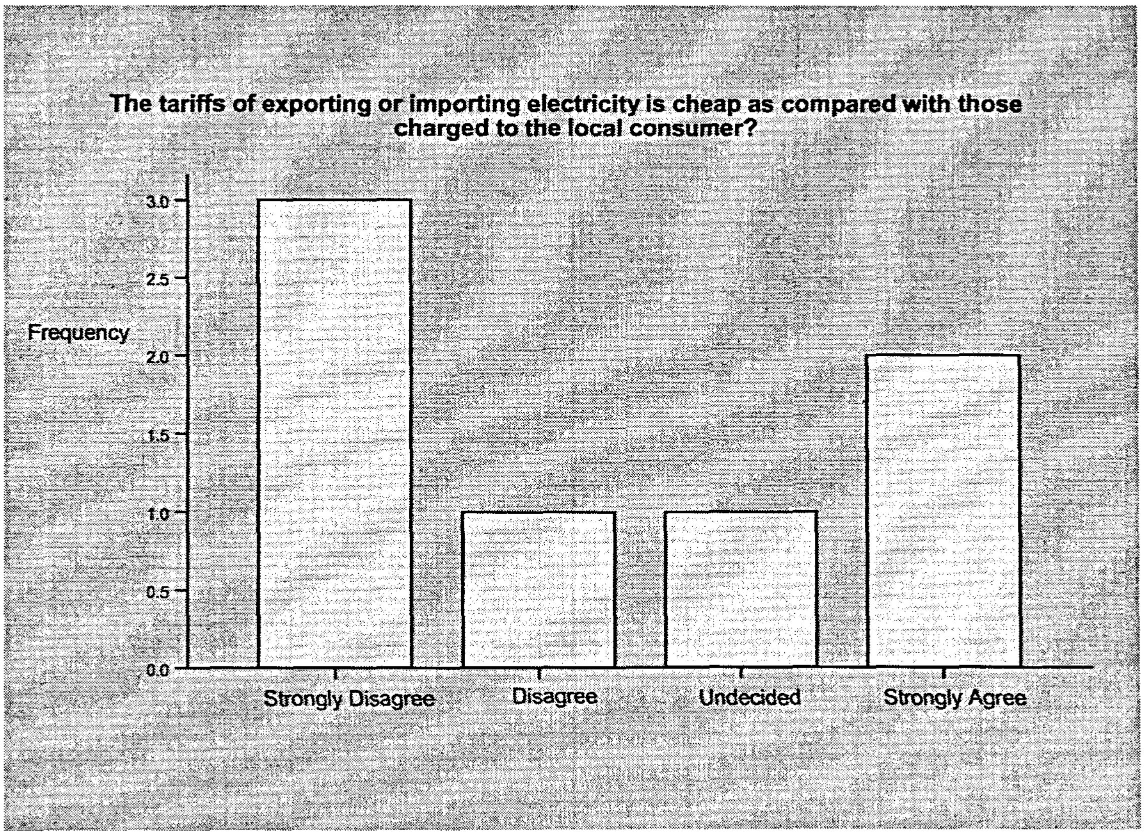

Figure 8. 8: The tariffs of exporting/ importing electricity

After interviews with public officials and senior executives in different countries it was clear that each country had its own views relating to this question. In the DRC, government officials and SNEL executives strongly agreed (28.6%) that electricity for exportation was cheap. Officials in the ministry of energy argued electricity tariffs for exportation were preferential because of political relationship with that country. Senior SNEL executive believed their tariffs of exportation were complex.

SNEL raised the problem with Eskom because the South African electricity company always proposed lower tariffs to buy electricity from the DRC.

However, the Zimbabwe authority, the SAPP co-ordinator and senior executives in ZESA strongly disagreed (42.9%) with the statement. According to government officials in the ministry, the tariff for importing was expensive for the Zimbabwe Government. ZESA stated the tariffs were expensive. The South African utility, Eskom disagreed (14.3%) and the DME in Pretoria was undecided (14.3%). The reason was two organisations were afraid to choose the proper answer.

5. What type of contract has your country signed with other SADC countries?

Table 8. 11: Bilateral contracts

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	5	71.4	83.3	83.3
	No	1	14.3	16.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

The above question regarding the type of contract a country had signed with another concerned mainly countries that imported and exported electricity. Regarding the DRC government and SNEL, most of their contracts were bilateral. This was similar to Zimbabwe and South Africa. It's merged most countries in the southern African region used bilateral contracts for the import or export of electricity. None of the countries in the study used the hybrid model; a combination of a bilateral contract and another model such as the Poolco model. It was also disclosed in the selected countries this model was not yet in use anywhere on the African continent. Currently the model has only been adopted in the European electricity market and the North America power pool. On the Africa continent, a hybrid model remained new for many electricity companies. The selected countries chose not to respond to this statement.

6. How do you review the contract?

Table 8. 12: How to review the contract

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	28.6	33.3	33.3
	Undecided	1	14.3	16.7	50.0
	Strongly Agree	3	42.9	50.0	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

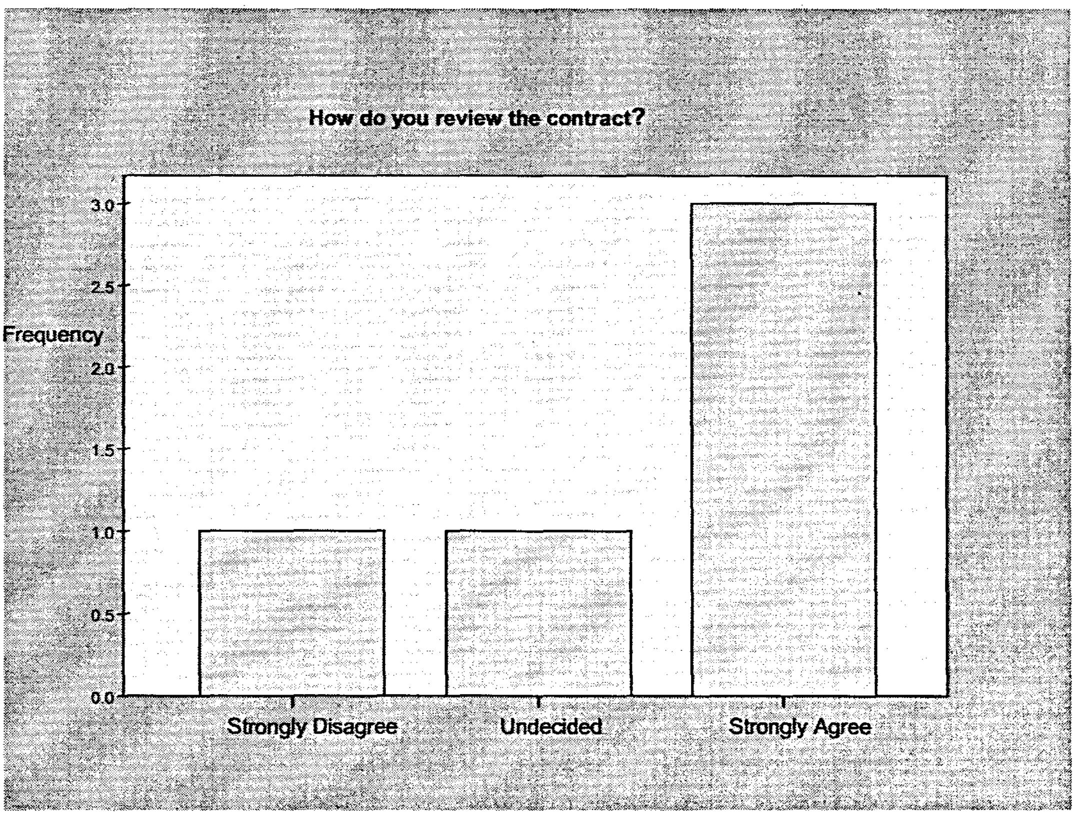

Figure 8. 9: How do you review the contract?

There were different views in terms of reviewing the contract of exporting and importing electricity in the SADC region. As shown in Table 8.10 and Figure 8.9 the Ministry of Energy in the DRC, SNEL and the Ministry of Power in Zimbabwe, strongly agreed (50.0 %) that they review their contracts every five years. ZESA and Eskom strongly disagreed (33.3%), since they reviewed contracts after one year. The DME in Pretoria was undecided (16.7%) and did not want to answer to the question citing personal reasons.

7 Who signed the contract on behalf of the government?

Table 8. 13: The person who signed the contract

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Minister of Energy	4	57.1	66.7	66.7
	CEO of Utility	2	28.6	33.3	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

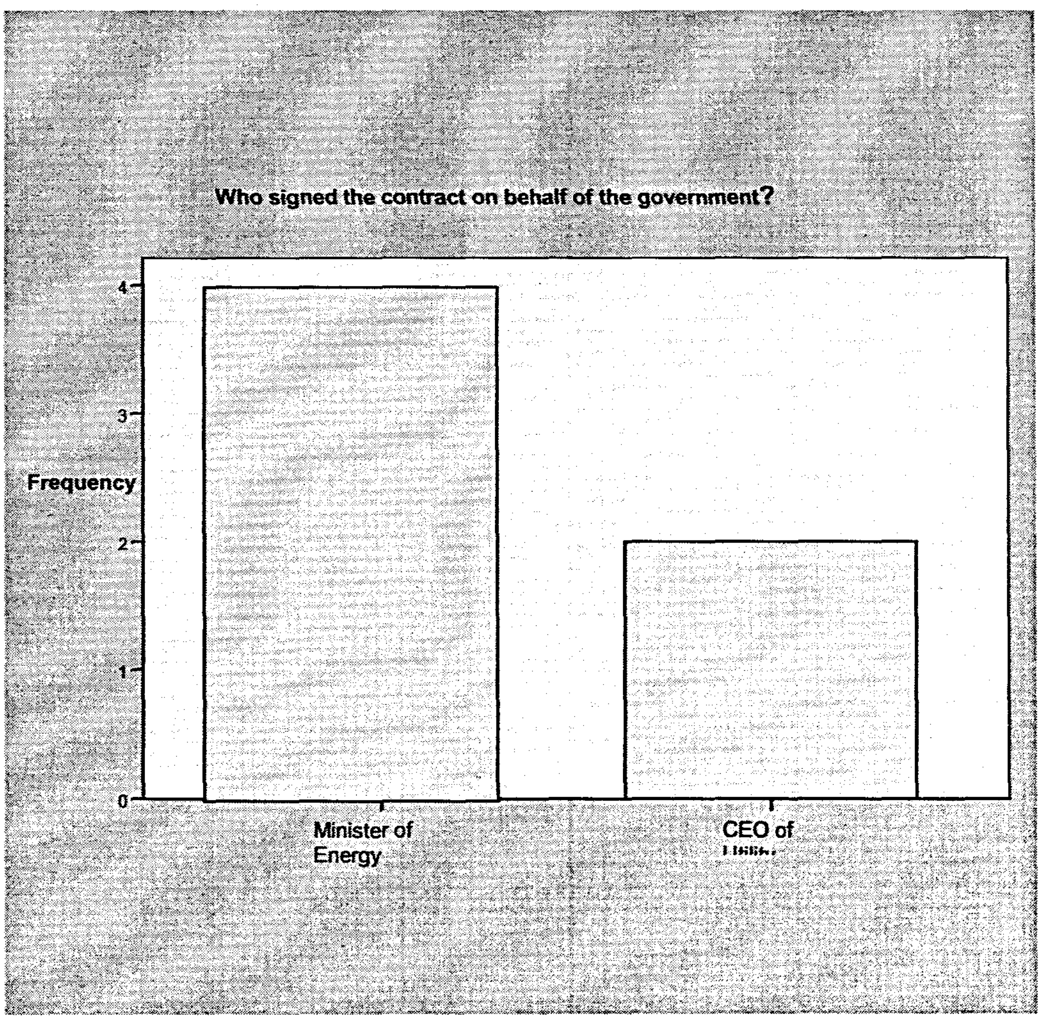

Figure 8. 10: The person who signed the contract

According to SNEL, the CEO signed the contracts with other utilities in terms of bilateral agreements with other electricity companies. The response from the ministry hold a different view, since the department of energy agreed the Minister had the responsibility to sign bilateral contracts. In Zimbabwe the responses were identical. ZESA agreed that the CEO signed the contracts, but the ministry of power said the Minister signed agreement with other countries.

In the case of South Africa, a Department of Minerals and Energy argued the Minister signed the contracts and Eskom said its CEO signed the contract. It was found there were two different responses from government officials and senior executives among the utilities.

8 Is there a need for PPP in the electricity sector of your country?

Table 8. 14: Is there a need for PPP in the electricity sector in your country

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	16.7	16.7	16.7
	Strongly Agree	5	83.3	83.3	100.0
	Total	6	100.0	100.0	

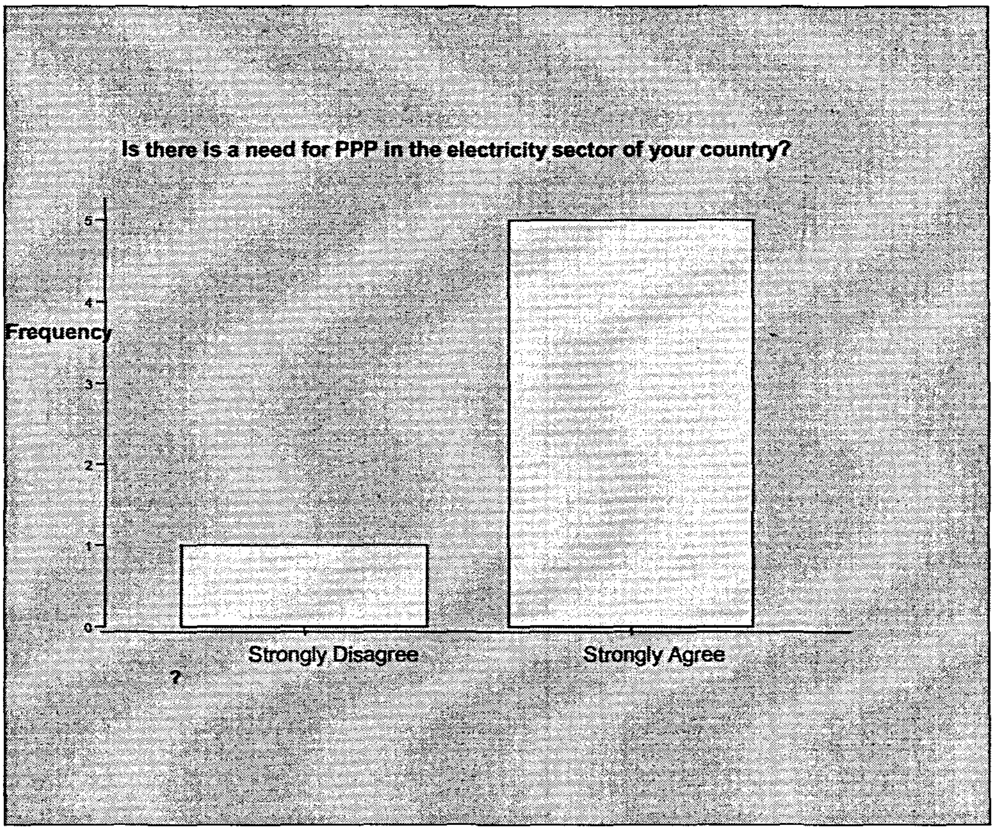

Figure 8. 11: Is the need for PPP in the electricity sector in your country

Most of the countries in Table 8.14 and Figure 8.11 strongly agreed (83.3%) that they supported the model of PPP in the electricity sector. Only Eskom strongly disagreed (16.7%) with the PPP model. To emphasise the arguments of each country, the Zimbabwe Government said it was a new mechanism which the government had implemented to build new electricity infrastructure nationwide. According to the department of power, the new method would boost government coffers.

The ministry of power stated each PPPs in the electricity sector would be allowed to participate in the SAPP. This meant the over-capacity generated by the private sector, would be sold within the SAPP. The policy applied by the Zimbabwean government, was to protect the private investor. This was the best opportunity for private companies to recover their investments. According to the Department of Power, no time frame existed to review the contract, as this was the decision of the Zimbabwean Government.

For ZESA, because of an inability to raise capital for its new generation plant, PPP was the model of investment. The national utility wanted to use PPP to build new power generation. Whereas, in the DRC, the ministry of energy had already begun to sign other PPP contracts with local partners to refurbish some hydropower plants around the country. SNEL wanted PPP because the national utility required a partner to refurbish their hydropower.

In South Africa, the DME supported the PPP model to increase the capacity of power within the country. With regards to PPP in South Africa, the government decided to give 30 % of their assets to the private sector, while Eskom retained 70 %. The specific model which the South African government wanted the private sector to apply was Build-Own-Operate (BOO), with the government requiring 15 years contracts. The predictions of many energy analysts who believed Eskom could experience power generation problems from 2008 (e.g. Eberhard: 2006) have largely come true. In order to avert this situation, the South African Government was trying to introduce new financial mechanisms to invest in the building of power plants.

9 Does the weather plays a major role during the transmission of electricity from your country to another?

Table 8. 15: Does the weather plays a major role during the transmission of electricity?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	14.3	16.7	16.7
	Agree	2	28.6	33.3	50.0
	Strongly Agree	3	42.9	50.0	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

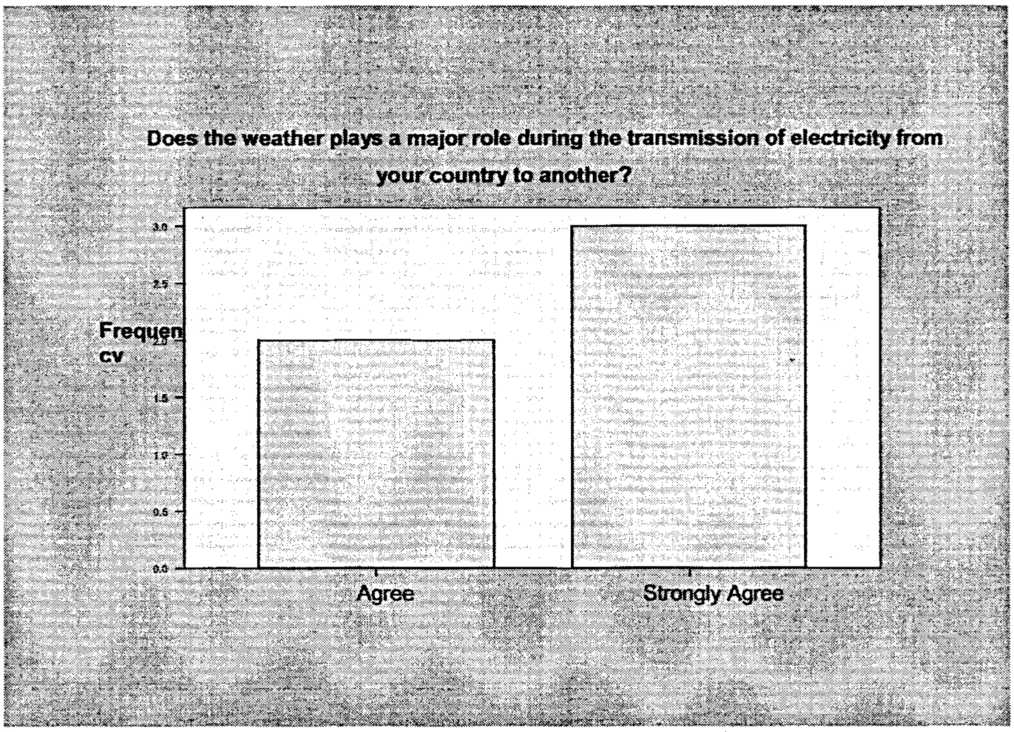

Figure 8. 12: Does the weather plays a major role during the transmission of electricity?

Each respondent in the three different countries admitted there was a problem with weather during the transmission of electricity. The Zimbabwe Ministry of Power, ZESA and the Ministry of Minerals and Energy in Pretoria, strongly agreed (50.0%) that weather played a major role. In the case of the Ministry of Power in Zimbabwe the weather affected transmission infrastructure which required funding to maintain and refurbish the infrastructure that might be damaged. ZESA argued storms caused short circuit trips and power-line disturbances, which affected the transmission of power between counties. The key sales and customer Division at Eskom strongly disagreed (14.3%) with the statement. This may well reflect the relatively strong network system South African utility operates compared to other countries in the region.

The Ministry of Energy and SNEL in the DRC agreed (33.3%) that weather played a major role in successful power transportation during the rain season, while it also played a role in electricity tariffs since the price of electricity varied by season. If there were any problems, the company supplying electricity had to pay a penalty to the buyer. These situations are understood by the parties when they signed a bilateral contract.

10 Does your government buy electricity from the SAPP?

Table 8. 16: Does your government buy electricity from the SAPP?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	42.9	60.0	60.0
	No	2	28.6	40.0	100.0
	Total	5	71.4	100.0	
Missing	System	2	28.6		
Total		7	100.0		

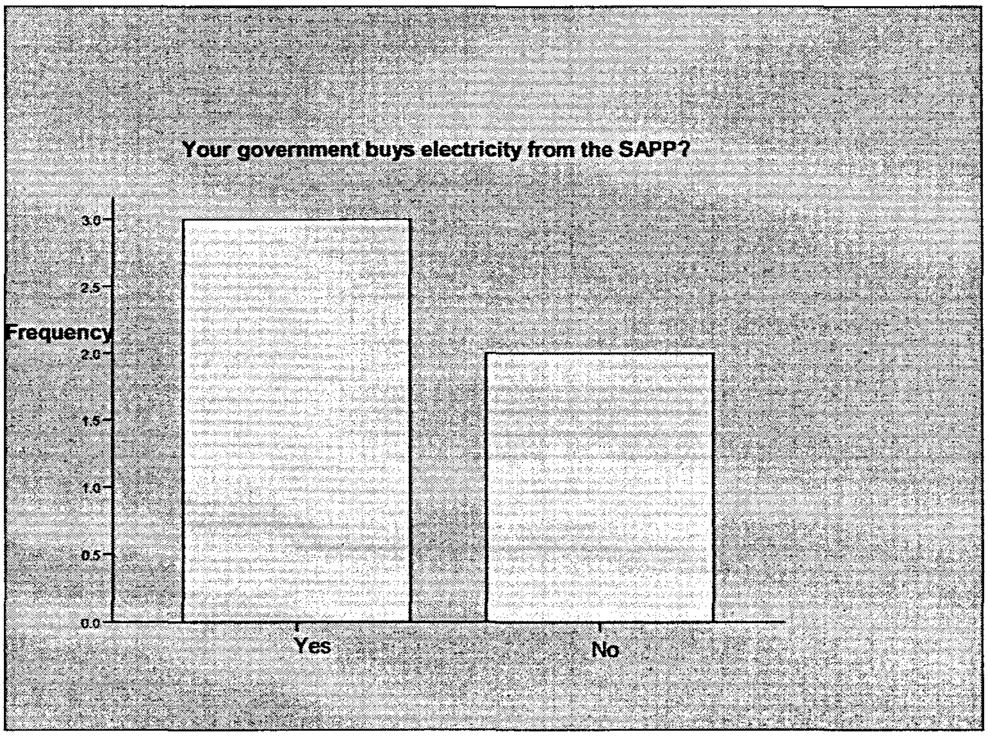

Figure 8. 13: Does your government buy electricity from the SAPP?

It was indicated only two countries purchased electricity to SAPP, South Africa and Zimbabwe (60.0%). The DRC did not (40.0%) because that country did not import electricity. The DRC government benefited the SAPP by selling electricity and planning for the construction of a new hydropower.

11 Do you purchase power from the DRC, South Africa or Zimbabwe?

Table 8. 17: Do you purchase power from the DRC, South Africa or Zimbabwe?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	28.6	40.0	40.0
	No	3	42.9	60.0	100.0
	Total	5	71.4	100.0	
Missing	System	2	28.6		
Total		7	100.0		

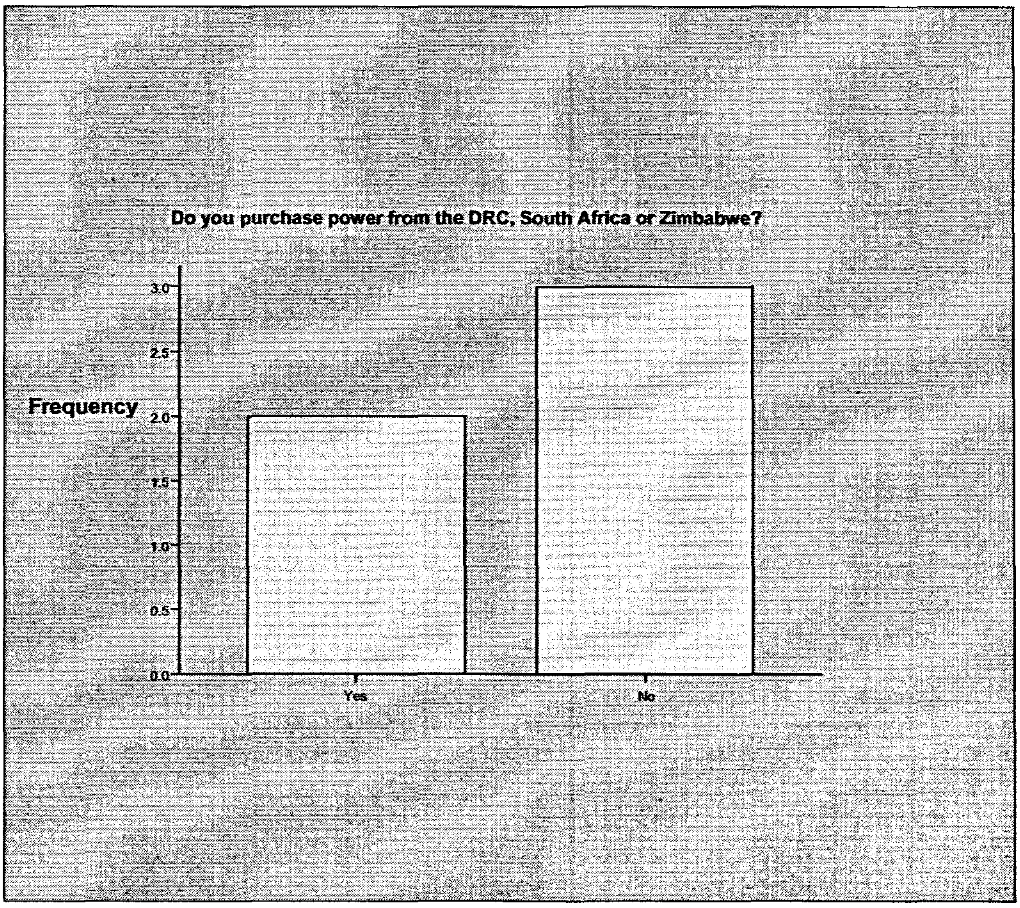

Figure 8. 14: Do you purchase power from the DRC, South Africa or Zimbabwe?

The responses to this statement indicated that both South Africa and Zimbabwe (40.0%) purchased electricity from the DRC. Each country has signed a bilateral contract with the DRC in terms of power trading. The results show that the DRC did not purchase electricity from Zimbabwe and South Africa. While South Africa did not purchase power from Zimbabwe, it was revealed Zimbabwe purchased power from South Africa, Zambia and Mozambique.

12 Are electricity tariffs cheaper within the SAPP market?

Table 8. 18: Are electricity tariffs cheaper within the SAPP market?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	16.7	20.0	20.0
	Undecided	1	16.7	20.0	40.0
	Agree	3	50.0	60.0	100.0
	Total	5	83.3	100.0	
Missing	System	1	16.7		
Total		6	100.0		

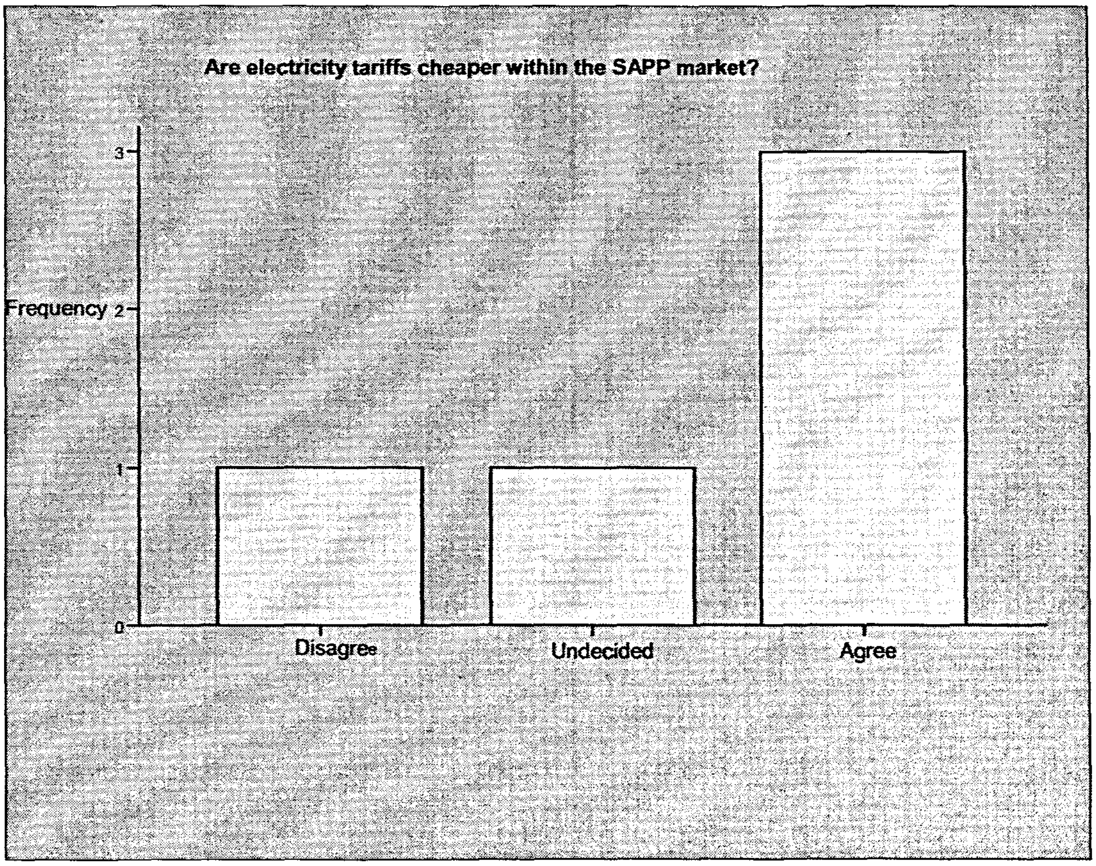

Figure 8. 15: Are electricity tariffs cheaper within the SAPP market?

The responses to this statement are comprised of findings of interviews with Eskom, SNEL and the Ministry of Energy in the DRC who agreed (60%) of the respondents electricity was cheaper in the SAPP. The DME in South Africa was undecided regarding this statement (20.0%), while the Ministry of Power disagreed. To the Ministry of Power in Harare, the price of electricity in the SAPP was expensive.

8.2.2 Interview with Southern African Power Pool manager

1 How do you plan electricity trading through the SAPP?

The co-ordinator centre manager, considered an executive director of the power pool, responded the power pool planned power trading on a daily basis. Each day, one particular country, via its electricity company, requested the capacity required. It was shown there was no monthly or annual plan for electricity trading.

2 Who is the main supplier of electricity within the pool?

During the interview with the co-ordination manager, he said there were few countries in the region considered as main suppliers of electricity to the power pool. The following countries were, however considered major supplies:

- DRC;
- Zambia;
- Mozambique; and
- South Africa.

Among this quartet, South Africa was recognised as one of the major supplies of electricity in the region. Zimbabwe was not considered because its local utilities had financial constraints because of political and economic situation in the country.

3 Which countries bought electricity from the SAPP?

According to the SAPP co-ordination centre, many countries purchased electricity from them daily. These countries bought electricity in relation to their internal demands. The major buyers were:

- Botswana;

- Namibia;
- South Africa;
- Mozambique; and
- Zimbabwe.

In relation to the previous question, it showed some countries were considered as sellers and buyers. For some reason, certain countries sold electricity during the day and bought electricity by night. For example, in the case of Zimbabwe, ZESA bought electricity during the day and sold electricity to Namibia at night. These actions sometimes also applied to South Africa, since Eskom sold to Zimbabwe during the day and bought power from Zimbabwe at night. Mozambique engaged in a similar process, since it sold to Eskom during the day and bought from others when there was a problem with hydropower within the country. The co-ordination centre said some countries were not listed because they did not have a network connection such as those countries not participating in daily electricity business within the region.

4 What type of market does the pool use?

The co-ordination centre responded to the above question by saying the power pool used a bilateral contract between the two countries. Another type of electricity market used was the short-term electricity market. The second model was more applicable to countries where networks were connected to a power pool. There were other types of electricity markets, not used by this power pool, because most of the utilities in the region were owned by their respective government.

5 How does the power pool collaborate with country member states?

The power pool had a mandate to report to all ministers of energy in the SADC. It meant each country should have a report concerning daily business of the pool, while each ministry of energy in the SADC should clarify its position regarding transformation of the power pool. The power pool did not have an obligation to sideline members that did not participate in the sale of electricity.

The same situation applied to the 12 national utilities in the SADC. The same system applied to the ministry of energy, the same system used for the electricity company. The only difference between the two was the ministry of energy, which had implemented the policy in terms of transformation of the power pool. Also, in order for a private company to participate in the pool, the ministry of energy needed control of details.

6 Is there a large influence from country member on electricity tariffs?

According to the power pool, there was no government involvement in terms of fixing the electricity tariffs in the pool. The pool was an independent body and not influenced by any country within the region. The price of electricity had been evaluated in terms of demand from member states. It was also explained the matching of offers and bids made use of the market principle, which was more applicable on a daily basis by the power pool for the country that purchased electricity daily. Nevertheless, for countries that signed bilateral contracts, prices were negotiated by the two parties which meant the power pool could not intervene in any discussions.

7 Are the price you fix based on marginal costs of production?

It was also found prices, unveiled by the power pool, were based on the production costs. These prices assisted electricity companies to profit or save money in US dollars. According to the co-ordination centre, many countries that sold electricity to the pool did not take into consideration the cost of production. The power pool began to advise most utilities within the region to base rate on the cost of production. For example, the price of electricity generated from a hydropower plant would differ those of coal power plant. These two plants had different characteristics, which is why the co-ordination centre manager was trying to encourage each electricity company to consider the recommendations from the power pool.

8 Are your prices based on marked bids?

This question could emphasise the above statement because the price would be determined according to the volume of electricity requested for that day. Based on this principle, the utility could buy electricity cheaply one month but the price could change for the next month. Therefore, the co-ordination centre suggested most countries should base their electricity prices on the cost of production.

9 Are the SAPP tariffs prices evaluated based on a geographical zone or distance?

It was demonstrated that tariffs were not based on distance or on geographical zone. However, transmission charges were based on the distance in the current megawatt – kilometre method, which was included in the tariffs of the electricity transmitted per day.

10 Do you consider transmission losses?

The co-ordination centre manager admitted they utilities consider transmission losses. The SAPP member countries suggested implementing a commission to study this matter. During the interview it was argued by the co-ordination centre a study was in progress to evaluate charges for transmission losses. All members would be informed of the study's outcomes.

11 Is there any profit sharing among members of the SAPP?

It was disclosed that there was sharing among members of the SAPP, especially those countries participating in bilateral trading as well as in short term energy markets. According to the SAPP manager, pooling had resulted in benefits which were shared, such as reliability and security of the transmission network. This was implemented in each country where there were network connections.

12 Is there any possibility that with an excess supply, the price could collapse within the SAPP?

According to the co-ordination centre manager of SAPP, there was a possibility to increase power in the region. That could influence the tariffs of electricity to fall down. However, the current situation was that there was electricity supply deficit in this region. No new investments had been made in the last 20 years, which is one of the problems facing most countries in the region. Each country had a programme for the construction of new power plants, and investments in the electricity sector would play a major role in order for this region to produce an excess capacity.

13. Do seasons influence tariffs?

The co-ordination centre manager agreed there was influence in terms of seasons, which influenced tariffs. This influence was divided into two seasons; high season and low season.

The high season is June to August, when the electricity tariffs increase. The tariffs change because the electricity demands in different countries can be high, usually in winter periods in this region. The low period is September to May, when electricity tariffs drop. This phenomena is clearly indicated in the analysis of the quantitative data relating to the trading of electricity daily described below.

In summary, the qualitative analysis part of this research in the selected countries of the study covered all relevant aspects. Government officials and senior executives within the electricity companies responded to the researcher's questionnaires understood the problems regarding electricity trading in the region. The co-ordination centre manager for the power pool also highlighted the importance of the SAPP and raised some opinions concerning power trading within the region.

8.3 Quantitative data analysis

The quantitative data was based on electricity trading during a five-year period in the region. The trading demonstrated how many countries traded power in the electricity market of the SADC. It was also important to know which countries in this study traded electricity during this five-year period. It is also important to inform the reader how much data values are missing.

The SAPP office in Harare informed the researcher some of the data was missing. In addition, there was missing data for some months, which totalled the capacity sold in 2002, as well as missing data for the total amount of money in US$ for the same year. The clarification of this information concerning the missing value was merely to inform the reader that some of the figures that follow will have gaps.

The quantitative analysis focuses on analysing the price of electricity during the five- year period, as well as, the capacity of power traded during that period. Furthermore, the amount of money gained by the SAPP for each year was also analysed. An interpretation of the data assisted the researcher to provide a projection forecast on the price of electricity.

8.3.1 Trading of electricity in 2002

The interpretation of the figures began in January 2002 after eight months of the opening of the short-term energy market in the region. The evaluation of electricity trading was based mostly on the country that traded electricity in the SAPP. Most figures clarified this study in terms of which country traded electricity each year. It is also important to emphasise the figures, reflect the information for the country that sold electricity in the power pool. Not all electricity companies in the southern African region traded power in the SAPP.

The amount of money made within the power pool was divided among the utilities that traded electricity in the SAPP, while the SAPP transferred money to the electricity company's bank account in Gaborone capital of Botswana.

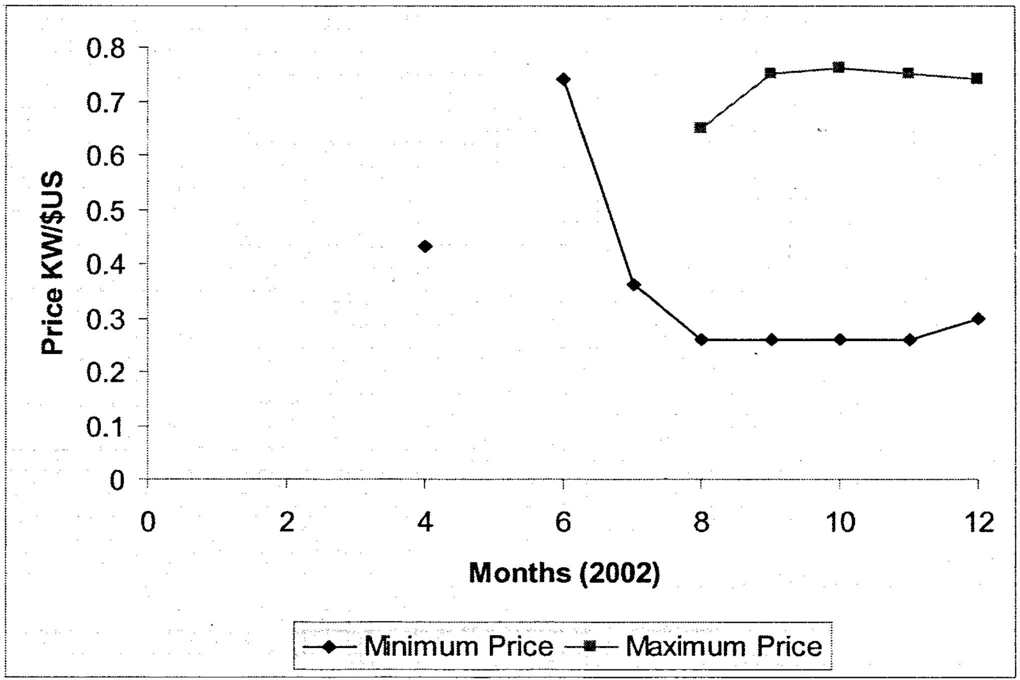

Figure 8. 16: Minimum and maximum price in US$/c kWh in 2002

Figure 8.16 shows the selling price of electricity in USc/per kWh in the region. The price of electricity traded in the power pool was categorised in minimum and maximum prices for each day. It was recorded during 2002, after eight months of operation of electricity traded in the region. The correct electricity price in USc/ per kWh of six months was missing, which could not help the researcher to give a specific price. Figure 8.16 shows from January to May 2002, the price of electricity per day was not shown because it was difficult to specify the minimum or maximum price. The power pool did not provide the real problems concerning the missing data values.

In June 2002, the price of electricity was recorded as the minimum price of electricity, which was 0.30 USc/ kWh, while the maximum price increased to 0.36 USc/kWh for the daily electricity market. Furthermore, in July no major changes were recorded in the SAPP in terms of the price of electricity that was traded. August differed because the minimum price of electricity decreased to 0.26 USc/kWh, while the maximum price was recorded at 0.65USc/kWh, which is shown in Figure 8.16. This price was recorded because of the demand of electricity during the day. Moreover, if demand for electricity during the day was high, the minimum or maximum prices increased.

In September of the same year, the price ranged from 0.26 to 0.75 USc / kWh. During this month, the SAPP recorded the entry of the Electricity Company from Swaziland (SEB), as well as from Zambia, Kariba North Bank Company (KNBC) to start selling electricity in short term energy markets. This brought the number of utilities, which participate in the STEM to seven: BPC, EDM, Eskom, KNBC, NAMPOWER, SEB and ZESA. Until September 2002, SNEL, from the DRC, did not sell electricity in the short term electricity markets. Most of the trade with SNEL was based on bilateral agreements with southern African countries. In October the price of electricity was 0.26 to 0.76 USc/kWh, similar to the previous month. The same situation was recorded in November, which were 0.26 to 0.75 USc/ kWh.

Compared to December, the minimum price was 0.30 USc/ kWh and the maximum electricity traded at 0.74 USc kWh per day. What could be learned from this figure is that in 2002 the prices of electricity traded that was in the region, was less than one American dollar. It is also recognised not all the countries in the SADC traded their electricity, only few traded electricity daily.

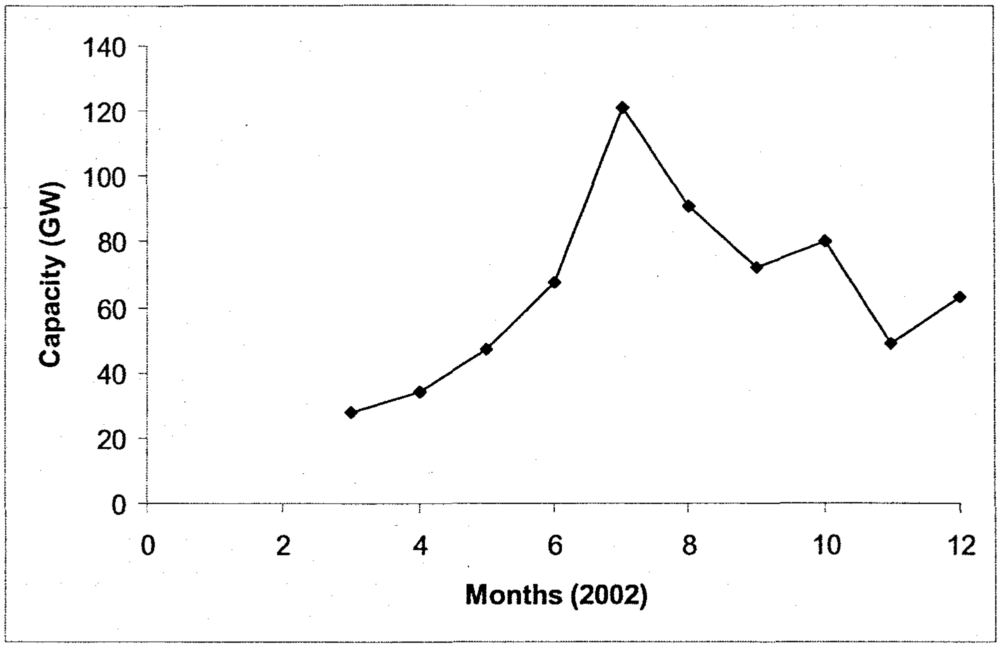

Figure 8. 17: Capacity sold in GWh for each month in 2002

Figure 8.17 shows the capacity sold in GWh per month. At the beginning of 2002, in January and February, 2002, it was recorded the two months did not have data.

But, in March that year that energy traded was 27.7 GWh; only three companies traded electricity in that month. In April the electricity traded increased to 34GWh compared an increase in capacity as demand increased. Following the same pattern, May 2002 saw capacity increased to 47 GWh. The power pool began to experience an increase in the capacity sold within the region. In June, 2002 the power pool experienced a large change compared with the beginning of the year. The total volume of power traded during June was 68 GWh. In order to understand the trading of power, the reader should link the capacity sold to the price of electricity within the pool. This will assist the research in making a correct judgment in terms of power trading in the SADC region.

In the second half of the year there was a change in terms of capacity demand. July recorded a sale of 121 GWh, which is the highest volume of electricity to be sold in the power pool that year. In August there was a decrease in capacity to 91 GWh. During that period there was an increase of countries participating in short term energy markets for the daily electricity business of the region. The energy trade in September dropped below the August figure. The capacity sold in September, was 72 GWh. October 2002 trade recorded 80 GWh, November there was a reduction in demand to 49 GWh, while in December 73 GWh, was sold to member states.

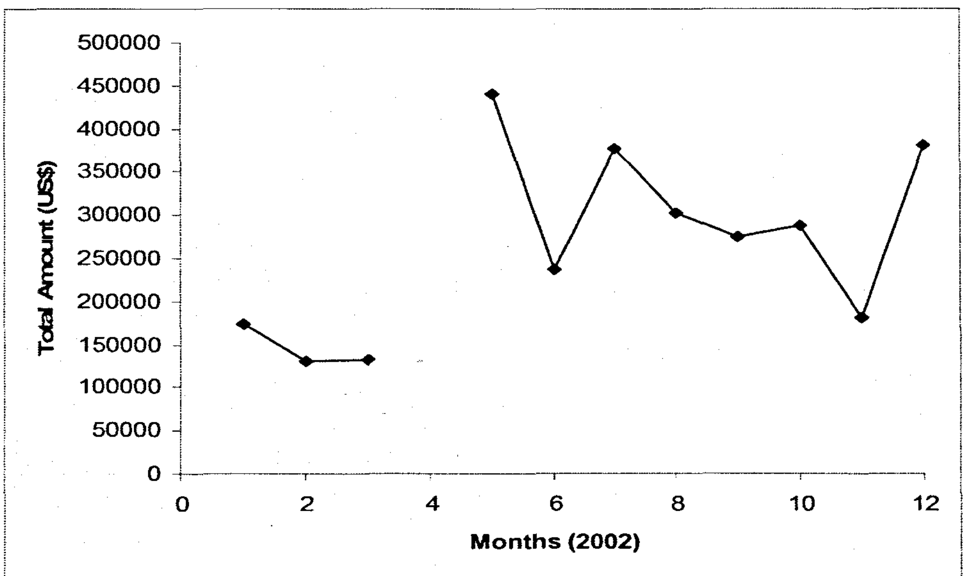

Figure 8. 18: Total amount in US$ SAPP made for each month 2002

Figure 8.18 represents the amount of money the power pool made for trading electricity each month during 2002. According to the interpretation of the data in

Figure 8.16 and Figure 8.17 there was a change for each month in terms of the amount of money made. It was acknowledged the capacity sold and the prices changed from month to month. In January 2002, the amount of money, the SAPP made was $172 878. In February of the same year, there was less money made at $ 131 312, February being a shortest month. According to Figure 8.18, during March, electricity trading amounted to $133 000. In April, no data was captured in terms of the amount of money made by the SAPP. There was an increase made in May, to $ 200 441, while the situation continued to improve in June with $237 000 of capacity sold.

At the start of the second period of that year, July recorded $337 000, which was the highest compared again the first six months of that year. In August, $303 000 was a reasonable reduction from July. The trading, however, was still considered favourable compared with previous months. In September, $ 274 000 US$ was recorded for electricity sold, less than in August. Furthermore, in October, SAPP registered $284 000 for power traded.

November was considered as the lowest month for the second period of the year, since only $181 000 was gained for the month. December recorded the best amount for money gained within the SAPP, since it received $380 000 highest of the year.

8.3.2 Trading of electricity in 2003

At the beginning of second year-and-a-half of the short term energy market in the power pool, there was less progress made by different utilities to boost the trading of electricity. It is recognised the demand of power in the region increased annually. Figure 8.19 demonstrates the change in prices within the SAPP compared with 2002. Another important element was the volume of electricity traded began to decrease compared to previous years.

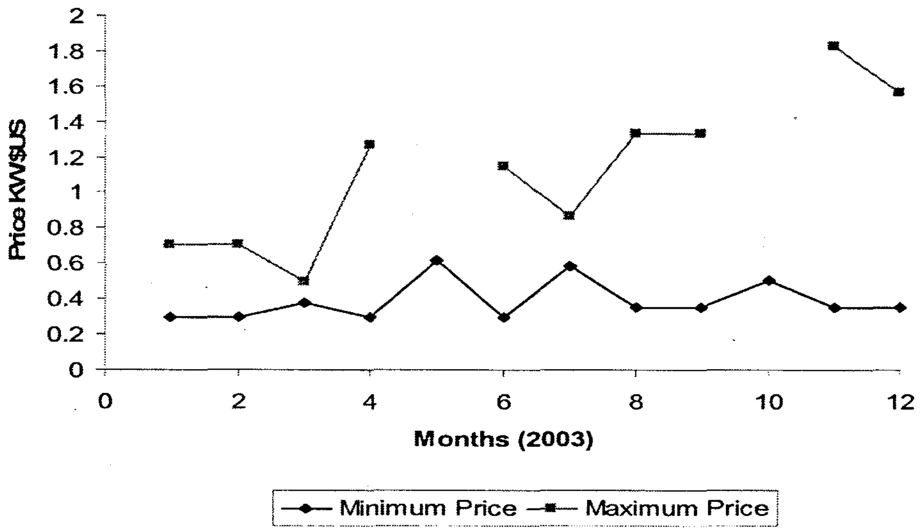

Figure 8. 19: Minimum and maximum prices in 2003

Figure 8.19 shows the minimum price at the beginning of 2003, was similar with 2002. In January 2003, the minimum price of electricity was 0.30 USc/kWh. The maximum price for that month was differed from the previous year (2002). The maximum price for electricity trade in January was 0.71 USc/kwh. In February of that year the price was the same as January. However, there was a probability that electricity traded during that month was fixed at the maximum price. This argument was verified in Figure 8.20, which shows money made each month. There was a difference in the following month, because in March the minimum price was 0.38 USc/kWh. Compared to maximum price, the price was decreased to 0.50 USc/kWh, which might reflect the demand for power from pool members.

In April the price stabilised again to a minimum of 0.30 USc/kWh; the reasons were not given. Nevertheless, the maximum price changed completely when it went to 1. 27 USc/kWh. Each year the wheeling price was increased from pool members. In May the minimum price was 0.30 USc/kWh, while the maximum was unavailable. In June, the minimum price remained stable, as in May, but the maximum price remained above 1.15 USc/kWh.

At the start of the second half of 2003, there was an increase in the minimum price in terms of kWh at the SAPP. Another element that could be raised in this analysis was the price of electricity within the pool was based on the members' demanded.

Changes occurred because of differing problems in the electricity sector in the region.

It was registered in July that the minimum price increased to 0.59 USc/kWh and the maximum price was 0.89 USc/kWh. In August, the minimum price decreased to 0. 35 USc/kWh, while the maximum increased to 1.33 USc/ kWh during the peak period.

The trading price in September was similar to August. In October the minimum price was 0.51 USc/kWh, the power pool did not register the maximum price for that month. Compared to the previous month, November witnessed price changes to a minimum of 0.35 USc/kWh, while the maximum price of trade in the power pool for that month, and was 1.83 USc / kWh.

The minimum price in December was similar to November, which was 0.35 USc/kWh and the maximum price decreased to 1.57 USc/ kWh. An interpretation of this figure is completely different from Figure 8.16 for 2002. In 2003, the minimum and maximum prices of electricity trade changed, since the price of electricity was traded at $1 a month, which could mean that electricity was traded at peak times during the day in the region. During that time the cost of electricity in the market was expensive. The increase in price could also be linked to a demand within each country that traded within the pool. When there were no reserves in each country, the price of electricity in the pool increased, which is why the price of electricity within the pool changed.

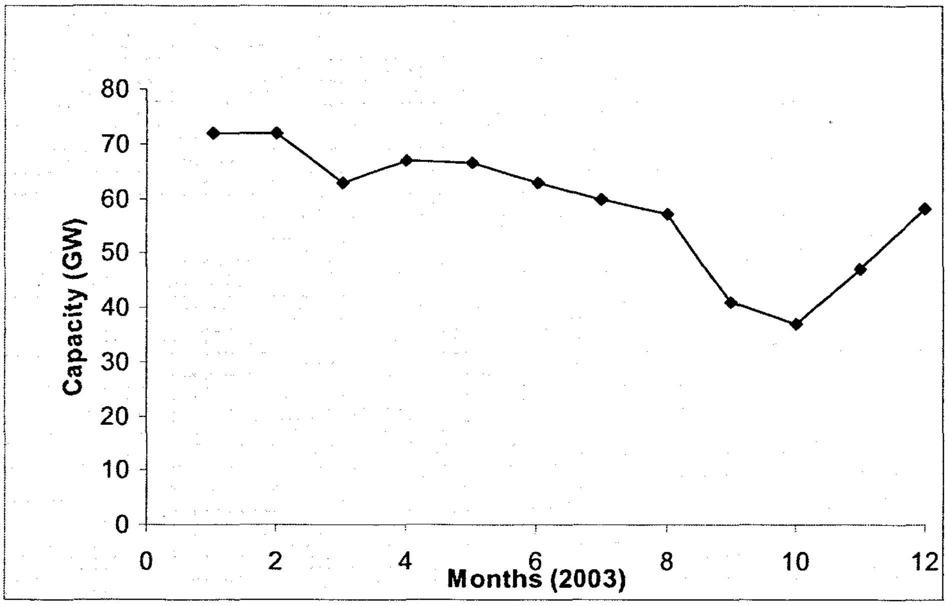

Figure 8. 20: Capacity Sold in GWh in 2003

It was recorded in January 2003, the capacity sold, was 72 GWh. The same capacity was sold in month of February. This does not mean the corresponding months earned similar revenue, February since the shortest month of the year. In March, there was a decrease in the volume sold in the region, since about 63 GWh of power was sold. In April, 67 GWh was sold to other members in the power pool. The member countries that traded within the pool did not increase. Another argument to be raised was that there were no new investments which might have boosted capacity in the region. In May the power pool sold 66.5 GWh and in June the capacity sold, was 63 GWh. During the first six months of 2003, the volume of electricity traded within the SAPP was still low because of the problem of power generation among members.

The second period of 2003 saw the volume of trade within the pool, decreased monthly. This might have been because fewer companies were trading electricity reserves in the SAPP. In July the capacity trade was 60 GWh for that month. In August 57 GWh were sold in the region, while the volume decreased further. The same pattern was experienced for September, since the capacity sold went lower than 41 GWh. In October, a similar situation occurred when capacity remained as low with 37 GWh sold. The demand for sales began to increase in November to almost 47 GWh. The end of December registered an increased sales capacity within the power pool of 58 GWh.

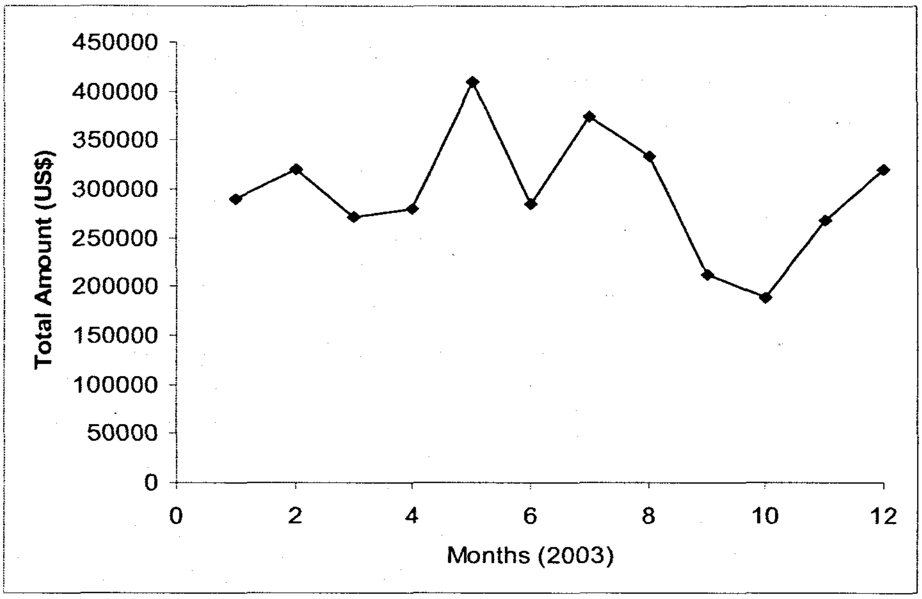

Figure 8. 21: Total amounts in US$ in 2003

An analysis of the price of electricity is presented in Figure 8.19 in 2003 and the volume of electricity trade is show in Figure 8.20 within the power pool. The interpretation of this figure shows the amount of money made, as well as the accuracy of the price trade for each month in 2003. In January the power pool registered $290 000 for electricity traded. The income generated for February was $320 523.90 compared to January, but, the situation in the following month changed. In March, $271 000 was made, less than the previous two months.

In April 2003 SAPP registered $279 000 in electricity trade, while May 2003 was considered the best month of the year in terms of money made in the power pool, $ 409 263. In June the power pool made $284 000. During the second period of 2003 there was little progress made by the pool in terms of electricity trade. July registered the second best figure $375 000 and, in August $333 000 was earned by the pool. The situation changed in September, with profits down to $212 000, and decreased even further to $188 000 in October.

November improved to $268 000 while in December the SAPP earned $321 000 for power trade. It was recognised in 2003 the pool increased the price of electricity. This was explained because of changes made by different utilities in terms of wheeling charges in the region. These wheeling charges affected mostly countries that bought electricity across-borders.

The countries, which did not purchase electricity outside the borders and whose wheeling charges were updated by different utilities, did not need increases.

8.3.3 Trading of electricity in 2004

During the third year of trading in the STEM there were different occurrence each year in terms of pricing and capacity of electricity demand by other utilities in the region. There were also other factors which played a major role, such as the stability of the power plants in each country. Another factor was the demand of electricity within each country, which may not allowed a utility to export power. The economic situation for each country also contributed to the changes in trading in the power pool. It was argued the power pool experienced difficulties in increasing volume of electricity trade each year.

The reason was already known within member countries of the SADC. Each country might suggest new investments be made in the electricity sector. The different figures, illustrated interpret the factors already stated.

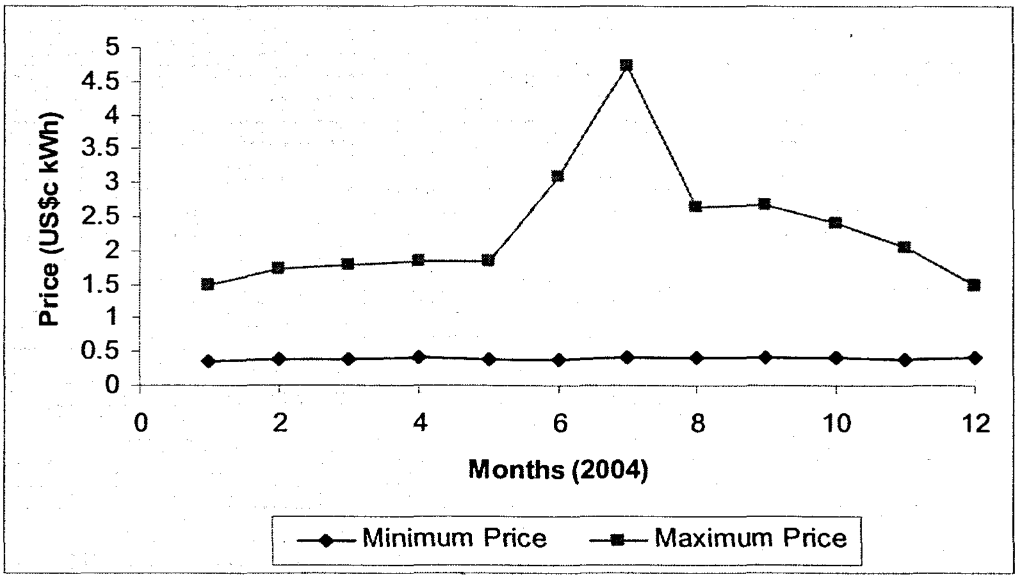

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Figure 8. 22: Minimum and maximum price in US$/c in 2004

In the third year of electricity trading in the power pool, the price of electricity appeared to change slowly. During the previous year the price of electricity began 0.35 USc/KWh. In 2004 the situation began to change. Figure 8.22 shows in January the minimum price of electricity was 0.35 USc/kWh, which was much higher compared to 2002. The maximum price in 2004 increased to 1.50

USc/kWh, which was considered expensive compared to other years. In February, the minimum price began to increase to 0.40 USc/kWh. The maximum price in February increased to 1.72 USc/kWh, while it is also important to emphasise that few electricity companies traded in the power pool in 2004.

This may have been regarded as a sign to increase the price of electricity in the market. Most problems were with the member states because they had insufficient reserve capacity to trade in the pool. Furthermore, in March, although the minimum price was the same as in February at 0.40 USc/kWh, there was another increase in the maximum price to 1.80 USc/kWh. The demand for electricity that year increased each month and supplies were too few to satisfy that demand. Another reason was buyers bid for an unstable market. In April 2004, the minimum price increased again to 0.41 USc/kWh, while the maximum price increased to 1.85 US/kWh. In May 2004, the minimum price was 0.40 USc/kWh and the maximum price similar to April's.

In June the minimum price was the same as in May, but it was the maximum price increased to 3.10 USc/ kWh high. There were different opinions for the increase in the maximum price. It was noted that the price was high during the day, and also a peak time when electricity was expensive. It was observed that during the peak period, the price of electricity was high. The price might have been lower or cheaper when trading took place at night (off-peak period).

In the second period of 2004, a similar situation occurred. In July the minimum price increased to 0.42USc/kWh, while the maximum price increased from 4.73 USc/ kWh. June and July saw an increase in price, which was much higher during the duration of the pool, while August showed a minimum price decrease 0.41 USc/kWh, while the maximum price also decreased, to 2.64 USc. A comparable situation occurred in September when the power pool acknowledged the price reduction. The minimum price was 0.41 USc/kWh and the maximum 2.76 USc/kWh. In October the price remained at the same level of 0.42 USc/kWh for the minimum price, while the maximum price at 2.42 USc/kWh, in November 0.40 USc/kWh and the maximum decreased to 2.06 USc/kWh. Finally December showed an increase in the minimum price at 0.41 USc/kWh, while the maximum price decreased to 1.48 USc/kWh.

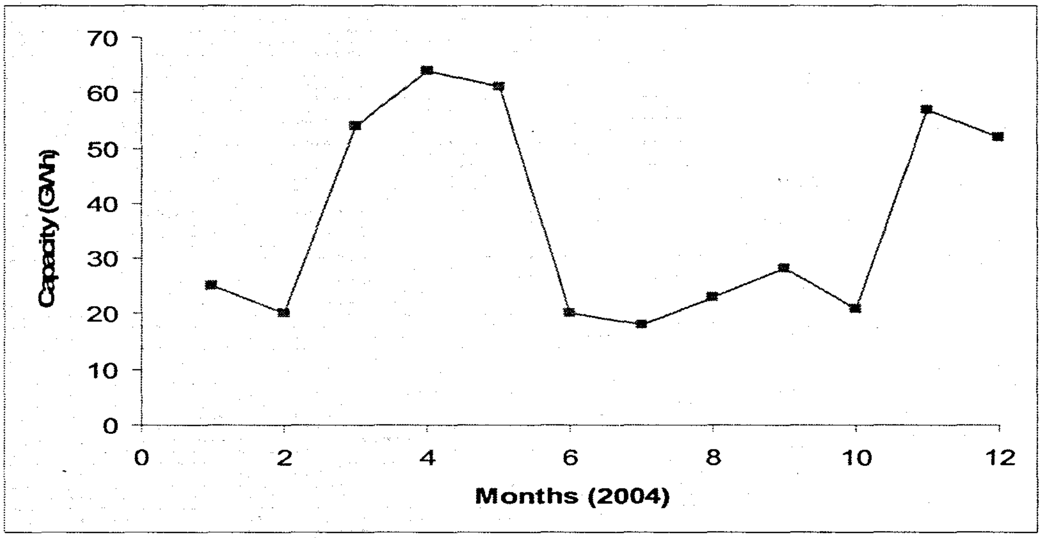

Figure 8. 23: Capacity sold in GWh in 2004

Each year had its own patterns in terms of capacity sold and money made. In 2004, as shown in Figure 8.23, 25 GWh was sold in January, 20.10 GWh in February. There was an increase sold in the power pool, which began to materialise in March with 54 GWh. It went higher in April with 64 GWh sold the highest capacity for 2004. The capacity decreased in May to less than 61 GWh and end of first period registered a decreased capacity of trade in the electricity market by exactly 20 GWh.

The beginning of the second period, in July 2004, registered the lowest capacity sold when only 18 GWh were traded during that month. Little progress was registered in August with 23 GWh sold to other electricity companies in the SADC or in September when 28.3 GWh was traded. In October the amount dropped again when capacity decreased to 21 GWh sold, but in November 57 was traded and in December 52 GWh went to SAPP members.

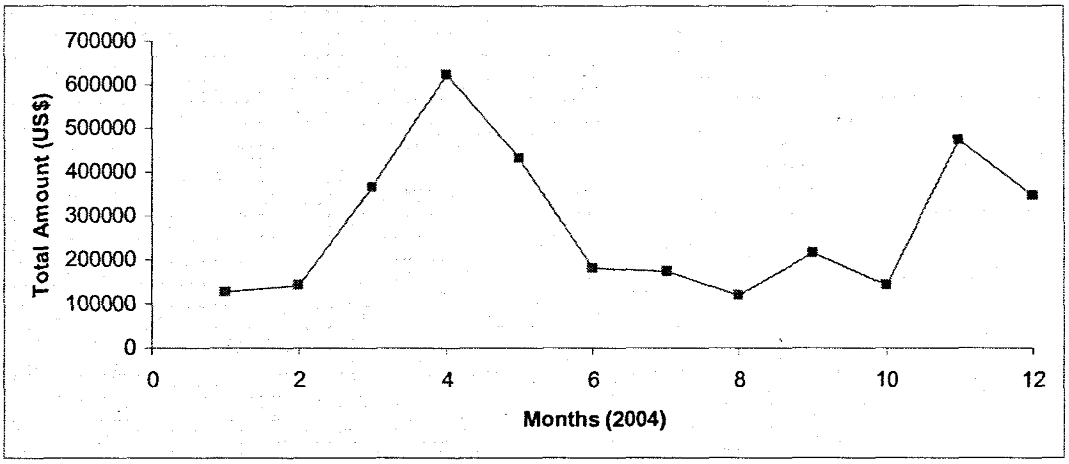

Figure 8. 24: Total amount in US$ in 2004

The financial report for each month is differs because of the prices fluctuations in the electricity market. There was also another element, contributing, to the volume sold and bought every month. In Figure 8.24 in January 2004, the sale of electricity was $120 000. In February that figure changed since there was an increase regarding the money earned in the SAPP $142 121. In March 2004 the electricity sold in the region was $360000 better when we compared to February. The highest trade for 2004 was registered in April $624000 for electricity sold in the pool. According to Figure 8.24, the month of May showed the decrease in the pool since $430 000 was registered. In June, the end of the first period of the year ended with a decrease in revenue $180 000.

The beginning of the second period of 2004 proved that there were no big changes. The financial report in July illustrated $173 000 were sold in the pool, but, August was the lowest in terms of revenue $120 000. Furthermore, in September the revenue of electricity again increased to $213 712.

In October, the power pool registered a lower returns of $142 000. The month of November seemed better than the previous month when $472 000 of electricity was sold. The end of the year ended on a positive note in terms of power trading with $348 000 was traded for the month. Irrespective of the closuring of different businesses in the region, the power pool registered a better closing financial year.

8.3.4 Trading of electricity in 2005

The power pool in 2005 reflects different observations electricity trading in the short term electricity market. There was a decrease of power trade in the region, due to different problems encountered in each country. Technical problems in different power plants across the region could have contributed to a reduction of capacity. Another element, which could be highlighted for 2005 was an increase surplus of power pool prices. Figures 8.25 indicate the results of energy trade in 2005.

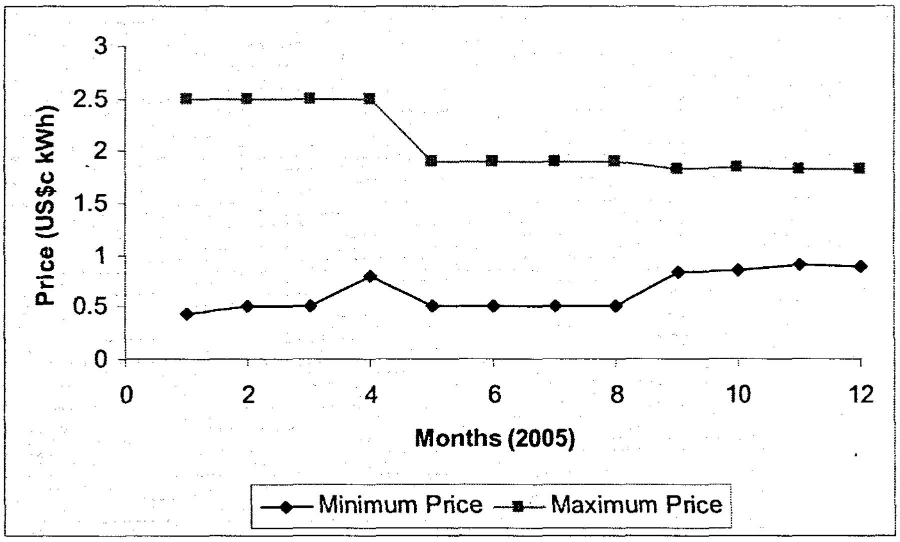

Figure 8. 25: Minimum and maximum price in US$/c kWh in 2005

Figure 8.25 shows a fluctuation of the minimum and maximum prices during the annual trading period. In January the minimum price started at 0.43 USc/kWh because of the volume of power within the pool. During the same period, the maximum price was registered at 2.50 USc/kWh. In February, the price minimum increased to 0.50 USc/kWh and the maximum appeared similar to January at 2.50 USc/kWh. In March the price was similar to February in both minimum and maximum prices but the volume of power trade differed. In April the price began to increase since the minimum price rose to 0.80 USc/kWh, while the maximum price stabilised at 2.50 USc/kWh. In May the minimum price decreased to 0.51 USc/kWh, while the maximum price decreased to 1.89 USc/kWh. The price at the end of the first period in June was similar to May's.

At the start of the second period of the year, in July, the minimum price remained 0.51 USc/kWh while the maximum was 1.89 USc/kWh. In August the minimum and maximum prices were parallel to July. An increase occurred in October, since minimum price was 0.83 USc/kWh and the maximum price remained at 1.85 USc/kWh. In November there was an increase in the minimum price, which was 0.90 USc/kWh and the maximum price decreased to 1.82 USc/kWh. The end of the year closed without bringing any changes in terms of pricing. In December the minimum price trade for electricity was 0.89 USc/kWh, while the maximum price was 1.82 USc/kWh.

It was shows that the price of electricity in the SAPP would not decreased below 0.50 USc/kWh during the coming year. A Lack of investment in the region is one of the key elements to blame for the increase of electricity prices in the pool. There is another factor, which is discussed later in the next section, concerning the results of the study.

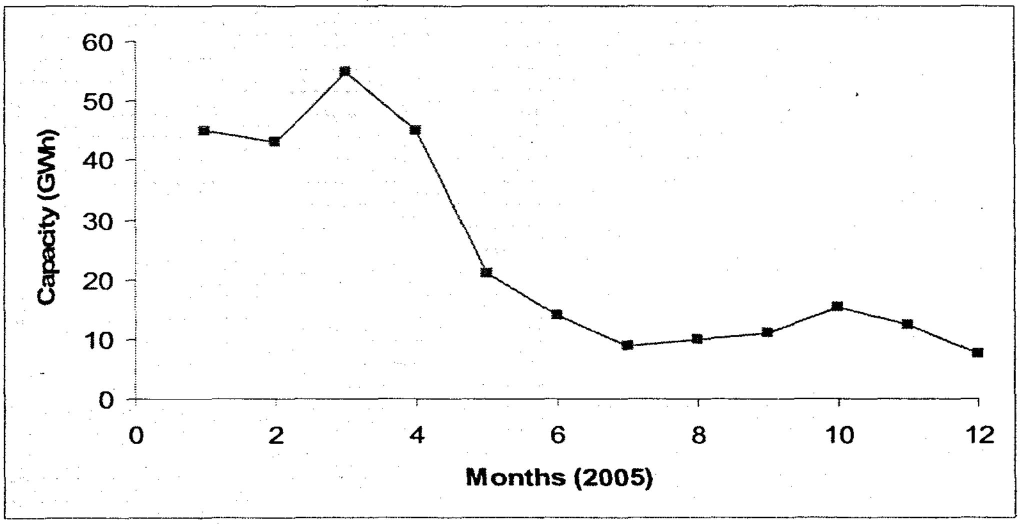

Figure 8. 26: Capacity sold in GWh in 2005

The capacity trade during the year 2005 began with a positive observation, which had declined by the end of the year. In January 2005, the capacity trade in the power pool, was 45 GWh. In February that volume declined to 43 GWh, and increased to 55 GWh in March. The change in capacity variation in the pool was linked to the reserves of electricity, which differed from one company to another. Some of the power plants did not have enough reserves to trade their capacity in the power pool.

In April, the capacity decreased again to 45 GWh. It went further down to 21 GWh in May, which showed that there was not enough capacity to trade in the SAPP. The end of the first period in June was negative for the power pool, since 14 GWh was traded. In July, the trade continued to decrease to 9 GWh. In August it increased 10 GWh, the reason being that many players participated in the power pool, but there were also other reasons, such as some power plants, had not operated to full capacity. In September, there was an increased of power trade to 11 GWh, which increased further to 15.4 GWh in October. In November the capacity trade decreased to 12.4 GWh, while at the end of the year, little capacity was sold in the SAPP, 7.6 GWh.

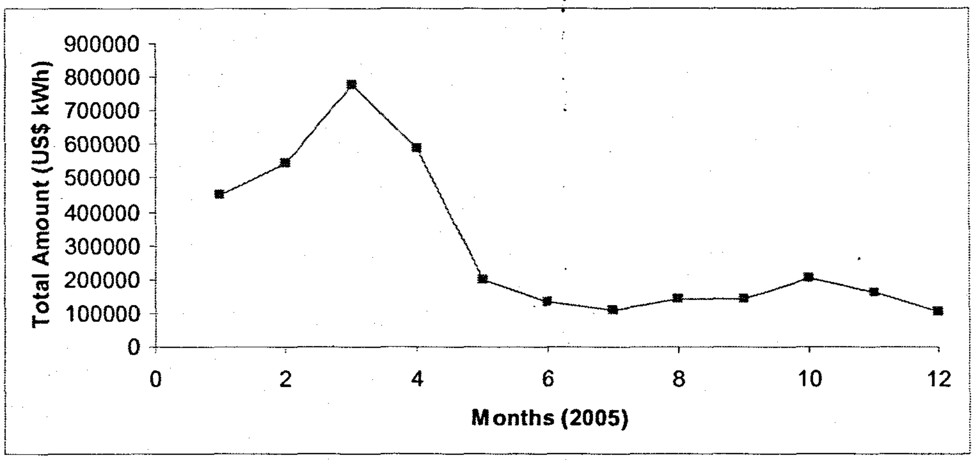

Figure 8. 27: Total amounts in US$ in 2005

The monetary value of power trading in the co-operative power pool of the region had decreased each year. This was because the volume of electricity, traded in the market, did not improved annually. Figure 8.27 reflected positive financial trade in January, since almost $450 000 was traded in the SAPP. During the shortest month of the year, February, there was increased sales of $544 000. March was the highest sales of electricity in the power pool, which amounted to $778 000, was sold in the region. Another similar situation occurred in April, since $586 000 was sold in the pool. After April the power pool began experience a decrease in trade. In May the pool sold $197 000. The end of the first period of the year showed a decreased to $131 000 in June.

July showed a decrease in the revenue of electricity when almost $108 000 was sold. In August the trade began to improve by earning $144 000. In September the pool registered a value of $141 000, while October increased to $204 792. November registered $158 722 and in December the lowest electricity sale of 2005 was recorded at an average of $105 926 was sold.

8.3.5 Trading of electricity in 2006

After five years of assessment concerning the trade of electricity in the sub-region, there is a major concern for the power trade. During five research years there was no improvement in terms of trading in the power pool, which meant the trading of power decreased each month during the five-year period of evaluation in the co-operative power pool of the region.

In 2006, the volume of electricity trade in STEM did not improve, while it almost collapsed compared to other years. Figure 8.28 present's an evaluation of power during 2006.

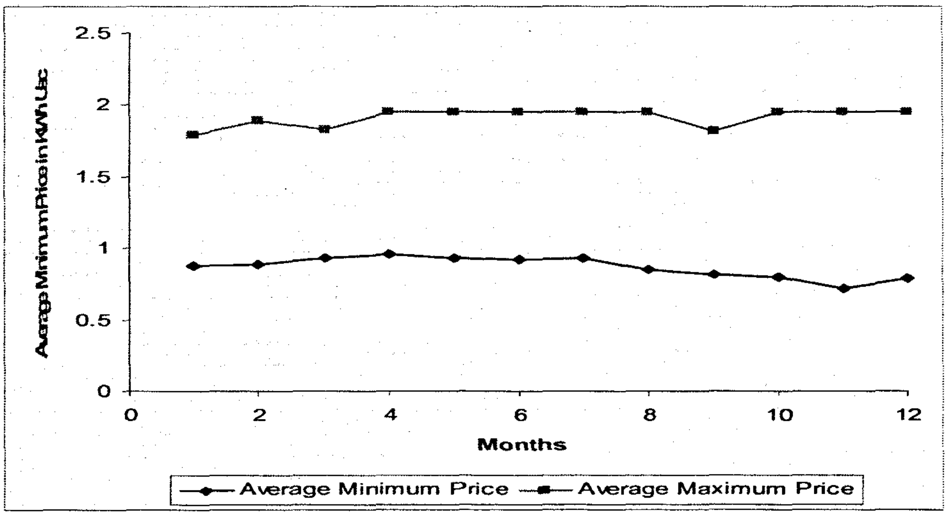

Figure 8. 28: Average minimum price in US$c/ kWh in 2005

At the beginning of 2006 the price of electricity per US cent, began with high figures. In January the minimum price of electricity was 0.88 USc/kWh, which was different to December 2005. The maximum price in January that month was 1.79 USc/kWh, while in February the average price of electricity changed to a minimum price of 0.89USc/kWh, and the maximum price increased to 1.89 USc/kWh.

The situation of price increase was in relation to the limited participation by electricity companies in the regional market.

In March the same situation occurred when the minimum price increased to 0.93 USc/kWh. The maximum price during that month decreased to 1.83 USc/kWh. April the average minimum price was 0.96 USc/kWh and the maximum price for the electricity sold was 1.95 USc/kWh. In May the minimum price changed to 0.93 USc/kWh, while the maximum price reflected the same as the month of April. The end of first period of the year ended with 0.92 USc/kWh for the minimum price and 1.95 USc/kWh for the maximum price.

The second period of the year in July did not reflect much change in terms of pricing, since the minimum price in the pool was 0.93 USc/kWh and the maximum price was 1.95 USc/kWh. In August the minimum price declined to 0.89 USc/kWh and the maximum price remained the same as the July price.

During the observation of prices in September, the minimum and maximum prices changed, which showed the minimum price at 0.82 USc/kWh and the maximum price was 1.82 USc/kWh. A similar situation occurred in October in terms of pricing, the minimum price decreased to 0.80 USc/kWh the maximum price increased to 1.95 USc/kWh. In November the minimum price was registered at a low 0.72 USc/kWh and the maximum price was 1.95 USc/kWh. In December the minimum price of electricity increased again to 0.79 USc/kWh, while the maximum price was similar to previous months at 1.95 USc/kWh.

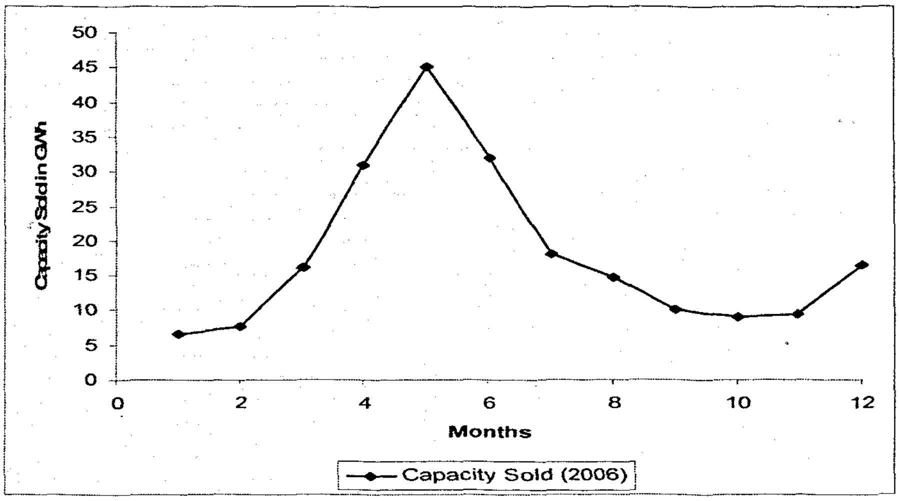

Figure 8. 29: Total capacity sold in GWh in 2006

The analysis of the capacity trade in 2006 was not as positive compared to previous year. In January the capacity trade in STEM was at a low 6.6 GWh. In February the electricity trade improved, slightly to 7.6 GWh sold. In March the power pool began to experience an increase in volume to 16 GWh. In April the power pool observed an increase in capacity to 31 GWh, while similar a occurred in May when 45 GWh went sold. In June, during the winter period, the capacity sold decreased to 32 GWh.

In July the performance of the power pool decreased further to 18 GWh. and in August to 14.7 GWh. A similar situation was registered in September when 10.1 only GWh was sold in the region. This showed how the trade of electricity has decreased in the SADC region. In October the pool recognised sales of 9 GWh in the STEM, whereas there was no change in November when 9.3 GWh was traded.

There was an increased capacity in December to 16.5 GWh. This evaluation has tried to demonstrate the problem, which the electricity sector faced in the region. There is a probability that these figures will continue to decrease during 2007 and 2008.

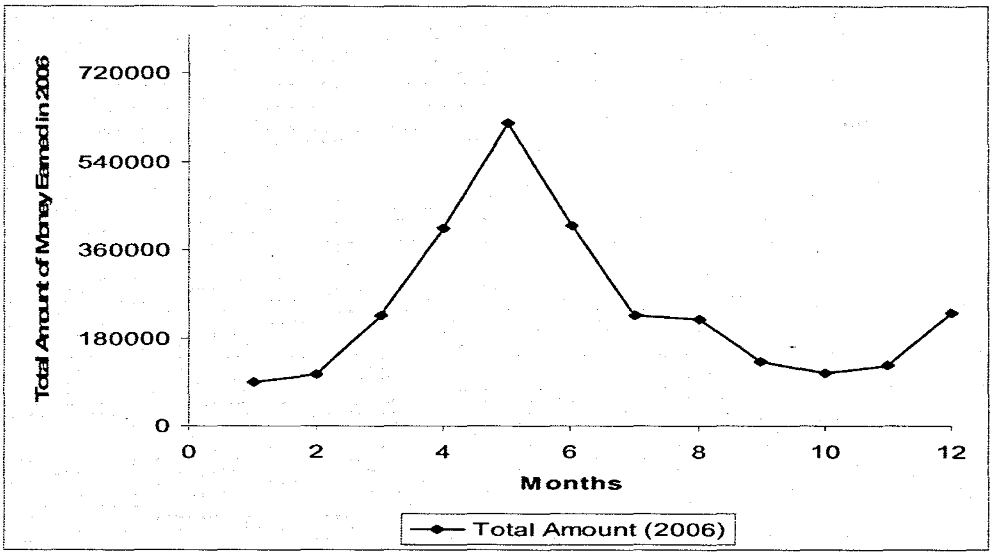

Figure 8. 30: Totals amount in US$ in 2006

The financial performance of the pool has declined each year for the past five years. There has not been positive growth in terms of electricity trading in the power pool among the national electricity companies. In January 2006, short term electricity market in the power pool sold electricity to the value of $90 000, while in February, the volume of trade increased, as shown in the figure above to $106 090. In March another increase was registered in terms of monetary value, which was observed within the pool at $227 382. It is important to understand that the value of the money has been shared among countries that trade electricity in the short terms electricity market, since the electricity trade is not only for one company.

In April the SAPP registered another good performance with regard to the trading of power when almost $405 548 was sold within the pool, while May also recorded an increase in the revenue of electricity at $618 696. This was the highest figure for 2006 for the trade of electricity in the region. In June that number decreased, which was not bad compared to other months. The value of electricity trade for that month was $409 843.

During the second period of the year, in July, there was a decrease in the money that was made in the SAPP when $225 253 was registered for the trade of power.

Also, in August there was another decreased of $218 744 for electricity sold. Furthermore, the decrease of electricity that was sold, continued in September when the power pool sold $130 958.

An analysis of these figures shows there was less participation within the pool among the utility companies, while trade remained low. A similar situation occurred in October when $107 270 was made for that month. There was little progress made in November when nearly $123 629 was sold. At the end of 2006, December ended on positive note with $232 789 was registered. The financial performance of electricity trade in the region was critical, particularly because there was no improvement in terms of cross-border trade.

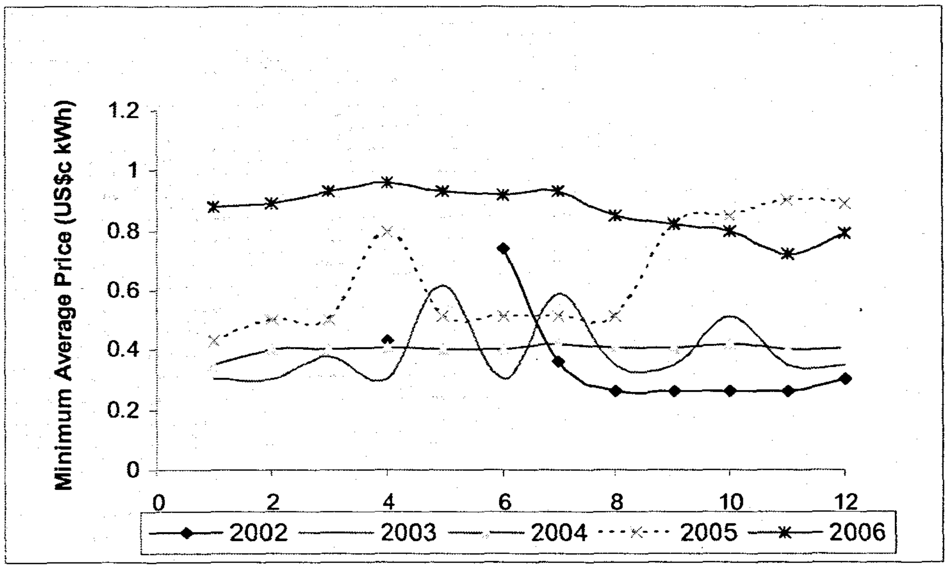

Figure 8. 31: Minimum average prices during five years

The importance of presenting the different minimum price to have an idea of when the minimum prices were higher compare to other years. Figure 8.31 demonstrates when electricity trading was expensive in terms of the minimum average price. It is shows in the figure above that in 2006 the minimum average price was the highest for the past five years. However, in 2005, during the period from October to December, the average minimum price was high compared to 2006.

The remaining months of that year showed that the price was lower compared to 2006. In addition, in 2004, the variation of the price was stable with only little difference in each month, is evident from the figure shown. The minimum average price changed almost each month during 2003, since the minimum price was not stable. The price fluctuated during the whole year.

In 2002, there was missing data from January to May when the minimum average price was not known. During that period the average price increased in June, however, compared to other years, 2002 was registered as the lowest minimum average price for the five-year period of evaluation of electricity trade in the SADC region.

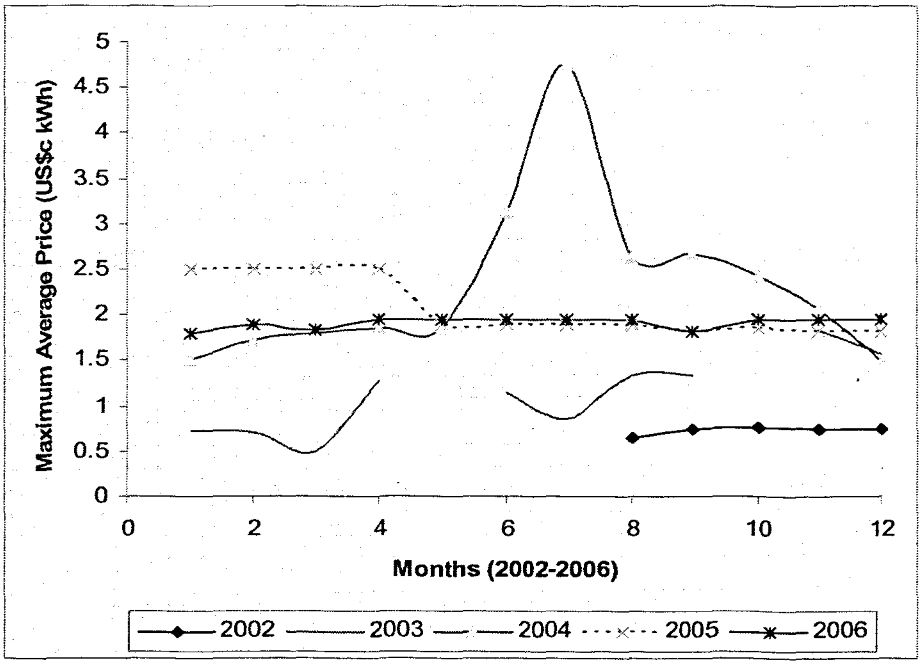

Figure 8. 32: Maximum average prices during five years

An assessment of the maximum average price in the SAPP reflected differences in the electricity prices, which traded in the pool. During the five years of trading there was no correlation of price. Figure 8.32 shows each year indicated different prices for the sale of electricity. The highest price in maximum average value was registered in 2004 during the middle of that year. In the beginning of that year, the price of electricity began lower but continued to change with the demands of electricity within the pool. At the end of 2004 the price decreased compared to other years.

In 2005, the maximum average price began at a high for four months only and declined in May until the end of the year. The different average prices during those seven months were 10 US cents. In 2006 the maximum average price remained stable but fluctuated throughout the year.

In 2002 and 2003, there was missing data, which could not convey to the study the exact maximum average price for some months. However, the two years (2002 and 2003) were registered as the lowest maximum average price of electricity trade for the duration of this study.

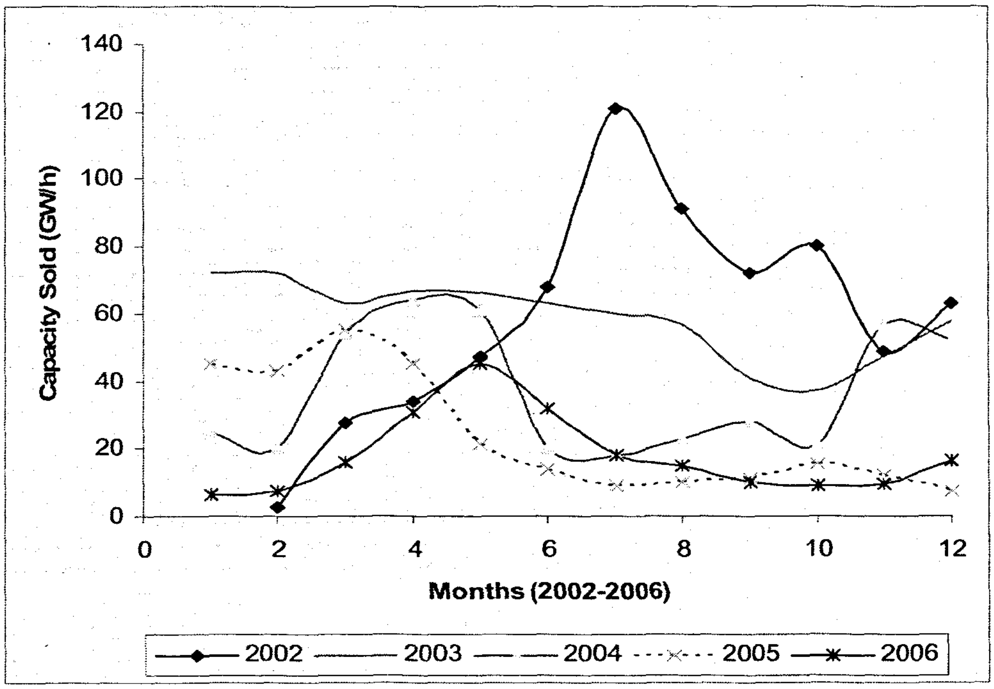

Figure 8. 33: Capacity sold during five years in GWh

The volumes were sold in the five-year period in the region differ. The demands of electricity in each country varied from one country to another. Some countries in the region did not have the surplus capacity to allow them to sell electricity to the pool. This is one of the reasons which were highlighted in the analysis of the power trading. In 2002, the capacity trade in the pool was the highest for the five-year. During that year many countries in the region traded their electricity reserves in the STEM, which would not be the case with other years.

Trading began with the lowest capacity of 25 GWh in February and ended in December with 63 GWh for electricity purchase by different companies. In 2003, the volume of electricity sold, increased to 72 GWh in January of that year and decreased to 58 GWh in December compared to 2002. In 2004, the trading capacity of electricity that was sold in the pool was similar to February in 2002, which had a capacity of 25 GWh, which was registered for the beginning of that year. The volume of trade fluctuated during the year and increased in December to 52 GWh.

The performance of the volume in January 2005 was better with 45 GWh. This volume was registered for a few months, but began to decline to a lowest level in December of 7.6 GWh, which was sold in the power pool. The last year of evaluation was in 2006 when the volume in January did not improve with an amount of 6.6 GWh. This volume did not increase for a few months and remained at a level of 16.5 GWh. This fluctuation of capacity trade in the pool did not stabilise because of a lack of investment infrastructure in the electricity sector for each country of this region.

In order to highlight the trade in the southern Africa region, there was one country, which traded the largest capacity in the SADC, namely Eskom, which was recognised as the biggest trader of power in the region. Table 8.18 provides a comparison of the volume of trade during the five-year period. The comparison assisted the researcher to know the importance of each country, selected in terms of selling electricity in this region.

Table 8. 19: Eskom capacity trade in the SADC and SAPP in GWh

Countries	2002	2003	2004	2005	2006
Botswana	1124	1390	1699	2111	1727
Mozambique	3907	5875	8076	10108	8167
Namibia	598	1114	1515	1821	1709
Zimbabwe	298	793	532	598	549
Lesotho	16	38	12	13	23
Swaziland	799	796	697	872	760
Zambia	103	151	403	465	187
SAPP	111	16	20	20	------

Sources: Eskom (2006)

Compare to the table 8.18 there was a difference in the trading of electricity in the region. It shows that Eskom increased the capacity on bilateral trade with other countries in the SADC. Nevertheless, it was observed that Eskom decreased the capacity in the STEM.

The large capacity of Eskom was traded by means of bilateral contracts with neighbouring countries. The table above also showed that Eskom did not trade electricity in the STEM for the whole of 2006, which could be one of the reasons for the decline in capacity trade in the power pool because Eskom could not sell its electricity reserves in STEM.

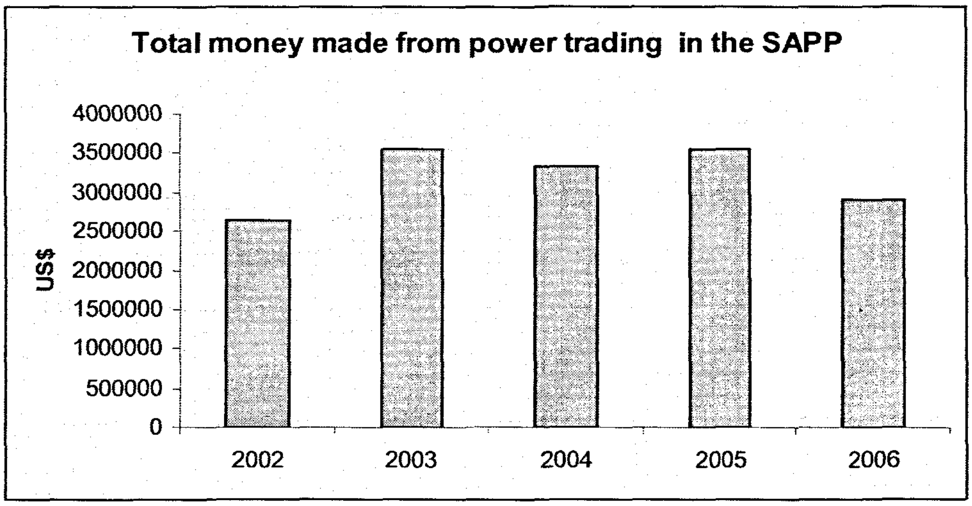

Figure 8. 34 Total money made in fiver-years from power trading in the SAPP

This figure represents the total amount of money made in each year in five years of evaluation in the STEM. In 2002, it is shows $ 2 632 753 was earned in the 12 months of electricity trading. In the following year 2003, the amount increased to $3 550 787. That year is registered as the highest money made in five years of this study. The analysis shows in 2004 almost $3 329 833 was earned in that year was less compared to 2003. Furthermore, another difference shows in 2005 in the STEM with an amount of $3 548 440 for electricity trade in 12 months. The 2006 showed a decrease in total money earned compared to 2005. During that year the STEM totalised $2 896 112 for the electricity trade within the region. This analysis shows there are fluctuations in total money made by the power pool in the SADC region. Each year represents a financial variable in terms of electricity traded in the regional power pool.

8. 4 Seasonality factor in a time series on electricity trade during five years

Seasonality is defined as a pattern that repeats itself over fixed intervals (Makridakis, Wheelwright and McGee, 1983:384). Seasonality could be found in the sale of crude oil, heating oil, electricity and so forth. For example, trading is higher in winter and lower in summer, which indicates a twelve month seasonal pattern. Normally this weather pattern is consistent from one year to the other. Figure 8.35 represents a time-series capacity for electricity trade in the STEM for different utility companies in the region. The figure shows a smoothing of the capacities of electricity trade in the SAPP from March 2002 to October 2006 obtained by using Equation 1 (SPSS, 15: 2007).

More of Equation 1 can be found in Makridakis, Wheelwright and McGee (1983:384). The seasonality applied in this research is only on the capacity traded in five-year of this study.

The importance of this statistic model is to understand the trends of electricity trade in the region, which have any seasonal trend. The research wanted to use a statistical model to analyse the trend, however, the statistical model needs five full years of data to interpret the findings. During the collection of data at the SAPP in Harare, missing values were encountered. For that reason the missing values prevented the researcher from using the statistical model. Furthermore, the time series models were created by using SPSS 15 a new version introduced in 2005. The SPSS 15 uses the formula below to interpret Graph 8.35, which present the time series analysis. This formula is the smoothed trend-cycle series (season algorithm). The smoothed trend-cycle series is obtained by applying a 3x3 moving average to a seasonal adjusted series. The result is as follows:

$$STC_t = \frac{1}{9}[(SAS)_{t-2} + 2(SAS)_{t-1} + 3(SAS)_t + 2(SAS)_{t+1} + (SAS)_{t+2}], \qquad t = 2,...n-2$$

An interpret of the formula is as follows:

STC= smoothed trend-cycle;

SAS= seasonal adjusted series; and

T= time.

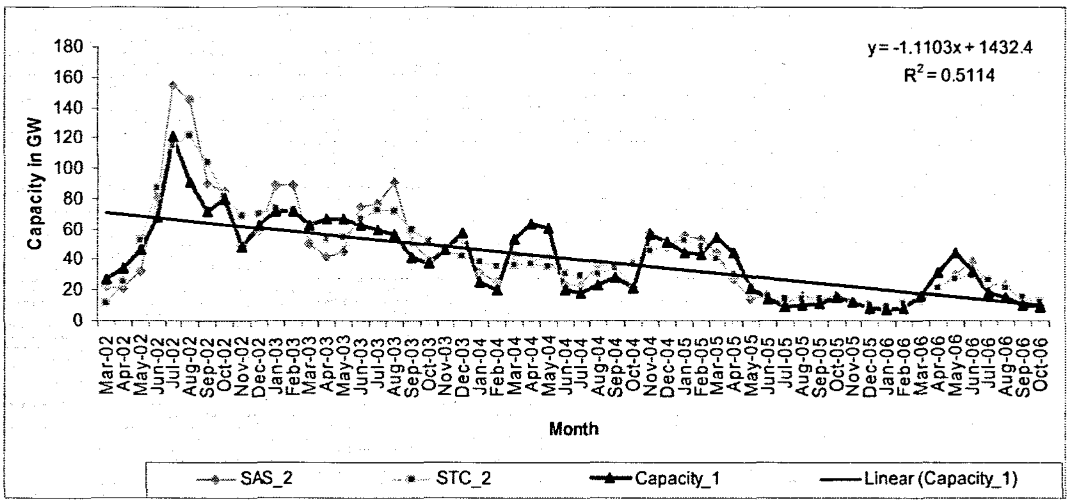

Figure 8. 35: Time series capacities

Figure 8.35 represents the time series analysis of the power traded in the short-term energy markets, from March 2002 until December 2006. There were differences that were registered in these four years and ten months concerning the seasonal adjusted series in terms of power trading within SADC. An interpretation of the figure highlighted the variation of the capacities, which occurred during these four years and ten months; each month represented a different capacity each year. It was difficult to find the same capacity trade in different months during the evaluation of electricity in the region. There were variations in seasonal trend cycles for capacities that were registered in the research.

The capacity in terms of season varied from the beginning of March 2002 and continues to change until the end of December 2006. The trade varied during the period of this research, while the regression linear showed a decline in capacity in the power pool. Many factors could be highlighted as reasons for the regression in capacity in the SAPP. There was a strong probability the capacity could continue to decrease in the future. This possibility is clear because of the reality of each country in the region.

The numbers of suppliers within the power pool have decreased each annually because of internal demands. Also, the problems which each country faced, impacted on the decrease of capacity within the power pool.

In terms of forecast, there was a limited chance capacity could increase to a high volume during the future year. The reasons for this decline are discussed in the following section. Figure 8.37 shows the minimum price of electricity, which began in August 2002 because of missing values from the beginning of that year. A similar situation occurred in 2003, when the values of two months were absent.

Furthermore, an interpretation of the minimum and maximum prices used the SPSS 15 formula to present Graph 8.22 and Graph 8.23. Therefore:

For t = 1... *n*

$$I_t = \begin{cases} (SAS)_t/(STC)t' & \text{if model is mutliplicative} \\ (SAS)\ t-(STC)t' & \text{if model is additive} \end{cases}$$

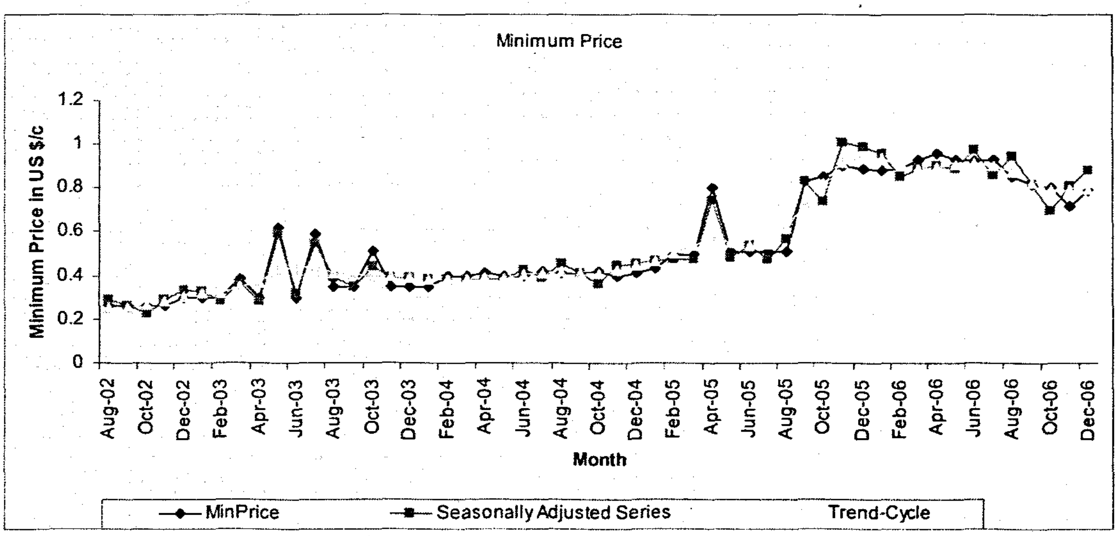

Figure 8. 36: The trend of minimum price

The minimum price changed with time when the research observed the price of electricity in USc/Kwh. A lower tariff began in the power pool, but the price increased each year because of the demand and supply of capacity within the pool.

The volatility of capacity within the SAPP influenced the increase of prices, was because of daily price variations. Another important element was the price of electricity was reviewed each year by the coordinator centre and member states. The seasonal adjusted series also showed a difference in each month, which could be related to the price of electricity. The trend cycle followed the pattern of electricity prices during the five-year period.

The analysis shows there was a probability that the price of electricity in the power pool would continue to increase in time. The factor, which could influence the increase of the price per Kwh, depended on the electricity reserves of each country within the region. Figure 8.38 presents an analysis of the maximum price USc/Kwh within the power pool.

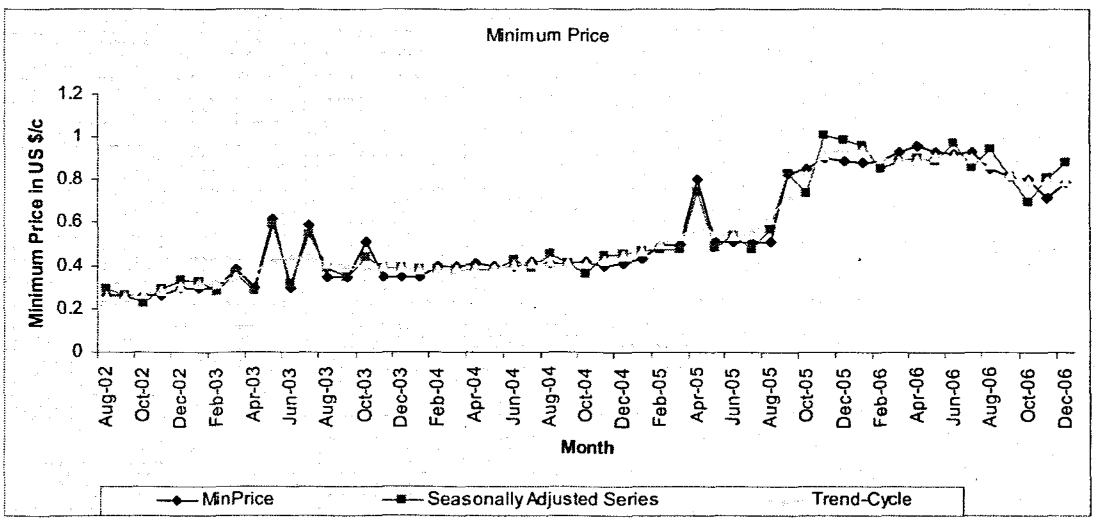

Figure 8. 37: The trend of maximum price USc/ Kwh

Maximum price increased gradually from August 2002 and continued each month. The highest price was observed in the middle of 2004, and decreased in December of that year. In 2005 and 2006 the maximum price fluctuated differently to 2003 and 2005. This situation should be relied on in terms of the demand and supply of electricity in the STEM. The price increased in accordance with the country bidders who bought electricity from the STEM. The seasonal adjusted series followed the same trend with the maximum price during the full four years and ten months. The trend cycle also showed the same pattern. An analysis of Figure 8.37 shows that a possibility the energy trade in the short term energy markets with regards to the maximum price would continue to increase.

The situation could change only when the energy minister for the 14 SADC countries decided to transform the power pool.

8.5 Autocorrelation to Verify Seasonality on Capacity Traded in Five Years

For seasonality to occur a positive autocorrelation should be shown. A higher positive autocorrelation means a higher reliability of seasonality. In this regard, autocorrelation analysis is carried out in this research in order to show some degree of seasonality in the evaluation of power trading in the SAPP on a five-year period. To estimate an autocorrelation value, the data should have 12 points. Autocorrelation value for 2002 was not calculated, as one value was not available. The formula that was used to calculate the autocorrelation values r_{auto} as follow:

$$r_{\substack{auto \\ (lag-k)}} = \frac{\sum_{t=k+1}^{n}\left(X_t - \overline{X}\right)\left(X_{t-k} - \overline{X}\right)}{\sum_{t=1}^{n}\left(X_t - \overline{X}\right)^2} \qquad (2)$$

Where X_t is the time series value that is lagged onto itself, $\overline{X}$ is the average of X_t for the reference year and *t* is the total time period (Makridakis et al; 1983:41). To further explain equation (2), X_t is capacity trade in first month of the year, $\overline{X}$ is average of entire capacity trade in 12 months, and X_{t-k} is observation at time (t – k) where the series lags on itself.

A positive value of autocorrelation, translate into seasonality, while a negative value shows no seasonality. Figures 8.38 will shows seasonality, which occurred during five years of the study. The calculation could not take the whole sixth data points, while only 15 lags were calculated because of limited data points. This will have a link with the trading of capacity during different periods of the year. It is important that this study avoids speculation concerning seasonality during the five-year period of the evaluation of electricity traded. Figure 8. 38 presents the results of calculations of autocorrelation relating to seasonality for power that was traded.

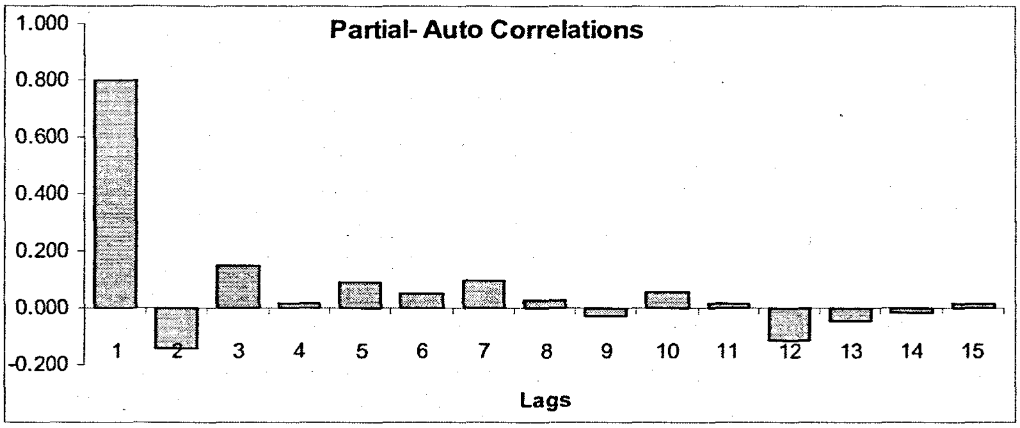

Figure 8. 38: partial-autocorrelation in the Southern Africa Power Pool

The results of autocorrelation show there was a limited seasonality occurring during the five-year period of the study. This could demonstrate less probability for this study to predict forecasts of an increase in capacity for next year or in the near future. The research findings in the short term energy market show a decrease of electricity capacity in the regional power market. This required a new mechanism strategy for the 14 member states, should they increase capacity in the power pool.

8.6 Nature of the Research Findings

The aim of this research was to evaluate the impact of power trading in selected countries within the southern Africa region and the policy mechanisms within the region. The research further aimed to make a marked contribution to the existing body of knowledge within the field of regional cross-border power trading, by identifying its strengths, weaknesses within the electricity companies; also opportunities and threats outside of the companies.

The researcher evaluated data collected to discover the problems, faced by selected countries within the region with regards to power trading. The research disclosed power trading by bilateral contract and for those on short-term energy markets was limited. The findings of the data analysis linked to four factors which could explain the limitations of capacity within the SAPP. Those factors included political, economical, population demand and infrastructure demand.

8.6.1 Political environment

Power trading in the countries used in this study differed because each country had different policy. More specifically, concerning cross-border electricity trading, it was found that Eskom, the public enterprise company and a member of the SAPP, did not sell its power reserves (Tables 8.19) in 2006. Power trading at SAPP was low compared to the bilateral contracts with neighbouring countries with whom Eskom trades. It was also recognised that the South African utility produced 90% of the electricity which is generated in the region. Politically speaking, the South African government, through Eskom, had neglected the regional body. The findings could be linked with what was stipulated by the minister of energy in Chapter Three. Further information concerning the MOU on power trading is presented in appendix B to this study. In the MOU, there is a commitment, which bounds member states to sell electricity reserves in the power pool. From this study it is evident that they do respect their commitment.

According to Musaba (2006:1), the decline of capacity in the regional market was because there was limited expansion of the electricity market within the region. The findings obtained from this study, showed the DRC government, in collaboration with its national electricity company, sold power by bilateral contract to Zimbabwe and South Africa within the SADC region. According to the information received from the SAPP, SNEL does not sell its power reserves to the short-term energy market. In addition, SNEL's participation in the power pool was based on a bilateral contract, rather than the short term energy market. In terms of the evaluation of power trading in the power pool on a daily basis, the participation of the DRC's in the short term energy market was almost zero. This situation was because SNEL had traded electricity with no members of the SADC, such as Congo Brazzaville, while it has also attempted to supply its internal demand.

This study found the internal political problem in Zimbabwe had negatively affected the national power utility (ZESA) for the past six years. In 2007, the Zimbabwe Government and ZESA were struggling to maintain the electricity company so that could operate smoothly and remain financially stable.

Those constraints were among the factors, affecting the decline of capacity in the SAPP. It was argued by Zimbabwe Online (2006:2) that ZESA had applied to the Reserve Bank of Zimbabwe (RBZ) for funding of two new power projects aimed at improving Zimbabwe power outage, as ZESA had failed to meet national demands, the demand of electricity in Zimbabwe had increased by 3% annually.

In addition , "Zimbabwe online" commented if foreign currency was available to improve generation at Hwange Power Station and Kariba Hydro Plant to a maximum capacity, their combined output would still fall short of national power consumption (Zimbabwe Online:2006).

The interview with a senior executive of ZESA clarified the problem. The central government allowed the national electricity company to sell electricity cheaper to customers. The electricity imported from South Africa, Mozambique and the DRC, proved more expensive, according to a government official in the Ministry of Energy and Power. The study also disclosed the Reserve Bank of Zimbabwe purchased power on behalf of the national utility (Zimbabwe Reserve Bank Policy Review, 2006:2).

Further evaluation showed the participation of Zimbabwe in power trade, was limited on a daily basis. It was, shown at times, that ZESA traded power in the power pool at night, while during the day the national utility imported part of its electricity from different countries. The financial crisis within ZESA did not allow the company to import power daily because of its lack of financial reserve. The continuation of political instability in Zimbabwe in the long run would affect the Southern Africa Power Pool. The five-year study on evaluation confirmed the problem.

This study also revealed the regional body SAPP faced a problem because capacity in the region had decreased. Most national electricity companies within the region experienced a lack of proper planning for new electricity infrastructure. This finding was clearly elaborated in Figure 8.35. According to the MOU of member states (1995), the SAPP was established to reduce the costs of building new power plants in the region and to use reserve capacity within the neighbouring countries. This was confirmed in Chapter Four of this research. However, the MOU has not in reality reflected this. Less capacity had been traded in the power pool. In reference to Asian countries, the development of power trading in that part of the world was developed by the involvement of private companies. According to Croussilat (1998:1), the initial attention for power trading was spread by the private companies was found to develop a cross-border trading agreement, something which could be used in the SADC.

There is a need for the regional body (SADC) to allow the participation of private companies to engage in oligopolistic competition in the electricity sector. It is argued by IEA (2002:34) that most electricity markets were oligopolistic in nature. An oligopolistic market structure tended to favour investment in structures that led to higher consumer prices and accrued profit, which induced the entry of new competitors. The participation of private partners was not yet well developed in the SADC region. Crossilat (1998) further commented oligopolist companies may also have incentives to deter new entries. In the UK, the power market had been in operation long enough to allow for an examination of the effects of market structures on investment. This study suggests recommendations on political points view in Chapter Ten.

8.6.2 Economic environment

With the establishment of power pools in this region government should ensure power plants operated fully. It was also exposed in the study that some power plants in the selected countries, particularly in Zimbabwe and the DRC, had defects. Furthermore, the study revealed many power plants (coal plants and hydro power) had not generated electricity to full capacity. From a business point-of-view, plants that do not operate fully cannot sell electricity, which is one reason for decrease in capacity within the SADC. When a plant was out of operation because of a lack of spare parts it represented a large loss of income for the nation's government. According to IEA (2002:16), even when a plant does not operate, keeping the plant available to meet unexpected demands has a substantial value.

The reliability of power can help to differentiate generators in the electricity market. Therefore, the governments (South Africa, Zimbabwe and the DRC) should emphasise an improvement of plant reliability and availability in order to maintain the demand of capacity within and outside the country.

Zimbabwe and the DRC face financial problems that have limited investments in many important social sectors. Such a lack of financial capacity does not allow a government to inject funding into its electricity company in order to repair any plants. Therefore, the electricity capacity to generate in those two countries was limited and unable to satisfy internal and, naturally, external demands, which is why, the principal argument of the study is that a new mechanism for investment in this region was required. According to IEA (1999:16), the abilities of the countries to mobilize sufficient capital for energy investments should depend on the quality of their investment, as well as their fiscal and regulatory policies. This, in turn, crucially affects the rate of economic growth and living standards of the people in those countries.

The economic development in the SADC region also played a major role in the decrease of power in the power pool. Each country in the region has realised an increase in power demand and electricity consumption owing to development of their economic activities. For this reason, most of the electricity reserves generated by different countries within the region, could not trade again because of higher internal demand linked to the economic growth of each country. For example, in South Africa last year (2006), the internal electricity demand increased to 4.6% after three months (Mbendi: 2006). This increase of consumption impacted negatively on the power trade because Eskom stopped supplying its internal reserves to SAPP. With an increased internal demand for power in member's countries, capacity trade in the power pool decreased.

Economic growth also affected the price of electricity traded during the five-year period of this study. The price of electricity changed each month because of instability of capacity. This was elaborated in Figure 8.36, which described the average minimum price; similar results are found in Figure 8.37 on the maximum average price. During the evaluation of the study it was observed the decline of capacity in the power pool affected prices within the electricity market. This was reflected in the quantitative data, which was collected from the Southern African Power Pool.

An analysis of the data showed less capacity was traded by the co-operative power pool. The implication of this situation within the SAPP showed a lack of investment in the electricity sector. According to IEA (2002:11), in order to create production capacity, which will sustain export and upgrade, the structures require investment. The above argument points to the fact governments in this region should invest in power capacity. The decrease of capacity within the SAPP was because of a lack of new investment in the energy sector. It was also argued by the IEA (2002:15) that, under traditional regulatory regimes, investment decisions were taken, and approved by governments. In this context, the planning process aimed, in principle, to achieve the optimal investment level, focusing on meeting forecast growth in the demand for electricity and on replacing plants no longer physically operable.

8.6.3 Population demand

The research found the population demand for electricity in the SADC region increased in the past five years. The domestic consumption in selected countries increased each year, which impacted on capacity demand. It was found not only were households obtaining new appliances, but were doing so rapidly. This situation was categorised by different groups. Another element the research observed was a change in population size. The size of homes and the number of housing units affects the amount of electricity consumed. From this study, in South Africa, electrification in rural and urban areas had increased owing to population demand.

The South African government had set a goal to increase national electrification programme levels to about 66% by 2001, with an average electrification level of 46% in rural areas and 80% in urban areas (Davidson and Mwakasonda, 2004:30).

It was also disclosed by the National Energy Regulator of South Africa (NERSA; 2003:1) in 2003, access of electricity in urban areas increased to 77%. These results implied consumer demand in electricity use increased annually, particularly in South Africa. However, in other selected countries of this study, such as the DRC and Zimbabwe, similar programme had not occurred.

8.6.4 Infrastructure demand

This research shows there was less infrastructure planning development in the electricity sector within the selected countries of this study. The researcher found the decrease of electricity volume within the power pool was because of lack of electricity infrastructure in SADC countries. The study also revealed no new electricity infrastructure in place within the countries of this research, as well as the remaining 11 SADC countries. For the passed 15 years in this region no new electricity infrastructures have been established. According to Leigland, (2005:3) African countries had less access to infrastructure than in any other developing countries. It is reported by the African Development Bank (1999:14) that infrastructure has a direct effect on investment, trade and growth. A similar finding in this study suggested the lack of infrastructure development impacts on the volatility of power capacity within the SAPP.

The IEA (2003:365) argued in Africa the rate of investment in power infrastructure declined during the 1990s. Economic growth was modest and per capita income remained flat throughout the 1990s. Spending on infrastructure, relative to GDP, appeared to have been less than 1%. In Asian countries, 2% to 3% of GDP was spent on electricity. This analysis of the IEA had an impact on this region because for the past 15 years none of the governments had produced new power infrastructure.

This situation is expected to change in South Africa because of better economic development and the soccer World Cup in 2010. Much infrastructure was needed and the demand for electricity would be high in order to respond to demands. There were other problems within the electricity infrastructure to which the South African government need to attend. In big cities such as Johannesburg, Cape

Town, electricity infrastructure was generally in poor shape. Although the large metropoles had better networks than the smaller municipalities, their infrastructures had deteriorated because of a lack of investment. This problem was found not only within South Africa, but was also present in the other selected countries used for this study. Most governments should prioritise the development of electricity infrastructure in different countries of the SADC. Government planning in the different countries of this study continues struggling to implement a strong mechanism which would boost electricity infrastructure. The success of electricity infrastructure implementation would contribute to an increase in capacity within the region. Also, the price of electricity within the power pool should then decrease. The researcher found most governments contacted for purposed of this study were willing to apply PPP to develop the electricity infrastructure. This technique was also applied on the Asian continent, in the south east region (Croussila, 1998:1).

In addition, Croussila (1998:1) argued, the Mekong region was influenced by the participation of the IPP in that part of the world. The initial attention was spread by private companies wanting to develop a cross-border trade agreement. Bringing PPP into action in the SADC region could have positive and negative impacts on the energy sector. On one hand, the implementation of PPPs should bring competition to the energy sector within the country, a positive element involving the development of industry and expansion of infrastructure. On other hand, the national utility will not complain concerning the decrease of energy. The participation of PPPs in the SADC region would assist the different governments to invite the private sector to enter the power market, particularly, where there were problems concerning power generation.

8.7 Research findings

The research findings have limitations that occur from the chosen triangulation research methodology used in this study. The findings focus only on the data collected during the fieldwork in three selected countries and five year, data power trading, collected from the Southern African Power Pool. Therefore, there are hypotheses that should be confirmed or rejected based on the results arising from this research. Firstly, the research should confirm the hypotheses suggested in the research. During the analysis of this research it emerged power trading was not as uniform as stated in Chapter One. Secondly, research rejected the hypotheses that power trading was not based only on bilateral agreements, but also on short-term energy markets.

Thirdly, a second hypothesis was confirmed because power trading was influenced by different factors within the region. Economic factors were among the strongest factors affecting power trading. It was also true there need some countries depend one on others for the importation of electricity, to satisfy internal demand.

Fourthly, another hypothesis was confirmed only for the DRC government because they had two companies, already operating in terms of PPP. Another two countries, South Africa and Zimbabwe, had not incorporated PPPs into their electricity sector; discussions with other respective ministries of energy with private companies were ongoing. The research should also confirm a hypothesis that seasonality occurred in power trading.

The research findings were divided into four sections. The first section, 8.7.1, discussed capacity; the second section, 8.7.2, discussed the fluctuation of price; the third section, 8.7.3, discussed the seasonality that occurred with power trading; while the fourth section, 8.7.4, discussed limited forecast for the Southern African Power Pool.

8.7.1 Decline of Capacity

The volume of electricity traded among different countries within the SAPP during the five years of data analysis demonstrated that the trade was declining. Figure 8.35 presented that there was a fluctuation of the capacity, less each year. The capacity trade in the pool had not stabilised because of a lack investment in the electricity sector in the countries. Based on the observations in this study, selected countries faced internal demands and their participation in the power pool had become limited.

Other countries had similar problems in terms of power generation. The impact of this situation in different countries reflected on the limitation of trading in the regional power pool.

8.7.2 Price Fluctuation

The price of electricity within the power pool changed with time in accordance with the capacity trade in the electricity market; figures 8.36 and 8.37 confirmed this statement. In terms of bilateral trading, the study found it was difficult to know the exact price which each country charged another. The observations in terms of the price in the electricity market showed the electricity price increased annually. Depending on the demand of member states, the price of electricity was fixed in terms of the cost of production. But capacity to trade in the power pool became limited, so the price in the power pool continued to rise.

8.7.3 Seasonality Factors

The seasonality analysis of electricity trade in the SAPP during the five years of this research reflected different answers. According to the co-ordinator centre manager, the lower season was between Octobers and May, the higher between June and August. During the calculation of the autocorrelation, seasonality did not occur in that fashion. The findings showed the seasonality differed because of volatility of capacity trade within the power pool. There was a seasonality difference shown in this study because of limited capacity trade in the electricity market.

8.7.4 Forecast limited

The linear regression in Figure 8.35 indicated a decrease in power capacity within the SADC and, more specifically, within the SAPP, which is considered as an electricity market. In terms of forecast, there was a limited probability that capacity could increase in higher volumes in the future (2008, 2009 and 2010). The study could not provide an answer for volume for that year because each country had its own problems in terms of its electricity sector.

8.8 Summary

The responses of government officials from the selected countries reflected the respective government's views in terms of power trading in the region. These responses assisted the researcher to understand the involvement of these governments in the power pool. Furthermore, the trade of power was well controlled and understood by each electricity company responsible in each country. The result of the data showed the power pool experienced difficulties in increasing capacity of power trade among its members. The selected countries indicated there were internal problems in terms of increasing external trade.

The next chapter will discuss the normative model which the research suggests for the transformation of the electricity industry in the SADC.

CHAPTER 9. A NORMATIVE MODEL TO IMPROVE POWER TRADING IN THE SADC

9.1 Introduction

Chapter Eight presented the analysis of the fieldwork data and an interpretation of the findings, as well as discussions of the results. This chapter discusses an implementation of the normative model in order to assist the increase of power trading in the SADC region. The implementation of the normative model is derived from the findings of the qualitative and quantitative survey, which was used in this study. The objective of the normative model in this study suggests an increase of electricity capacity within selected countries and the Southern African Power Pool.

The implementation of a normative model in the research will not have a link with other types of models, which have already been applied in other studies. The research applies a normative model because it was found there was a dysfunctional situation concerning power trading in the SADC. The application of the normative model was to develop framework criteria that could be used by governments and the electricity companies. The decrease of power within this region required a solution from policy makers within different governments. The utilisation of such framework criteria could change future conditions within the electricity sector in selected countries and the SADC region.

In this chapter, the concept of model will be briefly discussed and various examples of different types of models illustrated. The conclusion, a normative model which could suggest a change within the region. This model would be adapted to suit the regional body, which would increase the trading of power in the co-operative power pool.

9.2 Overview of Model Theory

The reason for choosing a normative model was to try to suggest a solution for energy security within this region. The SADC was a region, which faced a problem in terms of power capacity within its power pool. There was a need for policy recommendations from different governments to solve the electricity problem. It was important to define the concept of model. Different authors gave different definitions of the concept of model.

For the purpose of this research, the researcher decided to use the definition of Stachawiak (1973). According to Stachawiak (1973: 14) a model should possess three characteristics:

- The mapping feature of a model is based on an original;
- The reduction feature of a model reflects only a relevant selection of the original's properties; and
- The pragmatic feature of a model requires it is usable in place of an original unit with respect to some purposes.

Stachawiak further explains a characteristic of a model: The first two characteristics are covered simultaneously if one speaks of a model as a "projection", since this implies both something that is projected (the original) and that some information is lost during the projection (Stachawiak: 1973). It meant what is retained depended on model's the ultimate purpose. A third characteristic was detailing the pragmatic use of the model. It is argued by Steinmuller (1993:32) that a model is information:

- On something (content, meaning);
- Created by someone (sender);
- For somebody (receiver); and
- For some purpose (usage context).

In understanding the concept of model, it was necessary to relate it to the concept of this study. The model suggested in this research should rely on an increase of power trading in the Southern African Power Pool. This study used the concept of a model for the interpretation of a policy solution which would then solve the problem of power between member countries.

9.2.1 Different Types of Models

The importance of this different type of model was to demonstrate the way policy was chosen by governments.

A policy was constructed when there was need for a government to try to solve a problem facing its country. Several countries in this region faced many problems; environmental, economic, poverty, unemployment, a reduction of energy capacity and more. These problems presented required region governments to suggest a policy model which might bring a solution.

According to Dunn (1994:152), policy models were simplified representations of selected aspects of problem situations constructed for particular purposes. Just as policy problems are mental constructs based on the conceptualisation and specification of elements of a problem situation, policy models are artificial reconstructions of reality in issues areas ranging from energy and the environment to poverty, welfare and crime. The importance of a policy model derives from its ability to express a concept, drawing or figure, mathematical equation, or other type of symbol which could assist in finding a solution to a particular problem. Dunn further states that policy models were useful and even necessary (Dunn: 152). They simplified systems of problems by helping to reduce and make manageable complexities encountered by policy analysts in their work (Dunn: 152). In the context of this study the researcher discussed two different models, the descriptive and normative.

9.2.2 Descriptive Models

It is argued by Hanekom, Rowland and Bain (1986: 30) that descriptive models dealt with the actual process of policy making, the individuals or groups involved, and the institutions concerned with policy making. The same concept of descriptive model was also defended by Dunn (1994:153) who asserted, the purpose of the descriptive model was to explain and /or predict causes and consequences of policy choices.

Descriptive models are used to monitor policy actions outcomes, which could be illustrated by an example the annual list of social indicators published by the Statistics Bureau of South Africa. In order to illustrate it with other selected countries of this study, in Zimbabwe for example, the Reserve Bank of Zimbabwe represents this kind of indicators, while in the DRC it was the Banque Centrale du Congo.

a. Functional Process Model

According to Anderson (1979:20-21) an analysis of the functional activities involved in policy making is:

- Alternative solutions;
- Participants in policy- making and execution;
- Adjudicatory pertaining to the success or failure of a specific policy; and
- Adaptation of legislatory measures.

The functional process model was particularly appropriate for a comparative study of policy-making. This is not without defects however, since consideration of the aspects referred to might create an idea that policy formulation was nothing but an intellectual process, which, in turn, could lead to the disregard of certain variables. In spite of the inherent insufficiency of this model, consideration of the aspects on which the model is based might contribute toward rationality. Clarity could be obtained regarding specific functional activities, involved in the formulation of policy (Anderson: 1979).

b. Group Model

In this model there was a participation of different organisations, which could influence the formulation of policy. These different organisations could be called pressure groups. Dye (1978:23) state, a pressure group usually acted as a link between the individual and policy maker, as well as the importance of pressure group, which determined its contribution to policy. The legislator, however, remained the final judge and used legislative measures to ratify the results of group influence and demand. It should be kept in mind that the civic organisation or pressure group could disrupt the formulation of policy when there was poor collaboration between two parties. This situation occurred when the policy maker did not want to take into consideration demands of a pressure group. Hanekom, Rowland and Bain (1986: 32) demonstrated the value of the group model for policy analysis by the identification of pressure groups and an acceptance they did have the power to influence policy and, as a result, could not be disregarded when analysis was made of a specific policy.

In order to contextualise this study, the pressure group could influence a government to reduce the price of the electricity within the country, especially when they knew the economic situation of a country was poor as in the case of Zimbabwe.

d. Elite/ Mass Model

The elite model/mass model is occurred when a small group, at the top of the organisation or government, were responsible for formulating policy. The policy was formulated at the top level of government which flowed from the elite to public officials. Senior government officials ensured the policy was implemented. According to Dye (1978:25), the idea established by the elite/mass model was the elite had consensus on policy and that the interests of the masses were secondary to the interests of the elite. Most of the time the idea of an "elite" could cause conflict within many communities.

Hanekom, Rowland and Bain (1986:31) argued an advantage of this model, which analysed public policy, lay in its identification of the contribution of a specific group involved in policy formulation and execution. It was also argued by Cloete, Dekóning and Wissink (2005:37) this model was based on the assumption the elite were firmly in power that they knew best and that consensus on policy existed within the elite group. This model shows the priorities of the elite were of primary significance.

e. The institutional Model

The implementation of an institutional model was focused mostly on the role of public institutions involved in policy making. It is common knowledge that public policy was a product of government institutions. Cloete, Dekoning and Wissinck (2005:39) said public policy was legitimised by government and only government policies applied to all members of society, since the structure of governmental institutions had an important bearing on policy results.

The same argument was developed by Hanekom, Rowland and Bain (1986:32) when stated the importance of the institutional model was found in the possibility of formulating a uniform policy, which was given legitimacy by the legislator, thus ensuring a legislative monopoly in deciding what policy makers wanted to do with the community. For the changes to occur in the electricity sector within this region, legislator should advise each government of best procedure. The intervention of the legislator could make an impact on decisions the respective ministers of energy took for an increase of capacity in the Southern African Power Pool.

9.2.3 Prescriptive Model

It was pointed out the prescriptive model to policy–making focused within normative theory, that is, how senior government officials acted. It was argued by Dunn (1994:153) the objective of normative models was not only to explain and/or predict, but also to make rules and recommendations for optimising and attaining utility.

Among the many types of normative models used by policy analysts, were those that helped to determine optimum levels of service capacity (queuing models), the optimum timing of service and repairs (replacement models) and the optimum volume and timing of orders (inventory models), as well as optimum return on public investments (benefit-cost models).

Furthermore, according to Easton (1965:13), normative theory, adopted a value as its objective and evolved an explanation in terms of the conditions necessary to maximise a selected value. He commented further that this theoretical strategy was not unknown in social research and had paid considerable dividends, whatever its important limitations might be (Easton:1965).

Hanekom, Rowland and Bain (1986:32) pointed out policy outputs and policy impacts should therefore, be analysed to determine whether policies could be improved in other words, to determine how policies should look. The application of the normative model would be based on the literature review, which reflected on power trading across the world. The increase of electricity capacity within the SADC region required normative criteria. According to Cordes (1997:171), normative models of government focused mainly on discovering actions governments could take, which in theory, might produce gains from trade. There was generally quite a leap between an ideal policy and what could be devised in practice, given the information policy-makers actually had.

In the case of this study, normative models would assist government to know what to do in order to change the situation of a decrease of electricity within the region. A normative model would provide check-and-balance criteria to try to solve the problem of a decrease in power capacity within the sub-region. Furthermore, there were three policy making models which could be linked to a prescriptive approach: rational, incremental and mixed scanning models.

a. Rational Model

The importance of the rational model obliged intimate knowledge of the value of a community's preferences, as well as knowledge of all possible alternative approaches which could be followed to satisfy requirement (Dye 1978:38). In this model knowledge was needed to suggest the problem faced by a country. In the context of this research the rational model could be important to suggest a way to halt the decrease of electricity capacity within the region. According to Hanekom, Rowland and Bain (1986:33), if those were understood, the outcome should be a rational policy decision. However, this was also where the main constraint of this model lay.

There was no consensus on community value, with a result it became impossible to formulate an extensive range of alternatives which would satisfy needs or even calculate the result of each option.

b. Incremental Model

The importance of this model had, as a point of departure a notion that existing policies were legitimate and satisfactory and possibly only marginally ineffective. They should thus be adapted incrementally to eliminate such aspects, which were no longer effective (Henry 1975: 235 and Dye 1978: 32). For Hanekom, Rowland and Bain (1986:33), the advantage of this model is found in its low conflict potential, relatively expeditious adaptation to changing circumstances, and in its flexibility. It was quite possible to make changes, when later returning to the initial policy. This argument was demonstrated when a particular policy did not bring transformation within the community. There was a possibility to suggest another strategy which could change situation in that community.

The disadvantage of this particular model was its acceptance that exiting policy was satisfactory without having first analysed the policy and its ramifications. This model was also criticised by Gunn and Hogwood (1984:58) when they said there were several difficulties in applying Etzioni's model to the practical concerns of decision-maker (quite apart from the fact that his original metaphor of weather satellites was inaccurate as a description of how weather satellites operated and how they fit into overall weather forecasting). In the first place, it was not clear whether the analogy between weather satellites and social problems holds up.

c. Mixed Scanning Model

An analysis of the two previous models found there were inadequacies within the two models. According to Gunn and Hogwood (1984:63), the mixed scanning model emphasised a need to distinguish fundamental decisions from incremental. Fundamental decisions should be made by exploring as many possible options open to decision makers, but with deliberate omission of detailed assessments so that an overview was possible.

Another argument developed by Hanekom, Rowland and Bain (1986:33) was that the basis of the mixed scanning model as overall review was made up of a situation followed by concentration or any deviation. There was advantage and disadvantage to this model.

The advantage was that in all situations an overall picture was acquired, before concentrating on any deviation with a view to adaptation. But, the disadvantage of a mixed scanning model could be an overview of the total policy was too sketchy, with the result an in–depth analysis of any adaptations could be out of proportion in terms of their particular importance to total policy (Hanekom, Rowland and Bain: 1986).

9.3 Input/Output Normative Transformational Systems Model for Effective and Efficient Power Trading Between selected SADC Countries.

There was always a possibility of finding a solution to any problem a government might encounter in its daily activities. Currently, the region faced a decrease of electricity capacity within each of the region's countries.

During the evaluation of the research, it showed there was a decrease of electricity trading within the electricity market of the region. The development of any country depended on the stability of the energy sector.

There was a need, for solutions to be found for member states in order to improve the economic development of the region. This study used a David Easton transformational systems model for political change, which could bring about transformation in the environment (means country). According to Parsons (1997:22), the most important characteristic of the Eastonian Model, was viewing the policy process in terms of received inputs in the form of flows from the environment, mediated through an input channel (parties, media, interest group etc); demand within the political system (with inputs) and its conversion into policy and outcome.

This model is presented as an environmentally-orientated normative model, where working relationships take place both in an external and internal environment. The external element refers to the factors which could contribute to the ending of the electricity problems in selected countries, as well as within the region. The internal elements are those decisions taken by government which opened the regional market to other private partners, leading to an increase in capacity of electricity within the countries of this study, as well as within the SAPP.

The input phase in this normative model represented the summary variables (political, economic, social, statutory), which reflected everything in the environment important to political change (Easton, 1965:150). Therefore, the concept of input served as a powerful tool, since the elements represented the input as the major key areas, which influenced the increase of power capacity within each country of this study. **The external environments** were political, economic, social and statutory. There are also other elements were not presented in this study. However, the elements present in this model are those that played a major role in terms of influencing goal achievement within each country.

According to Ferreira (1996:403), these are only examples of possible external input environments that might influence goal-achievement, as the numbers and types of environments possible, could be unlimited.

The political environment, which is an element of the external environment, plays an influencing role in any decision, to be taken. This complements the value of the government in place. It is argued by Easton (1965:151) that, as in the case of inputs, however, there was an immense amount of activity placed within a political system. The observation in this study showed most of governments willing to suggest new policies which could respond to the development of the country.

The economic environment is an element of the external environment, which influences the policy changes within each country. This external environment was an indicator for development of the country which influenced the government decisions. According to Pal (1997:71), indicators could be contrived through research or can consist of routine feedback mechanisms, which are attached to programmes themselves. It is for this reason that the economic system was chosen for this model. The context of this study showed the economic development of different countries within the sub-region, influenced electricity generation.

The social environment, in terms of this research, has been considered as an element of external environment, which influenced the government decisions, since it was related to the transformation, which occurred within society. The social system was linked with the entire change which took place in the country and this could be in terms of demographic demand. It could also be that the social system changed the perceptions of policy decisions.

The statutory environment, as an element of the external environment in this study assessed the laws of the electricity sector. For any changes to occur within the electricity sector there is a need for policy transformation, which could affect the law that protected the national electricity company. The difficulties in the use of regulatory instruments surface principally from four sources: international trade agreements, technology, economics and cost (Pal, 1997:117). Large subsets of economic regulatory instruments have been devoted in one way or another to the protection of domestic industries from excessive internal or foreign competition. An interpreted action of this quotation, in terms of this study, showed an influence of international trade with other countries. Therefore, most governments should be convinced they should review policy in terms of electricity generation.

The internal environment, in the normative model, examined the influence of environmental value-laden occurrences in the political system. According to Easton (1965:71), economic depression has had greater consequences for the political system. These transformations occurred within the same environment, which is the political system. These parts of the total engaged a considerable share of one's attention. Furthermore, the internal environment was subdivided into different categories.

In the **body politic** there was a tenet of democracy, constitutional supremacy and public accountability. There was also community value, fairness, reasonableness and probity. Other elements were rules of legality, ***intra vires*** *mean ("within jurisdiction"),* ***Ultra vires*** *("outside jurisdiction")* and **Audi altreram partem** *("listen to the other side").*

Tenets of democracy: in this context, the country should respect the principles of the democratic system within each country.

All institutions should respect law and order, and any policy change within the country should follow a democratic system.

Constitutional supremacy: the law of the country was the highest instrument, and protected every citizen of that country. According to Kumm (2001:5), national constitutional supremacy was a legal rule that governed national practice, while the constitution of a country was the cornerstone which protected all communities. Any changes which occurred within a country should follow the principles written in its constitution.

Public accountability: since the beginning of constitutional democracies in the free world the debate has continued regarding the degree of freedom which the public service should enjoy in terms of public-control, public participation and public scrutiny (Vocino and Rabin; 1981:398). It could also be said public accountability was a responsibility of public officials to become accountable to the community, in general. Hanekom and Thornill (1983:184) argued public accountability was one of the prominent characteristics of the 21th century's public administration and pointed out the public and elected representatives needed assurance, since public services were under control and were carried out within the framework of policy laid down by parliament.

Furthermore, there was also **community values,** which all should respect. This context recognised the participation of the community in decision-making. The community's values should have **fairness,** which means that everyone within the community should be treated equally. In the context of this study, the suggestion of the normative model should be fair because the government was trying to open the market to allow other parties to participate. There was also **probity (honesty),** which required protecting the community and placed the interests and rights of all individuals and groups above those of any individual. A public official's conduct should be above reproach so that he or she will be able to give account of higher actions in public (Cloete; 1986:17). Another important element in community values was **reasonableness,** since in the context of this study, the government should have a positive judgment in terms of the electricity problem within the country.

Based on positive judgments, a good decision should be made by different stakeholders concerning the decrease of power in the SADC region.

There were also **rules of legality,** which means that no one was above the law. Every citizen of the country was equal before the law and the law of the country should protect all. In the context of the normative model, there was ***Ultra Vires***, which, according to Wade and Phillips (1977:576) was if a procedure laid down in the Enabling Act for the making of delegated legislation was not adhered to, the relevant regulations would be declared null and void by the courts. In the context of ***Intra Vires***, public officials should pertain to an action within the proper authority or stated purposes of a corporation or corporate officer (Alexander, Cooper, and Briand: 1951). Furthermore, the normative model should have the ***Audi alteram partem***, which means that all sides should be heard. According to Cockram (1967:43), there were some preconditions that should be met under this particular rule. The first was an affected person should be afforded an opportunity to answer the case disclosed by the notice.

In the context of this normative model, all the factors presented in this section (**external environment and internal environment**) influenced the formulation of the normative model. The problem is already known and different elements, which could contribute to the transformation of SAPP and selected countries were already in place.

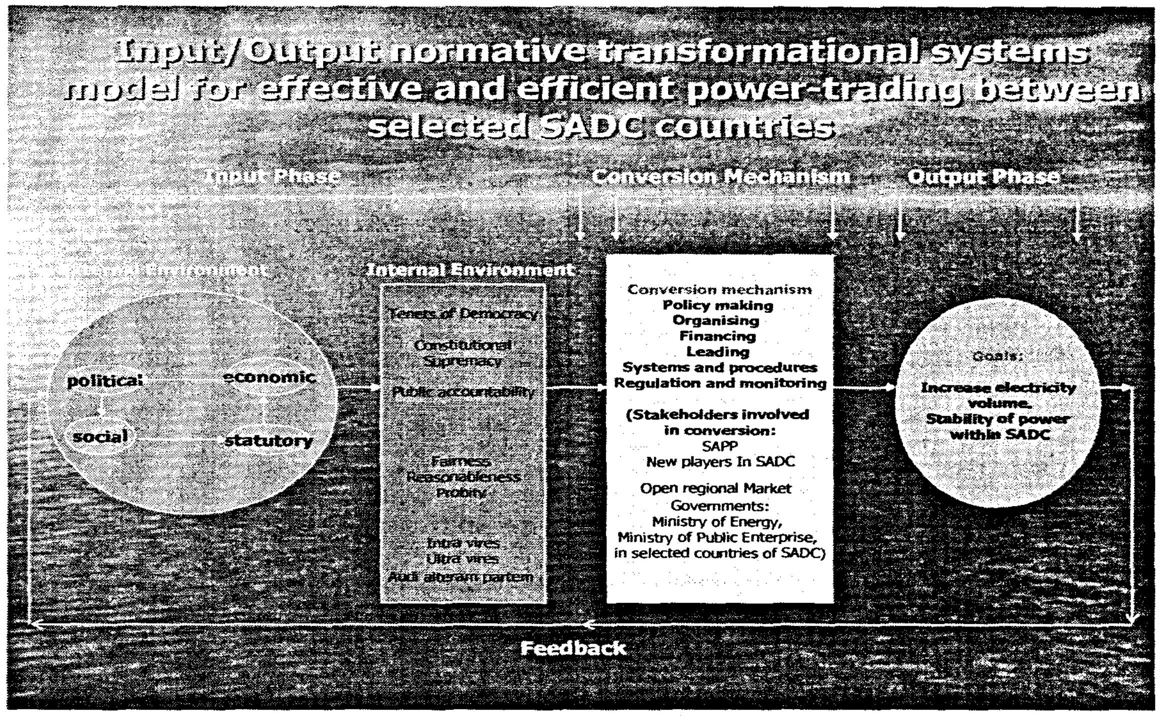

Figure 9. 1: Normative model proposed by the research

A conversion relates to policy implementation mechanism was a complex area in which senior government officials should decide which way policy should follow. According to Easton (1965:150), input would serve as a summary variable to concentrate and mirror everything in the environment relevant to political pressure. In addition, the external element had already specified the factors which could influence policy transformation in the electricity sector. The major problem here was a new decision which should have an impact that facilitates an increase of capacity in the SADC region.

The formulation of **policy making** was based on the input from the external and internal environment. It was argued by Hogwood and Gunn (1984:24) policy-making involved many sub-processes and could extend over a considerable time. Under the circumstances of this study, the normative model suggested a new policy, which should favourable access the electricity sector to other partners. Today, in most countries, the electricity sector was not accessible for private companies to participate. The implementation of new policy should try to allow private companies to be involved in power generation. By allowing them to generate power within a particular country, the regional body (SAPP) should accept that private companies participated.

In the context of **organising** in terms of implementing new policy, there was participation from different experts in government policy in order to achieve objectives. More specifically, the energy sector was a key area for economic development of a country. Any transformation in the sector requires an involvement of several experts to work with the government. In order for this policy to succeed, there was a need for **financing,** since new investments would be required to enable government policy. Therefore, the new policy would clarify the financing mechanisms which a government would use to transform electricity sector. In the context of this study, new investment will be applied by using a PPP as a mechanism for investment. Chapter Six provides further information in this aspect. The PPP mechanism suggested in this study is not a "best model". However, many developing countries prepare to use a PPP in new infrastructural development. There are also other types of investments which each country could use. In order to achieve this there were systems and procedures to be followed.

Following that discussion in terms of policy making, there was need for **regulation** and **monitoring**. **Regulation** was crucial for an application of new policy, to bring new partners to the electricity sector. Regulation was also required to allow private partners to participate in the regional market for electricity. Today, there was no regulation, to permit private companies to trade power within the SAPP. The impetus of new policy, would allow private companies to enter the regional power market.

This regulation would be based on standard private companies that should participate in the regional electricity market. According to Pal (1997:118), the key to regulatory instruments was the government's ability to first forbid some activity or outcome, then permit it under certain conditions.

This assumed the activity or outcome in question could, be controlled and monitored. In order to interpret this quotation in the context of this study, private companies were previously not allowed to participate in its. With a decrease of power capacity in many countries in the SADC region, policy should be changed to allow private companies to participate in the SAPP. Therefore, the ministers of energy in the 14 countries should consult and suggest a new regulation which would allow private companies to participate in the regional market. The new regulations would protect the country and the private company.

On the other hand, **the monitoring** system of the policy was to evaluate the impact of policy action within the community. Basically, monitoring in this normative model would examine the effect of the policy. It was argued by Dunn (1994:336) in order to monitor public policies in any given area it required information relevant, reliable and valid. In the context of this research, a new policy for monitoring would evaluate the impact of a private company in the electricity sector and measure it participation within the regional power market. According to Dunn (1994:335), monitoring helped to determine whether resources and services, which were intended for certain target groups and beneficiaries (individuals, families, municipalities, states and regions), have actually reached them.

In addition, the government should monitor the involvement of private companies in the regional market and also assess the increase of the power capacity within the country and in the region. The implementation of this normative model should have standards, which the private partners should follow. When a private partner did not adhere to standards imposed by government, a penalty would be imposed on a private company. This meant the normative model would create an opportunity for new players in the electricity sector; governed by rules and regulations.

The **stakeholder involved in the conversion of the normative model is** seen in Figure 9.1.The SAPP has already begun to suggest the different ministries within the regional body should open the regional market to other players. The ministers of energy and the ministers of public enterprise in the selected countries and other countries should suggest an implementation of the new policy in the SADC. The implication of the new policy would also impact in the community. The goal, which the new policy would implement, increases the volume of electricity in the long-term; the normative model will try to stabilise power within the SADC.

Feedback of the policy will satisfy complaints from the economic, political, social and statutory situation within the country. Easton (1965:152) argued the feedback loop itself had a number of parts worthy of detailed investigation. It consisted of the production of outputs by the authorities, a response from the members of society to these outputs, the communication of information about the response to the authorities and, finally, possible succeeding action by authorities.

9.4 Summary

The research comes with the suggestion to address the problem and to develop a model, which could be used by different countries to open the electricity market. The understanding of the normative transformation model in the different governments would assist policy makers to transform the electricity industry. The experience brought forward by different countries around the world shows there was a need to suggest a normative transformation of electricity industries in the SADC region.

It was demonstrated there was a poorly designed electricity market in the SADC. This situation had also disadvantaged the SAPP by having less electricity capacity to trade in the power pool. The implementation of the normative model in the context of this study should analyse the entire aspect which influenced the transformation of the electricity sector. The normative model would not be implemented in the same way in the selected countries, or the remaining SADC countries. Each country had its own reality in terms of transformation of its public enterprises. The elected government in each country should assess when would be the best time to implement the normative model.

The last chapter will provide a conclusion, and also contribution of the knowledge relating to the result of the research. The chapter provide recommendations and further research on power trading.

CHAPTER 10. CONCLUSION AND RECOMMENDATIONS

10.1 Introduction

This chapter draws conclusions from the research as a whole and makes recommendations based on those conclusions. Firstly, the research provided an overview of how the research aims and objectives were pursued. Secondly, it makes recommendations to the different governments in terms of how they could transform the Southern African Power Pool, as well as the electricity sector within their respective countries. The recommendations will also clarify future research agendas in electricity trading. Finally, the chapter highlights the contributions of the research.

10.2 Research overview

The fundamental aims of this research were to evaluate electricity trading in selected countries and in the Southern African Power Pool. The research investigated the involvement of selected countries in terms of power trading with other countries within the region. The research analysed other types of electricity markets around the world in order to understand the way they operated. Furthermore, the research applied strategic management analysis methods in the electricity companies of selected countries. In order to upgrade the electricity infrastructure within the selected country, the researcher suggested a mechanism to fund the project within the region.

The aim of this research **was to study and evaluate the impact of power trading in selected countries within the Southern African region, as well as the policy mechanisms in the region.** The aims were pursued by using a triangulation method of research **qualitative** and **quantitative** methods.

Firstly, qualitative methods were used to collect data in different ministries of energy, and electricity companies from selected countries of this study. Secondly, quantitative methods were applied to collect data in the SAPP for energy trading during a five-year period. Thirdly, the application of using a triangulation method assisted this study to find some findings for this study.

Fourthly, the findings of the results arose from the application of the normative model, which proposed a transformation of the Southern African Power Pool.

The first objective of this study was to evaluate the potential of power trading in the SAPP. The application of qualitative methods assisted an understanding of the participation of selected countries in the power pool. The findings showed that the participation of the countries of this study was limited. None of their electricity companies participated fully in the short-term electricity market.

The second objective of this study was to review policy mechanisms and private sector involvement within the electricity sector in the SADC. The findings of this study disclosed each country had limited participation by private companies in the electricity sector. The participation of the private sector within the electricity market of the SADC was not yet applicable, since it would depend on 14 government's ministries of energy for the SADC region allowing private companies to participate in the pool.

The third objective of this study was to investigate the applicability of a Public Private Partnership model in the electricity sector in the SADC. The findings of the data revealed each country of this research, seek the participation of a PPP in the electricity sector. It was a new mechanism for a government to secure investment funds which could build new power plants. Each country within this study had a particular model which could approach a PPP model.

The fourth objective investigated key factors, which influence the performance of PPP in the electricity sector in the SADC. The key findings in this study showed there was a limited capacity in the power pool. The financial constraints in each country played a major role for the future involvement of PPPs in the electricity sector.

The fifth objective studies and evaluates the impact of power trading in selected countries within the SADC. The analysis of the quantitative data in this study showed the impact of electricity trade in the selected countries was limited.

This situation could be attributed to a lack of reserves within the region. Some power plants were faulty which meant there was no surplus capacity to trade.

The six objective designed and presented a normative model to improve power trading in the SADC. An analysis of the study showed the decline of power trade within the power pool, as well as the limited participation of the selected countries. The research suggests input and output normative transformational systems models for effective and efficient power trading in selected countries.

10.3 Recommendations

The recommendations are specifically based on power trading in selected countries within the SADC region. These recommendations are based on the findings, which are linked to the triangulation method used in the research. The recommendations also take into consideration the normative model, which suggests need for an improvement of power trading in the Southern Africa Power Pool. The recommendations are listed below:

10.3.1 Recommendation 1

Each ministry of energy should review its respective policies, to allow participation of other players in the electricity sector. This recommendation is based on the reality in each country of this study. The review of the policy within the member states would be a guideline to transform the electricity industry for restructuring of the industry. The transformation of the industry would have an impact within the country, as well as on the Southern African Power Pool.

10.3.2 Recommendation 2

The ministry of energy and most Chief Executive Officers of the 12 electricity utilities should suggest a transformation of the power pool. The prevailing status of the power pool did not assist the electricity market to develop. A new policy should be opened to private companies and industries capable of trading power in the market. The regional body should implement a regulation to protect the minority in that power pool.

10.3.3 Recommendation 3

The 14 ministers of energy should suggest a regional regulatory body. The regulatory body should review the costs of electricity tariffs within the power pool. The same regional regulatory body should fix and review the wheeling charges on the transmission network. Today, the wheeling charges were being discussed by member states, electricity companies and co-ordinator centre managers. The old mechanism should be replaced by a regional regularity body.

10.3.4 Recommendation 4

SADC should reduce bilateral contract, a large volume of electricity trade in the region and suggest power be purchased on the short term electricity markets through a new type of model, "forward market" was introduced in 2007. The implementation of this mechanism could verify the capacity of power, which continued to decrease within the SAPP.

10.3.5 Recommendation 5

The participation of public-private partnerships should be supported in the regions, particularly in the electricity sector. It would assist some governments to raise funds as the electricity sector was a capital-intensive industry. The current financial situations in the selected countries of this research had problems when it came to raising funds. This was evident in the DRC and Zimbabwe.

10.3.6 Recommendation 6

The member states involved in trading within the SAPP should introduce price in terms of season, instead of the price fluctuating each month. It was also important for the co-ordination centre manager to be aware of bilateral pricing. This would assist countries which purchased electricity in the power pool in terms of best procedure to purchase power.

10.3.7 Recommendation 7

Price cap should also be introduced in the power pool to assist countries which purchased large volumes of electricity. Price caps had been set in several electricity markets around the world to limit price spikes and prevent the abuse of dominant positions by electricity companies.

10.3.8 Recommendation 8

The ministries of energy should suggest to the utilities (electricity companies) prices be set in terms of capacity price and the cost of producing energy. This should be taken into consideration when a contract was signed for bilateral purposes, short term electricity markets and forward markets. The purpose of suggesting the capacity price was to guarantee the basic benefits for the power plants.

10.3.9 Recommendation 9

Further research was required in the field of regional power trading in order to discover capacity price and energy price in the SADC power pool. The application of this further research would enable to inform policy makers of the importance of price in the power pool. It would also assist governments to transform the electricity sectors in the region.

10.3.10 Recommendation 10

Political interference in the management of the electricity sector should be avoided in Zimbabwe and the DR Congo, since it led to company's fiscal instability. The two companies currently operated without a strong cash flow.

10.3.11 Recommendation 11

Most governments should understand the importance of the energy security in the region. The current states of the power pool did not provide enough energy to trade in the region. Therefore, there was need for energy infrastructure to be developed in each country which would stabilise the energy security of the SADC countries.

10.3.12 Recommendation 12

Further research should be conducted to analyse the financial performance of SAPP because the electricity market still operates with the financial assistance of the member's countries and international donors.

10.3.13 Recommendation 13

Further research should consider the participation of private companies in the power pool. In addition to that, the research should analyse policy mechanisms which could protect private companies in a market.

Also, the difficulties which private companies might encounter with public enterprises operating in that sector should be analysed.

10.3.14 Recommendation 14

Further research should investigate the economic situation of Zimbabwe and the importance of the Southern Africa Power Pool in that country. The political and economic situation of that country could be a threat factor to the effectiveness of the regional electricity market. The turbulence of the network in that country could spell the collapse of the entire electricity transaction in the SADC. This situation could occur because of the financial trouble faced by ZESA.

10.3.15 Recommendation 15

Most governments should apply a normative model in the electricity sector. Taking into consideration all the factors, which could influence the transformation of the electricity market, a normative model should be considered as a benchmark to change the electricity sector. This change will require strong support from the central government. Therefore, it will require strong implementation from policy makers.

10.3.16 Recommendation 16

The SADC and the SAPP should encourage member states unconnected to the power pool to try their best to connect. The connection of this new network would increase the capacity of power trading. The accomplishment of this network within the region required investment. In order to carry on the development of networks, governments should invite private partners on-board. This meant the private sector and governments could jointly manage the transmission line.

10.3.17 Recommendation 17

SADC and SAPP should encourage different governments to allow other types of technology, for example, solar home systems, to sell power in the pool. The utilisation of this technology could also assist to increase the electricity volume within the power pool.

10.3.18 Recommendation 18

Further research should analyse the impact of introducing other technology such as renewable energy (solar home system) and natural gas as power generators to trade power in the pool.

10.3.19 Recommendation 19

Eskom should continue trading its reserve capacity in the SAPP, which will increase the volume of power trade in the electricity markets. In 2006, Eskom, as a public enterprise, did not trade power in the power pool. The company should respect the memorandum of understanding signed with other utilities.

10.3.20 Recommendation 20

Governments in selected countries should address possibility to improve their electricity infrastructure. It was shown some plants in Zimbabwe and the DRC were not in a position to respond to the demands for electricity within and outside each country. The management of the utility should play a major role if it wanted to solve the problem within their electricity sectors.

10.3.21 Recommendation 21

Most SADC government should establish a clear policy goal and their responsibilities for securities of supply in the electricity sector. This would assist them to solve the problem of power capacity within the SAPP.

10.3.22 Recommendation 22

There should be an independent regulatory board within the SADC to allow private companies to enter the co-operatives power pool. This should include industries that owned power generators to meet their own power needs, but allowing them to sell their excess capacity to the SAPP. Regulators could play an important role in the critical review of industry proposals for interim cross-border mechanism.

10.3.23 Recommendation 23

Additional investment in power generation was required in the selected countries of this study, as well as in the remaining SADC nations.

10.3.24 Recommendation 24

There was a need for power market reform in the DRC and Zimbabwe which should be implemented gradually as political and economic instability, was faced by both countries. Regulation of the power market should achieve a fair balance between protecting the interests of electricity consumers and attracting investments necessary to meet demands.

10.3.25 Recommendation 25

The governments of the DRC and Zimbabwe should increase access of electricity to a larger number of people in urban and rural areas.

10.3.26 Recommendation 26

Electricity infrastructure demand in selected countries of this study was required to assist the current situation to change. It was also a good strategy in terms of energy security for the country.

10.3.27 Recommendation 27

The power infrastructure demand in this region required considerable investment. Each SADC government should promote market expansion, which would facilitate investment, rationalise tariffs, and development competition.

10.3 Contribution to the existing body of knowledge

This research is the first, to evaluate power trading in the selected countries and in the Southern African Power Pool to have been analysed at this level. The case study chosen makes a significant contribution in its own right. Furthermore, the research contributed to existing knowledge by:

- Normative model, which suggest an input and output normative transformational system model for effective and efficient power trading between selected SADC countries and recommendations;
- Clarifying a future research agenda in terms of regional cross-border power trading;
- Strengthening the theoretical understanding of the electricity market around the world and developing an understanding of power trading;
- Identifying a SWOT analysis, this examines the internal and external capabilities of selected electricity companies and the SAPP in this study; and
- Providing evidence of the capacity of electricity trade in the power pool has decreased each year.

While the successful completion of the research will make a contribution to the existing body of knowledge on the topic, this investigation has laid the groundwork for further research. With the earth's population approaching over billion, much research need to be undertaken to clarify and meet the dynamic of energy generation in general and electricity in particular.

10.4 Concluding remarks

The dysfunctional power trading in the selected countries of this study and the SAPP, suggests a normative model should be implemented to change the application of the electricity market in the region. The normative model and recommendations suggested in the research will be successful for the decisions of policy makers in the different governments. The trading of power was important for energy security in the SADC.

The evaluation of power trading in selected countries of the SADC was the beginning of research in cross-border electricity trading. This research would not close this study because more research will surface and close the gap in regional power trading.

The research was the first completed study on the Southern African Power Pool, however, other findings will be presented via future studies and research within this field.

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APPENDIX A. FIELDWORK QUESTIONNAIRE

D Tech TOPIC: EVALUATING POWER TRADING IN SELECTED COUNTRIES IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY.

(A) QUESTIONNAIRE FOR GOVERNMENT OFFICIALS SOUTH AFRICA(MINISTRY OF MENERALS AND ENENRGY), & ESKOM ,ZIMBABWE(MINISTRY OF ENERGY AND POWER, & ZESA) and DRC (MINISTRY of ENERGY, & SNEL).

Please indicate your preferred answer in the appropriate block

1. What is your participation in the SAPP?

1 Supply capacity in the SAPP

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

2 We don't supply capacity

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

1.3 Participation is limited

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

2. How does your government benefit from the SAPP?

2.1 Sources of getting foreign currency when we sell electricity to the pool.

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

2.2 There is no benefit for us

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

2.3 The SAPP is not important for our country

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

3. Which department was involved in fixing the electricity tariffs through the SAPP? 3.1Specify..

3.2 No Ministry involvement

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

3.3 The pool is independent

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

4. Were tariffs for exporting / importing electricity cheap compared with those charged to the local consumer? (Explain) ....

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

5. Which countries are the main clients?

....

....

....

....

....

6. **What type of contract has your country signed with other SADC countries?**

6.1 Bilateral contract

Yes	
No	

6.2 Hybrid model

Yes	
No	

7. **How do you review the contract?**

Number of Years	**Answer**
1 Year	
2Years	
3Years	
4Years	
5Years	

8. **Who signed the contract on behalf of the government?**

8.1 President	**Minister of Energy**	**CEO of utility**

9. **Is there a need for PPP in the electricity sector in your country?**

Because.....................................

....

Statements	**Answer**
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

10. **Does the weather play a major role during the transmission of electricity from your country to another?**

Statements	**Answer**
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

Why? ....

....

....

11. There is benefit for your government to participate in the SAPP?

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

12. Does your government buy electricity from the SAPP?

Yes	
No	

13. Do you purchase power from the DRC, South Africa or Zimbabwe?

Yes	
No	

Specify...

....

....

....

14. Are the electricity tariffs cheaper within the SAPP market?

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

15. There is a need for Public Private Participation in electricity sector?

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

1 6. What countries buy electricity from your country?

And during what month?

Country	Month
A	
B	
C	
D	
E	

17. What are the strength and the weaknesses of ZESA, SNEL, Eskom?

18. What are the opportunities and the threat for ZESA, SNEL, Eskom?

19. What are the strength and the weaknesses of SNEL, SNEL, Eskom?

20. What are the opportunities and the threat for SNEL, SNEL, Eskom?

<u>THANK YOU FOR YOUR TIME</u>

APPENDIX B. QUESTIONNAIRES FOR THE SOUTHERN AFRICA POWER POOL

Please indicate your preferred answer in the appropriate block

1. How do you plan electricity trading through the SAPP?

1.1 Monthly

Statements	**Answer**
Yes	1
No	2
Don't know	3

1.2 Daily

Statements	**Answer**
Yes	1
No	2
Don't know	3

1.3 Annually

Statements	**Answer**
Yes	1
No	2
Don't know	3

2. Who is the main supplier of electricity within the pool?

2.1 DRC

Statements	**Answer**
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

2.2 Zambia

Statements	**Answer**
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

2.3 Mozambique

Statements	**Answer**
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

2.4 South Africa

Statements	**Answer**
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

2.5 Zimbabwe

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

3. Which countries bought electricity from the SAPP?

3.1 Botswana

Statements	Answer
Yes	1
No	2
Don't know	3

3.2 Namibia

Statements	Answer
Yes	1
No	2
Don't know	3

3.3 Malawi

Statements	Answer
Yes	1
No	2
Don't know	3

3.4 DRC

Statements	Answer
Yes	1
No	2
Don't know	3

3.5 South Africa

Statements	Answer
Yes	1
No	2
Don't know	3

3.6 Mozambique

Statements	Answer
Yes	1
No	2
Don't know	3

3.7 Zimbabwe

Statements	Answer
Yes	1
No	2
Don't know	3

4. What types of market does the pool use?

4.1 Spot market, why? ....

Statements	Answer
Yes	1
No	2
Don't know	3

4.2 Future market, why...

Statements	Answer
Yes	1
No	2
Don't know	3

5. Please explain the underlying reason(s) for the choice of this market?

....
....
....
....

6. How does the power pool collaborate with country member states?

6.1 Reports to the SADC "Minister of Energy"

Statements	Answer
Yes	1
No	2
Don't know	3

6.2 Report to the twelve national utility of SADC.

Statements	Answer
Yes	1
No	2
Don't know	3

6.3 Only the countries that trade power through the pool

Statements	Answer
Yes	1
No	2
Don't know	3

7. Is there a large influence from country members on electricity tariffs?

Statements	Answer
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

8. Please explain how the pool fixes the tariff?

....
....
....
....

9. Are the prices you fix based on marginal costs of production?

Statements	Answer
Yes	1
No	2
Don't know	3

If yes, please explain: ....

....

....

....

....

10. Are your prices based on market bids?

Statements	Answer
Yes	1
No	2
Don't know	3

11. Are the SAPP tariff prices evaluated based on a geographical zone or distance?

Statements	Answer
Yes	1
No	2
Don't know	3

12. Do you consider transmission losses?

Statements	Answer
Yes	1
No	2
Don't know	3

13. Is there any profit sharing among members of the SAPP?

Statements	Answer
Yes	1
No	2
Don't know	3

14. Is there any possibility that with an excess supply, the prices could collapse within the SAPP?

Statements	Answer
Yes	1
No	2
Don't know	3

If yes, please explain...

....

....

....

....

15. Do seasons influence tariffs?

Statements	**Answer**
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

16. There is a charge for cross-border transmission within the SADC region?

Statements	**Answer**
Strongly disagree	1
disagree	2
Undecided	3
Agree	4
Strongly agree	5

17. Kindly submit the statistical reports and for data electricity trade for the past five years?

18. What are the strength and the weaknesses of SAPP?

19. What are the opportunities and the trait for SAPP?

THANK YOU FOR YOUR TIME

APPENDIX C. PAPERS PUBLISHED

APPENDIX D. RECOMMENDATION LETTERS

APPENDIX E. SOUTHERN AFRICAN POWER POOL INTER-UTILITY MEMORANDUM OF UNDERSTANDING 16 MAY 1995

APPENDIX F. LETTER OF LANGUAGE EDITOR

APPENDIX C. PAPERS PUBLISHED

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The electricity supply industry in the Democratic Republic of the Congo

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Abstract

The electricity supply industry of the Democratic Republic of Congo is reviewed, from the formation of the Societé National d'Electricité (SNEL) in 1970 until today. The DRC government established a national utility, because electricity is a key element in the socio -economic development of a country. Due to the national monopoly of SNEL, hydropower plants could be constructed such as Inga1 and Inga2. They supply power to mining in the Katanga province, and to a steel company in Maluku, not far from Kinshasa. Currently, Inga1 and Inga 2 are not operating at full capacity. Many hydropower and thermal plants are located in different provinces and need to be refurbished to increase their capacity of electricity for the DRC. Due to technical problems, SNEL only generates 1150 MW. The electrification programme in urban and rural areas across the DRC caters for less than 10% of the 60 million inhabitants. In 1980, the government implemented a policy called Plan Directeur de SNEL for electrification, but the policies never reached their objectives. No Energy White Paper exists which outlines the entire policy framework for energy supply and demand. Power sector reform has also not been implemented in the electricity sector. This paper outlines future government options in the electricity sector. Accordingly, the Public Private Partnership model could play a major role in attracting private partners to invest in the electricity sector in order to have different hydropower and thermal plants refurbished.

Keywords: hydropower, Democratic Republic of Congo (DRC), electricity use, public private partnership

1. Introduction

In most African countries people still use wood, paraffin, candles and other fuel for lighting, heating and cooking. Despite this, the continent has abundant potential sources of energy, especially solar, wind, thermal and hydroelectric power. On 16 May 1970, the Zairian government, under the Mobutu regime, signed a government decree, number 70/033, for the establishment of SNEL as a Public Enterprise Company. It is a national utility with characteristics of an industrial and commercial public enterprise. On 5 May 1978, the Zairian government signed another decree, No 78/196. After the implementation of the new decree, SNEL took over the generation, transmission and distribution of electricity in the DRC. The company is run by a board of directors, the management committee, and 'le College des Commissaires aux Comptes' which manages the national utility (SNEL, 2005:4). The establishment of SNEL in 1970 was subjected to the Royal Decree of 9 November 1956, including a set of regulations and general Block Notes, determining applicable principles and concessions for public distribution of electric energy.

Current electricity capacity in the DRC is 1150 Megawatts (MW) per year, consisting of 98% hydropower and 2% thermal plants. The potential hydropower capacity of the DRC is estimated to be as high as about 100 000 MW, of which the Inga Dam constitutes 44% of the 'Societé National d'Electricité' (SNEL, 2000:3). If exploited to its fullest capacity, the Inga Dam could be one of the biggest hydropower stations in the world. This would increase the DRC's ability to electrify the entire country and also to export more electricity to other African states. The internal generation, transmission, and distribution as well as the exportation of electricity from the DRC is the responsibility of SNEL.

Since 1970, when SNEL was established, the government made the following contribution at various levels:

- New hydropower plants and thermal plants (for example, Inga 1, Inga 2, and Hydropower of Mobayi).
- New transmission and distribution lines in different provinces.
- Nationalisation of private electricity companies in 1972 and 1974.
- Transfer of all thermal plants from Regideso (another public company that distributes water in the country) to SNEL in 1979 (SNEL, 2005:4). All these transfers of infrastructure by the government do not give the national utility financial support. Since that time the national utility has experienced financial difficulties.

The national utility generates and sells electric energy across the country. In addition to that, SNEL also purchases electricity from independent power producers such as some mining companies, which have their own power plants. The national utility has a national monopoly in terms of generation, transmission and distribution of electricity in the DRC, including exporting electricity to neighbouring countries.

This paper reviews the current situation of Electricity Supply Industry (ESI) in the DRC after 45 years of its independence, highlighting its export potential of electricity to the Southern African Development Community (SADC) and other countries in Africa. Access to electricity in the DRC is still a luxury for many households. Although the DRC government has been in power since 1960, it still does not have an effective energy policy in place to promote an electrification programme in urban and rural areas. The policies formulated during the rule of the previous government under Mobutu could not be implemented, because of general mismanagement. Access to electrification today is enjoyed by less than 10% of the population. This paper will also analyse what the impact of a public private partnership (PPP) could be after the elections, which were to be held in June this year.

2. Socio-economic background of the DRC

The Democratic Republic of the Congo, formerly known as Zaire, is a nation in which monumental, political and administrative problems have occurred since independence. The population of the DRC rose to 60 million inhabitants according to the 2005 census. It borders Angola in the Southwest and west, with Cabinda and the Republic of Congo in the West, Central African Republic and Sudan in the North, with Uganda, Rwanda, Burundi and Tanzania in the East, and with the Republic of Zambia in the Southeast (Columbia encyclopaedia, 2002:1). The country consists of 11 provinces: Bandundu, Bas Congo, Equateur, Kasai-Occidental, Kasai-Oriental, Katanga, Maniema, Nord-Kivu, Sud-Kivu and Province Oriental and Kinshasa, which is the capital, with a population of 8 million inhabitants.

The DRC is potentially the wealthiest country in Africa, but stands today as an impoverished development tragedy. Gifted with fabulous natural resources, including copper, cobalt, gold, silver, tin, fertile soil and bounteous waterfalls, the DRC has woefully failed to meet its promise. According to the Columbia encyclopaedia (2002:2) mining is centred in Katanga province, which provides copper, cobalt, zinc, manganese, uranium, cassiterite (tin ore), coal, gold, and silver. Diamonds are mined in the Kasai and Oriental provinces. Major deposits of petroleum were discovered offshore, near the mouth of the Congo River. Almost 75% of the DRC is covered with forest, and a considerable amount of ebony and teak are produced annually, as well as less valuable types of wood.

From an economic point of view, Kinshasa and Lubumbashi are the most industrial cities of the country. Manufacturing includes processed copper, zinc, and cassiterite; refined petroleum, basic consumer goods such as processed food, beverages, clothing, footwear, and cement. The numerous rivers of the Congo give an immense potential for generating electricity, a small but significant percentage of which has been realized. The important hydroelectric facilities are situated in Katanga and produce electricity for the mining industry. In addition, there is another big project at Inga, on the Congo River, in the Bas Congo province.

3. Historical background of electricity supply in the DRC

Before the government established SNEL in 1970, another public Enterprise Company called Regideso controlled the Electricity Supply Industry (ESI) from 1960 to 1972. Today Regideso's principal work is to connect and distribute water all over the country. Beside Regideso, six other private companies generated and distributed electricity in the country, namely:

- Comectrick
- Forces de L'est
- Forces du Bas-Congo
- Sogefor
- Sogelec, and
- Cogelin

In 1970, SNEL became a national utility with the mandate to generate, transmit and distribute electricity across the country. Four years later the government decided to implement a new decree, No 74/012 of 14 May 1974, allowing SNEL to take over all six private companies, which had an obligation to generate and distribute electricity in the other provinces. This decision, gave SNEL a national monopoly as the ESI (SNEL, 2000:7). The Regideso returned its hydroelectric plants and thermal, plants to SNEL only in 1979. Therefore, Régideso no longer controls power plants in the DRC.

The implementation of the SNEL policy is to ensure that the state controls the generation, transmission and distribution sector. Electricity is considered to be a main factor for the economic and social development of the country. There are a few independent power producers around the country. Most of these are mining companies, although some other companies also have their own thermal generators to supply electricity for their own use. SNEL also has the option to buy electricity from private companies. Figure 1 shows all the sites for hydropower and thermal plants across the country.

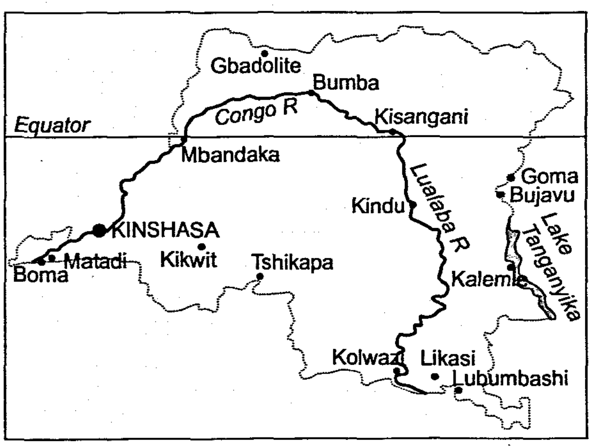

Figure 1: Hydropower potential across the country
Source: (SNEL 2000)

Figure 1 shows different provinces with potential for the construction of hydropower across the country. The River Congo (Lualaba) starts in the south of the DRC, ending at the mouth in Boma, not far from where the Inga hydropower is located.

The different types of energy carriers used in the DRC are also considered later, suggesting some solutions which the DRC government could consider to ensure energy security in future. The ESI in the DRC is reviewed under the following headings:

- Electricity capacity in the DRC
- Electricity supply industry, and
- Future governance option

4. Electricity capacity of the DRC

The total capacity of electricity generated with all hydropower and thermal plants fully operational is 2505 MW. According to SNEL, Plan de Sauvetage et de Redressement (PSR, 2005:15), the technical problems in different hydropower and thermal plants limit SNEL to currently only generate 1150 MW respectively, is due to a lack of maintenance and spare parts. SNEL has a strategic programme to rehabilitate different hydropower plants, starting with Inga 1, Inga 2 and Zongo, located in the province of Bas Congo, Nseke and Mwadingusha in the Katanga province. Only a few turbines are operating in each hydropower plant. Figure 2 represents different plants that SNEL is rehabilitating since last year. The capacity in terms of MW of all these different hydropower plants is also shown in Table 1.

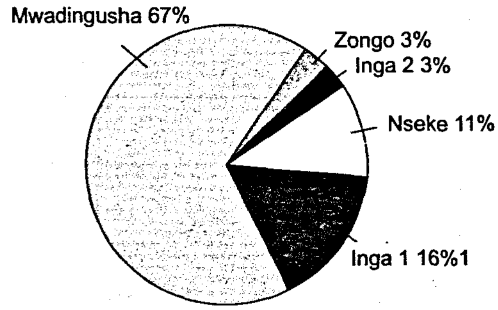

Figure 2: Hydropower plants under rehabilitation

The rehabilitation of these plants will increase the capacity in terms of electricity generation. Beside these hydropower plants, there are also other hydropower and thermal plants that need refurbishment. There is the possibility of upgrading some plants, but it is a problem for the government to find partners to invest. The rehabilitation of the five hydropower plants could assist SNEL recover 1416 MW estimated capacity from rehabilitated hydropower plants across the country. Table 1 below represents all hydropower plants for SNEL and different mining companies across the country. The dates when the SNEL plants were commissioned, are given in brackets.

According to Table 1, the DRC has at least 27 hydropower stations across the country. Some of the plants are not working to their full capacity. Therefore, there are plants that need to be refurbished scattered across the country. The large number of existing hydropower stations and the potential assets should allow the government to implement a successful policy for improving electrification and offering far greater access within the country.

Apart from the hydropower, there are also a number of thermal power plants around the country without an interconnection or grid connection with transmission lines coming from Inga 1 and Inga 2. Some of these thermal plants are located in the north and eastern part of the DRC. These plants are not in operation everyday, because of the lack of spare parts and fuel shortage in certain areas. The five years of civil war exacerbated also this situation. Plan de Sauvetage et de Redressement (2005) reports that, it is the intention to change this situation in 2006. For example, in the Equatorial

Table 1: Hydropower capacity in the DRC in 2000

Source: SNEL Annual Report (2000:19)

Power plant & year of commissioning by province	Ownership (SNEL or mining company)	Installed Capacity (MW)
Bas Congo		
Inga 1 (1972-74)	SNEL	351
Inga2 (1981-82)	SNEL	1 424
Zongo (1955-65)	SNEL	75
Sanga (1932-49)	SNEL	12
Mpozo (1934)	SNEL	2.21
Katanga		
Mwadingusha (1929-54)	SNEL	68
Koni (1950	SNEL	42.12
Nseke & Nzilo (1953-57)	SNEL	356.40
Kyimbi (1959)	SNEL	17.20
Kilubi(1954)	SNEL	9.9
Kivu		
Ruzizi 1 (1958-1972)	SNEL	28.2
Ruzizi 2 (1989)	SNEL	26.6
Kasai occidental		
Lungudi (1949)	SNEL	1.6
Province Oriental		
Tshopo (155-1974)	SNEL	18.8
Equateur		
Mobayi (1988-1989)	SNEL	11.40
Budana	Kilomoto	13.8
Nzoro	Kilomoto	1.4
Soleniama1	Kilomoto	13.5
Soleniama2	Kilomoto	1.6
Ambwe/Kailo	Sominki	2.2
Belia	Sominki	2.2
Mangembe	Sominki	1.8
Lulingu	Sominki	0.7
Lutshurukuru	Sominki	5.1
Moga	Sominki	0.4
Tshala&Lubilanjil	Miba	8.6
Piana Mwanga	Congo Etain	29
Total		**2 524.13**

province a lack of fuel can cause a power outage for an entire month. Table 2 shows the status of thermal power plants per province starting from 1980 compared with those of 2000, to indicate broad trends.

During the civil war from 1998 to 2003, some of these thermal power plants could not run properly, because of the lack of fuel and engine parts from the SNEL head office in Kinshasa. According to a

Table 2: Thermal power plants in the DRC in 1980 and 2000

Source: SNEL Annual Report (2000:21)

	1980		2000	
Site of plant by province	*No. of plants*	*Capacity*	*No. of plants*	*Capacity & type of plant*
Bas Congo				
1. Muanda	2	2.2	3	1.6 (Gas plant)
2. Lukala	2	0.3	1	0.3
3. Tshela	2	0.4	2	0.4
4. Lemba	1	1.3		Grid*
5. Bomba	5	4.5		Grid*
Bandundu				
6. Kikwit	4	1	2	0.9
7. Inongo	2	0.3	1	0.2
8. Bandundu	2	0.8		Grid*
Kasai Occidental				
9. Kananga	4	4.2	3	2.7
10. Mweka	2	0.4	2	0.4
Kasai Oriental				
11. Mbuji Mayi	4	12.9	1	Grid*
12. Lusambo	2	0.6	2	0.6
13. Kabinda	2	0.6	2	0.6
Equateur				
14. Mbandaka	4	4.3	3	2.3
15. Basankusu	2	0.3	2	0.3
16. Boende	2	0.4	2	0.4
17. Bumba	3	0.8	1	0.4
18. Lisala	6	1.4	6	1.4
19. Gemena	4	1.2	4	1.2
20. Libenge	2	0.8	2	0.8
21. Zongo	1	0.3	1	Grid*
22.Gbadolite	4	1.2	-	-
Maniema				
23. Kindu	3	1.7	1	0.6
24. Kasongo	2	0.6	2	0.6
Katanga				
25. Kabalo	2	0.4	2	0.4
26. Kongolo	3	0.9	1	0.3
27. Kamina	3	0.8	-	Grid*
28. Kaniama	3	0.5	3	0.5
29. Kasenga	2	0.2	-	Grid*
Nord Kivu				
30. Goma	4	2.4	-	Grid*
31. Butembo	1	0.3	1	0.3 not running
32. Kisangani	4	12.8	4	12.8
33. Buta	3	0.6	3	0.6
Total	**92**	**61.03MW**	**54**	**30.8MW**

** Connected to national grid*

senior official of SNEL (2005), few thermal plants in different provinces are connected to the national transmission lines. The major role for all these plants is to distribute electricity locally in the different provinces. Most of these plants will not operate again as thermal plants in future. Some of the thermal plants have, however, become operational again after the peace process.

5. The electricity supply industry

The working structure of the ESI can be divided, along operational lines, into three sectors: generation, transmission and distribution. The structure of generation of electricity starts from Hydropower, Thermal and Gas plants. The transmission sector is built up with high voltage lines starting from the generation to the distribution sector. The national utility transmission lines have been divided into six categories in terms of capacity. In Table 3, different transmission lines in kilowatt and kilometres within the DRC electricity sector are shown. The longest national grid in the DRC was inaugurated in 1982 when Inga 2 became operational. That transmission line is called Inga-Kolwezi. The same transmission line connects the DRC to Zambia and other countries in SADC.

Each province within the country has one or two hydropower, or thermal plants, which generate electricity. Large capacities of electricity generation are located in the Katanga and Bas Congo provinces.

According to the financial indicator of SNEL 2005, the performance of the national utility is not good. The sales of electricity in MW within the country are low. In 2003 SNEL sold 64% of electricity and in 2004 the utility sold 63%, due to a poor electrification programme for the country. Very low numbers of the population have access to electricity. Only 276 431 domestic customers in Kinshasa, a city of 8 million inhabitants, have access to electricity. There is also a large number of informal customers in Kinshasa and elsewhere in the country, which SNEL still found difficulty to capture on its database.

According to SNEL's Plan de Sauvetage et de Redressement (2005:10), less than 10% of the population has access to electricity. There are also big losses of electricity on the distribution side. SNEL recorded that more than 30% of electricity has been lost during the past four years. For example, in 2004 the companies recorded a loss of 41%, and in 2003 a loss of 37.4% (SNEL, 2005:19). There is a possibility to re-establish the national DRC utility by meeting the technical and commercial requirements of international standards. All this should be done with a responsible government and to avoid political interference. In Figure 3, the structure of ESI in the DRC is presented.

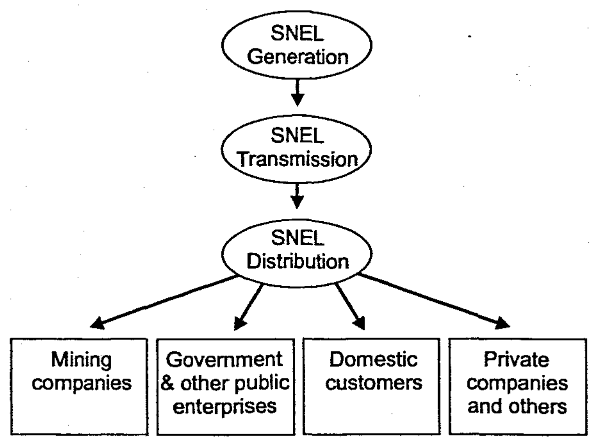

Figure 3: Structure of the ESI in the DRC

According to the International Energy Agency (IEA, 1994:24), vertical integration describes the relationship or linkage between the main functional activities within the electricity supply chain. It could be argued that SNEL is having a vertical integration on electricity sector within the country. The distribution of electricity in the country is problematic and power outages happen frequently. This situation of having poor electricity services in the DRC has impacted negatively on many households and on the economy generally. The consequence of not having reliable sources of electricity, in some urban

Table 3: Transmission lines in kilometres, in terms of high voltage values
Source: SNEL (2000: 24)

Location	*500KV*	*220KV*	*132KV*	*120KV*	*70KV*	*55/50KV*	*Total in km*
Bas-Congo		216.6	185.3		164.5		611.4
Kinshasa		123.6			80		203.6
Bandundu		264				264	
Equateur			22.5			22.5	
Kivu					260		260
Katanga		834.1	120	1198.8	70	188.8	2411.7
Inga-Kolwezi	1774					1774	
Total in Km	**1774**	**1483.3**	**327.8**	**1198.8**	**574.5**		**5547.2**

areas, contributes to the closure of many businesses, forcing them to move to places where electricity supply is reliable.

6. Future governance options

The government still has to implement an electrification programme across the country to boost the number of domestic customers who have access to electricity. This policy was approved by Mobutu's regime two decades ago. Currently, Plan Directeur de SNEL for urban and rural electrification is on hold. There are few places in Katanga province where electrification for rural areas is taking place. Hence, the major programme for urban and rural electrification programme is still lagging behind for over two decades. Discussions are taking place between the government and SNEL to carry out the programme of electrification after the presidential election, which will be held this year.

6.1 Major consumers of electricity

There are two major consumers of electricity in the country: the DRC's government buildings, and some public enterprise companies, like the mining sector. These two consumers use 50% of the electricity produced in the DRC each year (SNEL, 2005:5). The remaining companies are private and other businesses around the country.

The domestic consumption is very low because of the lack of electrification programmes. The remaining electricity generated is being exported to countries that have already signed a bilateral agreement with the national utility. These include Angola, Congo Brazzaville, Central Africa Republic, Burundi, Rwanda, Zimbabwe and South Africa. In Figure 4 the electricity usage in the DRC is shown. It will change with time, depending on demand and the accessibility of electricity by different sectors.

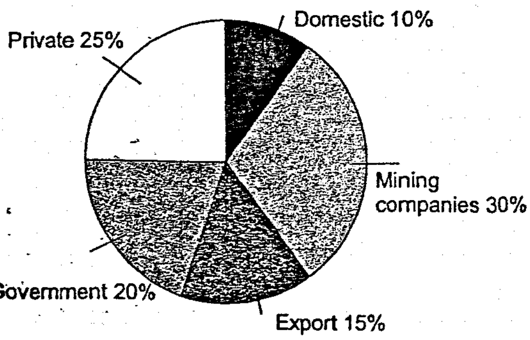

Figure 4: Profile of electricity usage in the DRC

6.2 Governance structure

The electricity sector of the DRC holds the key to social and economic development of the country. Government has controlled this sector since independence. The national utility is under the direct control of the Ministry of Energy, and all government decisions relating to the electricity supply industry are implemented by the Ministry of Energy. The Ministry of Public Enterprise controls the financial part of SNEL. Currently, there is no Energy White Paper from the transitional government which should underline the policy of the government. Most of the policies involved in the electricity sector are from the previous regime under Mobutu. There is a possibility of a new democratic government, after the election in June 2006, with a possibility of new policies and strategies for the country.

The ESI regulation generally involves a degree of public price control, and normally, it extends to control over other areas, such as levels of service, and planning and investment decisions (Steyn, 1994: 22). At present, in the case of the DRC government, there is no regulatory body for the electricity sector, as in the case of the National Energy Regulator of South Africa (NERSA). A commission has taken most of the decisions regarding electricity tariffs; the level of service delivery and other matters.

The International Energy Agency (1994:42) declared that the government has tended to reinforce the monopoly position of utilities by passing legislation, which granted the companies special or exclusive rights. SNEL, as national utility, has supplied electricity for over 35 years without a regulatory body. It would be important to assist the local utility to become more efficient, and evaluate the electricity tariff every year. However, the DRC government is the only agency which intervenes directly in any policy making for the transformation of SNEL. There is a need to have an independent body to start regulating the electricity tariffs and to suggest to the government and SNEL the way forward to improve the service levels of the national utility.

6.3 Public private partnership (PPP)

6.3.1 Background

After reviewing the ESI of the DRC, it became evident that a real need exists for the DRC government to take an initiative to apply a PPP model in the electricity sector. According to the European Union, (EU) Green Paper (2004:3), the term of PPP is not defined at the community level. In general, this term refers to a form of co-operation between public authorities and the world of business, which aims to ensure effective funding, construction, renovation, management or maintenance of an infrastructure or the provision of a service.

Furthermore, reviewing the ESI of the DRC, there are different possibilities to apply PPP model with many hydropower and thermal plants located in different provinces across the country. Most of the hydropower under SNEL supervision has over 25 years of operation, and some of them are not operating to their full capacity. The International Monetary Fund, World Bank and Belgian government granted a loan of over $200 million to rehabilitate some hydropower and thermal plants.

Another option is getting big loans from financial institutions, as the Congolese government is trying the PPP model to rehabilitate the electricity sector. According to SEFI (2001:12) PPP can be used for new projects and rehabilitation or maintenance projects. When one analyses the DRC electricity sector, the introduction of a PPP model appears very feasible, because there is a need for SNEL to rehabilitate most of the hydropower across the country. SNEL does not have sufficient funds to rehabilitate all its plants. A relationship with a private partner would be the best way for the government to come out of its financial difficulties.

6.3.2 Model for PPP

There are different types of PPP models that the DRC government could consider for the rehabilitation of different hydropower and thermal plants. It would be good for the government to realise that PPP does not mean privatisation of government assets. Instead, PPP can sustain the government to upgrade or rehabilitate some of the power plants. Seader (2004:4) argues that, instead, partnership refers to an entire spectrum of relationships where private sector resources are used in the delivery of services or facilities for public use. The private sector could support the national utility to provide one or more of the following:

- Designing a new project
- Financing
- Project initiation and planning
- Construction
- Ownership
- Operation, and
- Revenue collection.

The PPP model falls into two categories: the first is the establishment of a new project and the second aims at refurbishment of existing facilities.

6. 3.3 New projects

There are different models for new projects:

- Build-transfer (BT)
- Build-lease-transfer (BLT)
- Build-operate-transfer(BOT)
- Build-own-operate-transfer(BOOT)

The recommended approach for the government is to choose which model best suits the rehabilitation of electricity power plants. For example, the BOT could be appropriate for a plant rehabilitation and new construction. This model of PPP offers the government the possibility to convert development and initial operation from a public sector project to a private one.

Seader (2004:5) states that the private sector contractor or consortium of contractors finances the project, accomplishes the construction, and operates the new facility for some specified length of time, after which it is expected to transfer ownership to the government, mostly at no cost. The prospective transfer to the host government happens immediately it can retain control of the asset. The DRC's government could use this BOT model to build the third phase of Inga. The BOT model is especially suitable for different governments because it offer the host country many options such as:

- The capacity to reduce capital costs for a particular project at a time when it intends to provide funds for another project.
- The chance to encourage outside investment and introduce new or improved technology (Seader, 2004:5).

Furthermore, this model works as well for rehabilitation of power plants or expansion of an existing facility, sometimes called its Rehabilitate-Operate-Transfer (ROT). There are so many hydropower and thermal plants within the DRC that need a complete rehabilitation. If government could apply this type of PPP model it would enable SNEL to increase power generation across the country. In addition, according to Elizabeth (1999:3) this model is being used in different developing countries to build new infrastructure. There are a few examples in some of the French speaking countries in Sub Saharan Africa.

BOT is not the best model for all PPP models because, for example, it focuses only on one facility, which limits the private sector actor's ability to help optimise system wide resources or efficiencies (Elizabeth, at al: 1999). Nevertheless, this model provides a platform for increasing local capacity, and to operate infrastructure facilities. This type of model also provides an incentive to be efficient, since companies have to perform well in order to win the contracts.

In terms of applicability of PPP in the electricity sector, the DRC government has already allowed two local companies, Electricity du Congo (EDC) and Societé d'Electricité de Nord Kivu (SONEKI), to run two hydropower plants. According to Kalala (2005), the first project is located in Kasai Occidental, and the EDC is rehabilitating the hydropower of Lungudi, which was commissioned in 1949 with a capacity of 1.6 MW (Ministry of Energy, 2005). The objective of this PPP model is to rehabilitate the hydropower plants and also to electrify the city of Kananga. SENOKI, located in Butembo in North of Kivu province, runs the second project. The capacity of the plants is 1.2 MW. The transitional government gave the two companies a 25year period to run the plants with a possibility to renew the project. Learning from the local private company's experience, there is a possibility for the government to extend this kind of project for the big hydropower plants in different provinces.

6.3.4 Existing facilities

In the second type of appropriate model, the infrastructure is already in place, but the government is looking for a partner to mainly manage the existing facilities. The presentation of this model is to review the SNEL situation and to see which model can be used to solve some of the problems the national utility is facing.

One example could be a Service contract. This model could solve the problem concerning the billing and collection in order to increase the revenue for SNEL across the country. In service contracts, the government or the national utility maintains the greatest degree of control over its services and facilities. The private company has all its terms of service spelt out in the service contract.

According to Seader (2004:6), in service contracting, or contracting out, the government contracts with a private company to supply functional responsibilities that the public sector previously performed, such as billing and collection. In this kind of contract, the responsibility lies with the government to choose the best company to do the job. SNEL and the DRC government never used this kind of model for the electricity sector across the country. It is the responsibility of the government to check the performance of SNEL and to see if such a model would be efficient and work effective for the whole country, especially in rural areas.

7. Conclusion

Most observes seems to agree that the performance of SNEL during its 35 years of existence, calls for a real change. This means that SNEL should implement corporate governance within the structure of the utility. There is a need for power sector reform to help SNEL to rehabilitate most of its plants located in different provinces. There is a need for central government to avoid political interference in the running of the national utility.

Corruption within SNEL could also cause the company to collapse. A possible new government after the presidential election needs to encourage a better transformation in all the structures of the national utility. An aggressive electrification programme should be a priority for the government and SNEL, aimed at offering access to electricity to many more domestic customers in urban and rural areas.

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NEPAD vision and the INGA hydro-electric scheme

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Abstract

The concept of power trading is considered in the context of the vision of the New Partnership for Africa Development (NEPAD). A most promising option is to utilise the rich water resources of the Democratic Republic of Congo for hydro-power generation. Present and anticipated future potential generating capacities are quoted. The development of the Inga 3 and the Grand Inga schemes could supply grid-connected African states with sufficient electricity to stimulate their respective socio-economic development. Today's situation and plans are outlined, emphasising requirements for success. These include financial investment through public-private partnerships, the all-important role of governments to ensure political stability and independent regional regulation for equitable wheeling charges.

Keywords: hydropower, NEPAD, governance, political stability, service delivery

1. Introduction

Africa is the sole continent where 25 – 30% of the population only has access to electricity, compared to Europe where 100% of the population has access. There is, however, an opportunity to change the African scenario since the Democratic Republic of Congo (DRC) has the hydropower potential to boost the electricity capacity within the Central African region, the Southern African Development Community (SADC) countries, and possibly, the entire continent.

Electricity is a vital part of economic stability and growth in Africa. Stability in electricity production could promote the development of different economic sectors. When a country has insufficient energy, in terms of electricity production, distribution and access, then problems arise in terms of the development of that country. African nations, in particular, require collaboration within their energy sectors in order to develop. The development of electricity production within the DRC has potential to attract foreign investment thus impacting on other Africa countries.

The aim of an electricity company is to produce and distribute electricity to its customers and to generate an acceptable income. In order to achieve this, utility companies should invest adequately in infrastructure which includes constant maintenance of the power supply. The Edison Electric Institute (2002) claims electricity is an important element in the achievement of social, sustainable development. The electricity industry considers access to an adequate supply of electrical energy a basic requirement towards the eradication of poverty (Edison Electric Institute, 2002).

This paper indicates how the Inga scheme, if managed properly, will contribute to the New Partnership for African Development (NEPAD) as well as to the SADC sub-region as a whole. The result can be achieved through regional co-operation in the electricity sector including the West African Power Pool (WAPP), based in Lagos (Nigeria); the East African Power Pool (EAPP), based in Nairobi (Kenya); the Central African Power Pool (CAPP) in Brazzaville; and the Southern African Power Pool (SAPP), based in Harare. These different pools seek to improve the electricity supply and its security within sub-Saharan Africa.

2. NEPAD vision of the energy sector

According to NEPAD (2001), energy plays a key role in the development process, providing primarily a domestic necessity. Energy is also a factor of production, directly affecting prices of other goods and services and the competitiveness of enterprises. There is an unequal generation capacity of energy across the African continent. This imbalance hampers progress. NEPAD has short listed priority projects, which could help stabilise the energy sector in Africa.

According to Sekose (2003) the African Development Bank has agreed to finance two of the project-linking electricity power grids in West and North Africa. The long awaited project to develop the Inga-electric power plant on the Congo River and to link it to other countries is a priority. Many feasibility studies have been conducted in different regions throughout Africa. A report was submitted to the most advanced countries, including recommendations on how the developed world could contribute to project implementation.

Many discussions have been held aimed at developing the energy sector within the African continent (World Summit on Sustainable Development, 2002). During that workshop the energy sector under NEPAD reported African countries should increase access to reliable and affordable commercial energy. Within 20 years, reliability should be increased and the cost of energy decreased to enable an annual economic growth of 6%.

In order to emphasise that view, Saunders (2002) argues there are six points, critical to NEPAD's success. These are: to inward investment and the need for increased investment in Africa's infrastructure; poor transportation and an inadequate electricity system in Africa are major barriers to economic development, adding to the overall cost of exports; peace and security on the Africa continent; capacity building for an economy of 6% growth every year in each country to help to reduce poverty; capacity building in finance and market access, a critical issue as Africa needs good financial mechanisms and fair trade with other partners; and increased investment in human development to secure rapid progress in education and the delivery of effective health-care systems. These points must be prioritised to achieve the project.

Since the private sector will not fund electrification that does not provide a positive return, it is worthwhile examining some examples of similar projects being funded by, including the construction of the Mepanda Hydropower Plant in Mozambique. Another project shared by the Economic Community of West African States. The United States of America International Development (USAID), the Banque Ouest Africaine de Development and others have been approached to buy into these projects. The price of electricity, once these projects become operational has yet to be determined.

Another project is the Grand Inga Integrator. The DRC government works hand- in- hand with other financial institutions raising funds for the construction of the largest hydro-electric scheme in sub-Saharan Africa. Construction of the Grand Inga may be considered a major priority in terms of harnessing African hydro potential. The DRC's new democratic government has decided to prioritise the electricity sector. According to the CEO, Vika Di Panzu, of Societe Nationale d'Electricite (2005) the DRC government invited various stakeholders, including the World Bank, International Monetary Fund, Banque de Paris, and others who promised to inject funding for the Grand Inga project (Vika Di Panzu, 2005). Additional financial assistance will be provided by the African Development Bank.

3. Electricity supply

There is, therefore, a need for an African transmission network under NEPAD. The construction of such a network will materialise once a partnership between the government and the private sector is cemented. Each government should evaluate the possibility of involving internal investors for network construction. If local investors cannot invest, each government should invite international companies to participate for the success of the project. The transmission network will include those countries who want to buy electricity from the Grand Inga. The Inga site is 3 000 km from the southern African region, and 4 000 km from Egypt. The network in the SADC region will join the DRC to Angola, Namibia and South Africa. Major investment will have to be made in Angola, since most of the network was destroyed during the civil war. The cost of this network reconstruction remains unknown.

Ekongo (2004) has said the objective was to build an African transmission network to make it possible to regulate electricity throughout Africa. The power generating countries would then be in a position to supply electricity to countries with a shortage. The aim of NEPAD is to create a system, to ensure no country was without access to electricity at any given time. It emerged at the World Summit on Sustainable Development that as much as 70% of the total population of Africa lacks a basic service. The electricity, to be generated by Grand Inga, would therefore, reduce the numbers who lack access to electricity services in Africa by a 50% (WSSD, 2002). In terms of distribution this would depend on each country as distribution networks were already place in place in most countries. What would happen is most of the countries would join the upgrade of the distribution network to supply new customers.

4. INGA hydro-electric project

The Congo River has an annual flow rate of 42 000m^3 per second (SNEL, 2000). It is one of the largest rivers in the world with a significant gradient along its lower course. Between Sikila Island and the Congo River mouth (15 km as the crow flies) there is a difference in altitude of 102 m. This difference in altitude produces a sequence of rapids which make the Inga Dam the largest single source of hydropower in the world.

4.1 Current plan

The DRC is the leader of potential electricity generation – 370 000 Gigawatt per hour (GWh), ahead of Cameroon 115 000 GWh and ahead of Madagascar's 320 000 GWh productions (SNEL, 2000). Figure 1 shows the site of Inga 1 hydropower with Inga 2 on the right hand side. In the same area, the DRC government and other SADC countries plan to build the third phases of Inga 3, while the construction of Grand Inga will not be far from these three hydropower plants.

In Table 1, the capacities of the various Inga hydro-power plants are given.

The hydro site has the potential for the DRC to produce up to 100 000 MW. The construction of the new sites requires investment, because others power plants require urgent refurbishment. Since 1996 the DRC's national consumption of electricity has decreased, after negative economic growth.

In 1998 the total domestic peak demand was approximately 650 MWh. The mining industry, the single biggest consumer during the 1980s, with more than 60% of the total consumption, reduced its share to 25% in the last few years (Sadelec, 2000). The decrease of the electricity production was because in Inga 1 and Inga 2, some units were not operating because of a lack of spare parts. The actual production capacity in the DRC was only 750 MWh, although the total installed capacity stood at 2473 MWh.

The consumption of electricity began to change within the mining sector in Katanga Province between 2003 and 2006. Before the end of 2007 the actual production will increase with the rehabilitation of Inga 1 and Inga 2.

4.2. Future plan

Many countries struggle to distribute electricity internally because of poor management of utilities. The Mbendi Information Service (2003) has

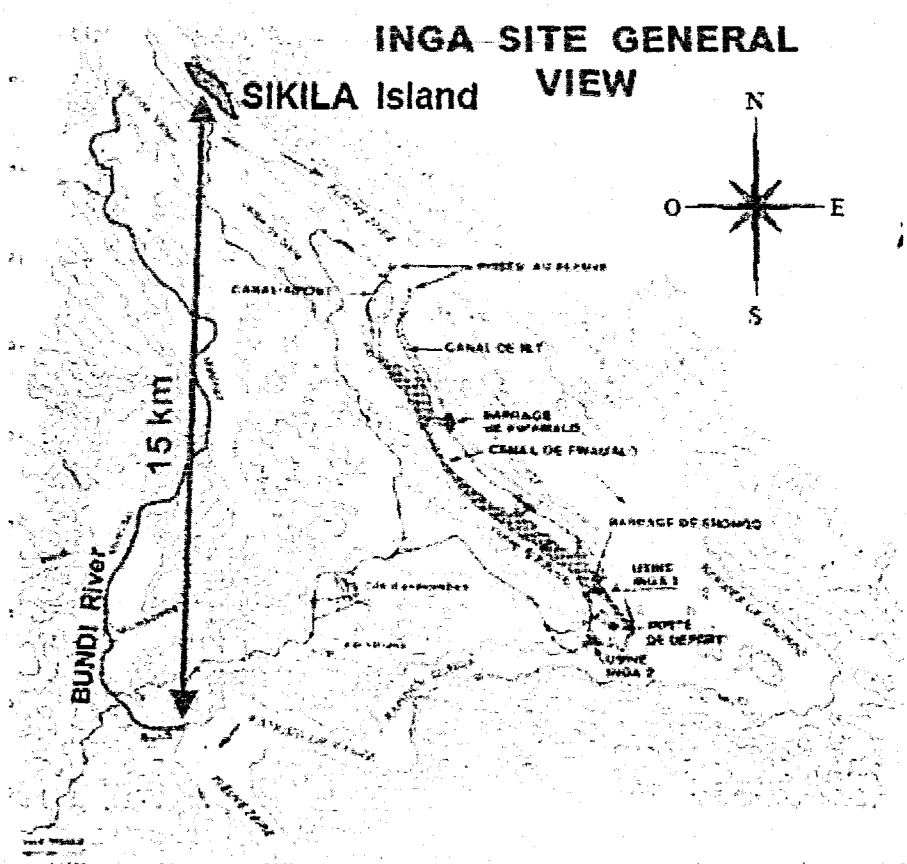

Figure 1: Inga 1 and Inga 2 and where Inga 3 and Grand Inga will be constructed
Source: SNEL, 2005

Table 1: Inga hydro electric plants

Element of hydropower	*Inga 1*	*Inga 2*	*Inga 3 planned*	*Grand Inga planned*
Number of unit	6	8	7	52
Total installed capacity	351 MWh	1424 MWh	1344 MWh	44 000 MWh
Height of water head	50 metres	58 metres	60 metres	150 metres
Gross energy capacity	2 400 GWh	10 400 GWh	9 900 GWh	324 900 GWh

Table 2: Grand Inga and power higher ways
Source: SNEL, 2005

Demand	*Unit*	*2012*	*2014*	*2016*	*2018*	*2020*
Northern highway (Egypt)	MW	4 000	6 000	7 000	8 000	10 000
Western highway (Nigeria)	MW	4 000	5 000	6 000	7 000	8 000
Southern highway (SADC)	MW	3 500	5 000	6 000	7 000	8 000
Total (including Central African Region)	MW	11 500	16 000	19 000	22 000	26 000
Installed capacity	MW	13 500	18 000	21 000	24 000	27 750
Number of units	#	18	24	28	32	37
Generation cost/ step	10^6 $	5 661	981	654	654	818
Cumulative generation cost	$/kW	419	369	347	331	316
Transmission systems costs	10^6 $	8 303	-	4 858	-	4 649
Total cost	10^6 $	13 964	981	5 552	654	5 467
Revenue load factor	%	70				
Electricity price	c$/kWh	3.5				
Annual energy	GWh	70 518	98 112	116 508	135 000	159 432
Annual revenue	10^6 $/y	2468	3434	4078	4722	5580

analysed the problems of power supply in Africa, concluding an inadequate power supply in many African countries, was a major barrier to economic growth. The causes of the supply difficulty are numerous and diverse. Civil wars in some African countries such as Angola have left generation and transmission facilities damaged. Based on the damage from civil war, many governments' financial plans have been stretched to the extent that the maintenance of electricity facilities has become a low priority. In addition, many countries have unreliable equipment and few means to upgrade them. African countries should, however, transform their energy sectors in order for to stimulate economic development.

In accordance with IEA (2003), developing countries account for a little more than a quarter of global electricity production. By 2030, this share is expected to increase to 44%. These countries could be producing as much electricity as the OECD. In order to provide for this rapid increase, they will need to invest more than US$ 5trillion (R40 trillion) in electricity infrastructure. For most countries, this means that investment should increase to well above current levels.

The Grand Inga scheme could be one of the solutions for NEPAD's economic development of the continent. The DRC government itself cannot realise this vision. It requires the participation of stakeholders. The Electricite De France (EDF) made an evaluation concerning the construction of the Grand Inga. Table 2 presents the financial estimation done by the EDF on behalf of the DRC utility. This estimation could be changed in terms of the US$ fluctuation in the international market.

The construction of Grand Inga will contribute positively to the socio-economic development of different parts of the African continent. According to a feasibility study conducted in 1997 by EDF, the French electricity company, Grand Inga will supply Egypt appreciable from 2012 onwards, as well as other countries such as the Central Africa Republic, and Sudan. In Figure 2, Inga 1 and Inga 2 are shown.

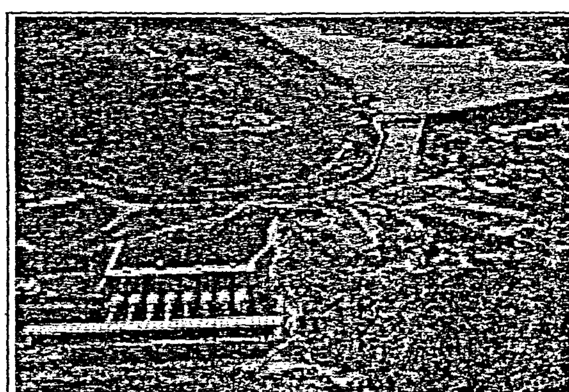

Figure 2: Photograph of Inga 1 and 2

In the West Africa sub region, Nigeria and the DRC have signed an agreement for the development of a transmission network from the DRC to Nigeria. The tapping of electricity from the DRC will solve some of the problems which Nigerian utilities face. The demand for electricity in Nigeria grows annually, but power outages occur frequently. The transmission of power within the DRC will reduce the problems of power failures within Nigeria. Power security will impact positively in terms of economic growth and social development. The power from the DRC will benefit not only Nigeria, but increase capacity in the Western African Power Pool, showing that the construction of the Grand

Inga is to be a priority requirement for the NEPAD programme.

The Southern Africa sub-region will also benefit from the Inga hydro-scheme, because of the construction of Inga 3, which has five participating countries. This project is called the Western Corridor Project with member states such as the DRC, Angola, Namibia and South Africa. The realisation of this project is a collaboration of five utilities (SNEL, Eskom, ANE, Nampower and BPC). These companies have decided to jointly contribute to the construction of Inga 3, while the head office of this Westcor Company is based in Gaborone. It has been shown that the construction of Inga 3 will probably boost the capacity of electricity in the SADC region. The introduction of the Westcor project will benefit the SADC in two ways as result of Inga hydropower. The eastern corridor network has the Inga Shaba network, which has links with Zambia, Zimbabwe and South Africa. The introduction of Inga 3 will increase the trading of power within the Southern Africa Power Pool. Currently, the trading of electricity has decreased because of a lack of capacity within the SADC sub-region. There is less capacity trading in the short term electricity market at SAPP (Muhiya, 2006), since most of the power is traded on bilateral agreements between countries.

5. Requirements for success

According to a director of the International Energy Agency (IEA, 2003), a US$5 trillion investment within the electricity sector of developing countries would be a daunting task, particularly in Africa and India.

5.1. Financial

The investment for power generation for export could be hampered by financiers' perception of risk related to country specific issues, or to the multinational character of the project. The nature and degree of risk varies from country to country on the African continent. This could be civil war or political instability (Croussilat, 1998).

Transmission tariffs also play a major role in financing the creation and expansion of a transmission network. According to Croussilat (1998) where cross-border transmission has been developed, costs are bundled into a delivery capacity. Most countries should use the same technical standards for the transmission line.

The transformation of the electricity industry in Sub-Saharan Africa is a prerequisite for larger investments in the electricity sector. It is also argued by the World Bank Group (2003) that a regional perspective on the energy market and sector development presents significant benefits. Interconnection of national petroleum and the power market will encourage private investment, which increases market size, thereby helping investors to manage commercial and political risk.

Interconnections encourage global scale projects. Investments in redundant facilities need to be avoided, and strategic and macroeconomic risks decreased by expanding a country's supply choices. Furthermore, energy interconnections create export opportunities. In the DRC, the energy sector is unique in its potential to forge closer economic ties among countries within the region.

Many investors are unprepared to invest in some African countries for differing reasons. For example, the problem of political instability discourages investors. This situation has, however, begun to change in some. For example, there is now peace in Sierra Leone, which has allowed the completion of the Bumbuna Hydropower project, with a capacity of more than 50 MWh, to continue until 2008. Currently, few households within the city of Freetown have access to electricity (Mazzei; 2005). The reason for this long delay is because of political instability and civil war. It took two decades for completion of that hydro-power plant.

Engineering News (2004) reported some of the international energy-sector investors' attitudes towards West Africa have become impartial, because of the small size of the region's countries and their history of military coups. This argument highlights the idea that African leaders should develop effective strategies in order to achieve NEPAD objectives as far as energy is concerned. The development of a power pool, through integrating the region's electricity sector, would result in a massive market, while well-managed and transparent cross-border energy trading, will alleviate investor concerns about high risk profiles of certain countries. There are others important issues such as a stable policy, feed-in tariffs, power purchasing agreements, and predictable rational regulation.

5.2. Role of government

Berg (2000) argues that change with regard to public policy of the electricity sector should take into account fundamental conditions within the electric utility industry. In the case of the DRC, there is no new policy in respect of the electricity sector. The utility works with a policy implemented in 1978 when the status of the company was approved under the legal framework of public enterprise. The new government has already considered the possibility of implementing reform in most public enterprises. SNEL is one company which the government seeks to reform, thereby reducing government control.

Political and economic stability not only contribute to a strong economy, but also have a strong positive external effect by providing steady markets for suppliers. Hill (2003) argues that electricity planning issues are more complicated in developing countries than in developed. Many developing countries face problems of financing construction of new power plants, including many African states.

The success of NEPAD should have an impact on the political stability of several nations. Without political stability it could prove difficult for private partners to invest. The construction of Grand Inga will go hand-in-hand with political stability. It is an opportunity for the host government to develop a major platform for investments across the country within different sectors. The state should implement an improved policy, acceptable to the policy maker (government) and the private sector. An effective policy will guarantee an improved result where there is a strong institution to implement such policy. One responsibility concerns service delivery to citizens. In addition, governments should provide improved infrastructure as a means to attract investors. Following the same argument, Stiglitz (1997) suggests any attempt to assess the appropriate role of governments within development, should come to terms with the limitations of governments, as well as the limitations of markets. In countries where governments remain ineffective, the scope for their action should be correspondingly limited. It is well known in most of the developing countries that government's role is limited in terms of service delivery.

It is also important to discuss the cost of electricity in African countries, especially in relation to NEPAD objectives, although the cost of electricity was not discussed. In addition, experience shows that Sub-Saharan African countries have varying electricity prices. For example, electricity is expensive in Kenya compared to countries such as South Africa where the tariff is low. Botchway (2000) proves the role that governments can play to solve problems of electricity, is to allow nations to establish electricity companies. However, he demonstrates how the role of government is necessary for a good performance of the industry. An analysis of global changes shows that the state usually plays a major role within the industry. The electricity sector has been considered as part of a national security concern and requires an effective policy in order to control the utility. Another element to be noted is government control of the utility, which must ensure all have access to electricity.

According to Botchway (2000), the electricity industry has also been restrained by national borders with regard to where power is generated and to who it is supplied. To the extent that any significant international relations that existed, they are related mainly to financing and the equipment or technology supply aspects of the industry. An increasing emphasis on the international dimensions of such business is a new characteristic of the electricity industry. This is one reason why African countries have developed regional co-operation in terms of electricity generation. Examples of this are the Southern African Power Pool, Western African Power Pool and the Eastern African Power Pool. The NEPAD vision for the energy sector should assist all regional bodies to work together cooperatively.

5.3. Regional regulations

Most governments suggest a regional regulatory body. It should begin to review the cost of electricity tariffs within the sub-region. This could be the case of the SADC, East Africa region, and the West Africa region. The regional regulatory body should be independent and different from the present Regional Electricity Regulators Association of Southern Africa (RERA). The regional regulatory body should fix and review the wheeling charge on the transmission network. Currently the wheeling charge is being discussed by member states and electricity companies in a power pool. Each participating country should nominate key knowledgeable personnel to serve on the electricity regulator. The old mechanism should be dropped to give the regional regularity body effective control.

6. Conclusions

In line with NEPADs vision, it is concluded that the challenges and security of electric power to sub-Saharan African countries could be met through power trading. This should be based on the development of the Inga 3 and Grand Inga hydro-power schemes in the Democratic Republic of Congo. Meaningful power trading between the West African Power Pool, the East African Power Pool; and the Southern African Power Pool is feasible and recommended.

Success of the outlined scheme depends largely on adequate financial resources to be raised by foreign investment in public-private partnerships. For this to materialise, respective governments will have to ensure political stability. The present and future potential generating capacities are cited, proving the technical feasibility of the proposed schemes. It is recommended that an independent regional energy regulator be established for this project, replacing the existing association of the various national regulators.

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APPENDIX D. RECOMMENDATION LETTERS

CAPE PENINSULA UNIVERSITY OF TECHNOLOGY

ENERGY TECHNOLOGY UNIT

Tel.: 021-460 3127
Fax: 021-460 3705
E-mail: ukene@cput.ac.za

7 October 2005

TO WHOM IT MAY CONCERN

This serves to confirm that

Mr Jean-Marc Lukamba-Muhiya

Is a research participant in the Energy Technology Unit (ETU) and that he is actively conducting research towards a DTech/PhD degree in the field of power trading and public-private partnership.

Any assistance afforded him would be greatly appreciated.

Prof Ernst Uken
Head: Energy Technology Unit

Secrétariat Général à l'Energie
<u>Gombe / Kinshasa</u>

Kin, le 28 /11/2005

MINISTERE DE L'ENERGIE
SECRETARIAT GE...
Date : 28 NOV 2005
N° Classement :

OBJET : Demande d'interview

A Monsieur le Secrétaire Général à l'Energie
A <u>KINSHASA/GOMBE</u>

Monsieur,

J'ai l'honneur de venir auprès de votre personnalité introduire une demande d'interview dans vos différentes directions concernant ma Thèse de doctorat à Cape Peninsula University of Technology. Cette Thèse est basée sur l'évaluation de commerce de l'énergie électrique dans quatre pays de la SADC, notamment la République démocratique du Congo, l'Afrique du Sud, le Zimbabwe et le Lesotho.

J'annexe à la présente la lettre de mon directeur qui justifie la collecte de données auprès de votre société.

Veuillez agréer, Monsieur le Secrétaire Général, assistance de ma considération distinguée.

Jean Marc Lukamba Muhiya

Cape Peninsula
University of Technology

08 August 2006

TO WHOM IT MAY CONCERN

This is to certify that Mr JM Lukhamba-Muhiya Tshombe is a registered doctoral student at this institution via the student number 205229646. He is making excellent progress with his work on evaluating power trading among selected SADC countries.

Please assist him with his field work in your respective country. His research aims to address problems in power trading among the SADC community of countries and, once completed, his work will make a marked contribution to the existing body of knowledge of the relevant field.

In light of current problems experienced in the electricity power supply industry in this region, it is expected that his work will set a high standard while proposing a normative model that can be used for successful inter-region and international co-operation to improve power trading practices in Sub-Saharan countries.

Thank you.

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APPENDIX E. SOUTHERN AFRICAN POWER POOL INTER-UTILITY MEMORANDUM OF UNDERSTANDING 16 MAY 1995

SOUTHERN AFRICAN POWER POOL (SAPP)

INTER-UTILITY MEMORANDUM OF UNDERSTANDING

SADC POWER UTILITIES AND NON-SADC UTILITIES

16 MAY 1995

SOUTHERN AFRICAN POWER POOL
INTER-UTILITY MEMORANDUM OF UNDERSTANDING

PREAMBLE

This Memorandum of Understanding (MOU) is made and entered into by the signatories. Those signatories which are also Electricity Supply Enterprises are referred to as "Members".

RECITALS

WHEREAS, the Southern African Development Community (SADC) power Utilities and other non-SADC utilities are engaged in the electricity supply business in their own countries; and

WHEREAS, the "Members" wish to continue with the development of interconnections between their respective networks and expand capacity and energy trade among themselves; and

WHEREAS, the "Members" desire to participate in a regional power pool under the name of the Southern African Power Pool (SAPP) to reduce investments and operating costs, enhance reliability of supply and share in the other benefits resulting from the interconnected operation of their systems; and

WHEREAS, the "Members" wish to provide further opportunities to co-ordinate the installation and operation of generation and transmission facilities in their respective networks; and

WHEREAS, the "Members" wish to co-operate and seek mutually beneficial arrangements wherever possible and to refrain from arrangements that would be detrimental to any "Member" or "Members"; and

WHEREAS, the "Members" accept that their relationship be based on the following principles:

(a) That issues related to interconnections be handled in a spirit of co-operation and in a friendly, open and trusting manner;

(b) That Members have equal rights and equal obligations, act in solidarity and refrain from taking advantage of each other.

NOW THEREFORE, the "Members" agree to enter into this MOU for the formation of the "Southern African Power Pool" hereinafter called the "SAPP" or the "Pool".

ARTICLE 1 : OBJECTIVES AND PURPOSE

The objective of this "Memorandum of Understanding" is to facilitate the establishment of the Southern African Power Pool (SAPP) which in turn has the objective to provide reliable and economical electric supply to the consumers of each of the SAPP Members consistent with reasonable utilisation of natural resources and effect on the environment.

The purpose is to establish the basic principles under which the SAPP will operate, inter alia:

(a) the co-ordination of and the co-operation in the planning and operation of the various systems to minimize costs while maintaining reliability and,

(b) the full recovery of costs and the equitable sharing of the resulting benefits.

Among the benefits that will be achieved, are reductions in required generating capacity, reductions in fuel costs and improved use of hydro-electric energy.

Each Member has the right and obligation, regardless of size or type of organisation, to own or otherwise provide the facilities required to provide its electric service requirements.

Each and all of the provisions of this "Memorandum of Understanding", are considered necessary to enable the signatories to this Memorandum to accomplish the objectives.

ARTICLE 2 : HIERARCHY OF THE DOCUMENTS GOVERNING THE SAPP

The following documents shall govern the establishment and administration of the SAPP. In case of inconsistency, the first document shall have precedence over the second document; the second document over the third document and the third document over the fourth document.

(i) The Inter-Government "Memorandum of Understanding".
(ii) The Inter-Utility "Memorandum of Understanding".
(iii) The "Agreement between Operating Members".
(iv) The "Operating Guidelines".

No other document can be construed as governing the establishment and the administration of the SAPP.

RTICLE 3 : DEFINITIONS

In addition to the definitions given below, definitions of terms directly related to the operation of the SAPP are given in the Agreement between Operating Members. Those definitions shall apply if the need arises to obtain the meaning of a term which is defined in the Agreement between Operating Members, but not in this MOU.

3.1 ELECTRICITY SUPPLY ENTERPRISE:

An Electricity Supply Enterprise shall mean an entity which operates a Control Centre around the clock; which owns - or controls through other means - the operation of several generating units and regularly operates such units to meet a portion or all of its load obligations; which owns a transmission system already interconnected internationally with neighbouring Electricity Supply Enterprise(s) or which may be interconnected with such Electricity Supply Enterprise(s) some time in the future (see also Independent Power Producers, Article 3.2).

MANAGEMENT STRUCTURE OF THE SOUTHERN AFRICAN POWER POOL

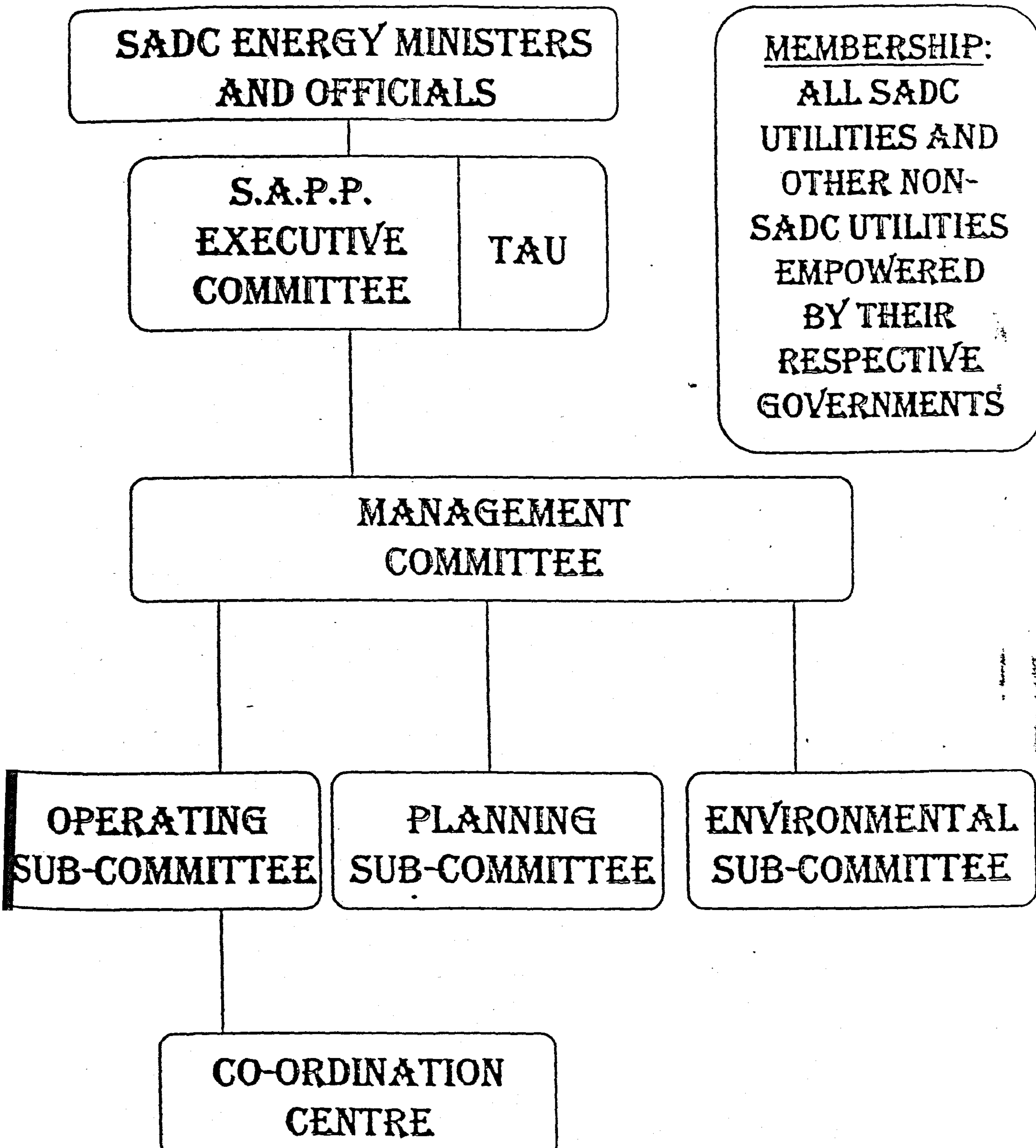

FIGURE 1

ARTICLE 4 : MANAGEMENT STRUCTURE OF THE SAPP

The Management Structure of the SAPP is given in Figure 1.

4.1 SADC ENERGY MINISTERS AND OFFICIALS:

The Southern African Development Community (SADC) Government Ministers and Officials shall be responsible for policy matters which are normally under their control in terms of the national administrative and legislative mechanisms that regulate the relations between the Government and its respective power utility.

The Executive Committee shall refer matters such as requests for membership by non-SADC countries and major policy issues that may arise to the SADC Energy Ministries.

4.2 EXECUTIVE COMMITTEE:

The Executive Committee shall be composed of the Chief Executives of only those Member Electricity Supply Enterprises who generate, wholesale and retail power to end-use customers. Independent Power Producers shall not be eligible to participate in the Executive Committee. The Committee shall act as the Board of the Pool and its duties are described in Article 10. Every Chief Executive shall continue to report to his own Controlling Body and the creation of the SAPP shall in no way alter or modify this relationship. A country having more than one utility meeting these requirements should designate one utility to represent it on the Executive Committee.

4.3 MANAGEMENT COMMITTEE:

The Management Committee shall oversee the administration of the Pool and shall ensure that the objectives of the Pool, as specified in this MOU, are met. Its duties are described in Article 11.5; in those areas which exceed its authority, the Management Committee shall make recommendations to the Executive Committee. Independent Power Producers shall not be eligible to participate in the Management Committee.

4.4 PLANNING SUB-COMMITTEE:

The Planning Sub-Committee shall report to the Management Committee and shall be responsible for planning and other duties described in Article 13.

4.5 OPERATING SUB-COMMITTEE:

The Operating Sub-Committee shall report to the Management Committee and shall be responsible for operating and other duties referred to in Article 14.

4.6 ENVIRONMENTAL SUB-COMMITTEE:

The Environmental Sub-Committee shall report to the Management Committee and shall be responsible for alerting and advising the Management Committee about environmental and other matters, as described in Article 15.

4.7 CO-ORDINATION CENTRE:

The Co-ordination Centre shall report to the Chairperson of the Operating Sub-Committee. Its duties are defined in the Agreement between Operating Members.

4.8 TAU:

TAU is the Technical and Administrative Unit of the Energy Sector of SADC. It shall provide secretarial and other services to the Executive Committee as defined in Article 12.

ARTICLE 5 : COMMENCEMENT AND TERMINATION OF THIS MOU

5.1 COMMENCEMENT DATE:

An Electricity Supply Enterprise may become party to this MOU upon signature of the Inter-Government MOU by the relevant Head of State or Minister. Membership of an Electricity Supply Enterprise in the SAPP shall start on the date of signature of this MOU by its Chief Executive. The SAPP shall come into being on the date of the fourth signature of this MOU.

5.2 TERMINATION:

Any Member may terminate its participation in the SAPP by giving three (3) months notice to the Executive Committee, provided the Member is not a signatory of the Agreement between Operating Members. A Member which is a signatory of the Agreement between Operating Members, shall have the right to terminate its participation in the SAPP as specified in the Agreement between Operating Members. Any unfulfilled duties including financial obligations existing as a result of the Pool at the date of termination, shall continue in full force until such items have been fulfilled or have expired.

ARTICLE 6 : CONDITIONS FOR MEMBERSHIP

6.1 MEMBERSHIP:

All Electricity Supply Enterprises as defined in Article 3.3 situated in a SADC country as of September 1994, and any other non-SADC countries subject to approval of the SADC Energy Ministers, may become a member of the SAPP. The recommendation from the Executive Committee for the acceptance of an Electricity Supply Enterprise from a non-SADC country which has applied for Membership, must receive a two-thirds majority before it can be forwarded to the SADC Ministers for approval or rejection.

6.2 OBSERVER STATUS:

By consensus or, failing this, by a two third majority the Executive Committee may grant, upon approval of the SADC Energy Ministers, Observer status to an Electricity Enterprise interested in the interconnected operation of the Pool. Electricity Supply Enterprises having obtained observer status shall all have the same rights and obligations as specified in advance by the Management Committee.

ARTICLE 7 : AGREEMENTS WITH NON-MEMBERS

This MOU shall not restrict any Member from having interconnections or agreements with Non-Members, provided the following conditions are met:

7.1.1 such agreement(s) shall not create obligations upon a Member which is not party to such agreement(s).

7.1.2 such agreement(s) shall not impair a Member from fulfilling its obligations under the SAPP Agreement.

7.1.3 unless all the affected Members have agreed beforehand, Members shall trade in electricity only with the Non-Member systems to which they are directly connected.

ARTICLE 8 : PREVIOUS AGREEMENTS

8.1 The execution of this MOU shall not impair, amend or change any previous contract or agreement, and such contracts or agreements shall continue, including all rates, terms and conditions, until the expiration of such contracts or agreements or termination of such contracts or agreements in accordance with the provisions contained in such contracts or agreements.

8.2 If this MOU requires Members to fulfill duties which are already specified in existing agreements, nothing additional needs to be done by the Members in those specific areas.

8.3 If this MOU requires Members to fulfill duties which are only in part specified in existing agreements, only the portion of the requirements which is in excess of what is already specified in existing agreements needs be added to what must already be done by the Members.

ARTICLE 9 : INTERCONNECTED TRANSMISSION FACILITIES

9.1 OWNERSHIP:

Unless otherwise agreed, each Pool Member, whether an Operating Member or not, shall at its own costs, build, operate and maintain its own transmission facilities.

9.2 OPERATION:

To the extent that the Management Committee is satisfied that no use of transmission facilities will cause overload, abnormal losses, endanger the stability of the interconnected system or cause undue hardship to another Member, nothing in this MOU shall restrict a Member in the use of its own transmission facilities.

ARTICLE 10 : EXECUTIVE COMMITTEE

10.1 REPRESENTATION:

The fourth signature of this MOU shall automatically create an Executive Committee consisting of the Chief Executives of eligible Members as defined in Article 4.2. It shall act as the Board of the Pool and shall be the authority governing the administration and formulating the objectives of the SAPP.

10.2 MEETINGS:

The Executive Committee shall meet at least once a year and the Chairperson shall be from the Member hosting the meeting. The Chairmanship and the venue of the meeting shall rotate annually and meetings at other times shall be at the call of the Chair or at the request of a Member(s).

10.3 MINUTES:

A summary of the main revisions shall be prepared at the end of each meeting and signed by the Member's representatives. The minutes of the meetings shall be prepared by TAU and shall include, but shall not be limited to: a summary of all decisions made; actions taken; tasks to be carried out and all future deadlines. Copies of such minutes shall be mailed within twenty-one (21) days after each meeting to each Member of the Committee. Failure to object in writing to the minutes within thirty (30) days after mailing shall be deemed to constitute approval thereof. The minutes of all meetings shall be kept by TAU and shall be made available to the SADC Energy Ministers for information and to all Members.

10.4 CHAIRPERSON

The Committee shall elect a Chairperson who shall hold office for a period of at least one year, but not more than three (3) years. The Chairmanship shall rotate among the Members who are signatories of the Agreement between Operating Members.

10.5 MANAGEMENT COMMITTEE AND SUB-COMMITTEES:

The Executive Committee shall specify and amend from time to time the duties and authority, other than set forth herein, of the Management Committee, the Environmental Sub-Committee, the Planning Sub-Committee the Operating Sub-Committee and any Working Group or Task Force which may be established by the Executive Committee.

10.6 OTHER MATTERS:

The Executive Committee shall decide within sixty (60) days on any matter referred to it by a Member(s) or by the Management Committee, including the exclusion of a Member(s).

10.7 ACCEPTANCE OF NEW MEMBERS:

The Executive Committee shall, upon the approval of the SADC Energy Ministers, accept new Members into the SAPP as specified in Article 6.1.

10.8 GRANTING OF OBSERVER STATUS:

The Executive Committee shall have the authority, upon approval of the SADC Energy Ministers, to grant observer status to Electricity Supply Enterprises which may apply as defined Article 6.2. The granting of Observer status shall allow the Electricity Supply Enterprise to attend meetings and participate, but it shall have no voting rights in any of the committees or sub-committees.

10.9 COMMITTEE EXPENSES:

Each Member represented at the Executive Committee shall arrange and finance the participation of its own representative(s) in the various committees, task forces and sub-committees. TAU shall arrange and finance the participation of its own representative(s).

10.10 DECISION PROCEDURES:

10.10.1 Each Member shall have one vote at the Executive Committee.

10.10.2 Decisions will be made by consensus or, failing this, by a two thirds majority of the Members present at the meeting, unless otherwise stated in this MOU.

10.10.3 The presence at the meeting of two thirds of the Members shall constitute a quorum.

10.10.4 Only Members which are signatories of the Agreement between Operating Members shall vote on Service Schedules and on operational issues.

10.10.5 The decisions made by the Committee shall be binding on all Members, including those which did not attend the meeting.

10.10.6 In case of a dispute between Operating Members, the matter shall be referred to Arbitration in accordance with the Agreement between Operating Members, unless another procedure is agreed to by the Members.

ARTICLE 11 : THE MANAGEMENT COMMITTEE

11.1 REPRESENTATION:

The Management Committee shall consist of a maximum of three representatives per Member and these representatives shall be of sufficient seniority in their own organisation to make all relevant decisions. A Member's main representative(s) at the Planning and at the Operating Sub-Committees shall also be its representatives at the Management Committee.

11.2 MEETINGS:

The Committee shall meet at least once a year. The Chairperson of the forthcoming meeting shall send notice of the meeting at least one month prior to the meeting. A final detailed Agenda shall be sent to all Members at least three weeks in advance. The date and venue of the following meeting shall be decided by the Members at each meeting.

11.3 MINUTES:

A summary of the main decisions shall be prepared at the end of each meeting and signed by the Members' representatives. Minutes shall be prepared by the Chairperson and shall include, but shall not be limited to: a summary of all decisions made; actions taken; tasks to be carried out and all future deadlines. Copies of such minutes shall be mailed within twenty-one (21) days after each meeting to each Member of the Committee. Failure to object in writing to the minutes within thirty (30) days after mailing shall be deemed to constitute approval thereof. Minutes of all meetings shall be sent to the Co-ordination Centre.

11.4 DECISION PROCEDURES:

11.4.1 Each Member shall have one vote at the Management Committee.

11.4.2 Decisions will be made by consensus or, failing this, by a two thirds majority of the Members present at the meeting, unless otherwise stated in this MOU.

11.4.3 The presence at the meeting of two thirds of the Members shall constitute a quorum.

11.4.4 Only Members which are signatories of the Agreement between Operating Members shall vote on recommendations pertaining to Service Schedules and on operational and planning issues affecting interconnected operations.

11.4.5 The decisions made by the Committee, shall be binding on all Members, including those which did not attend the meeting.

11.4.6 In case of a dispute between Members which cannot be resolved by this Committee, the matter shall be referred to the Executive Committee or Arbitration in accordance with the Agreement between Operating Members.

11.5 DUTIES OF THE MANAGEMENT COMMITTEE:

The duties of the Management Committee shall include, but shall not be limited to the following:

11.5.1 Oversee the work and approve the recommendations of the Sub-Committees.

11.5.2 Make all decisions on those matters not specifically delegated to other Committees.

11.5.3 Organise the training of the staff that will handle Pool interactions.

11.5.4 Direct the Operating, Planning and Environmental Sub-Committees to establish, working groups or task forces as required.

The following duties shall be carried out only by the Operating Members:

11.5.5 In accordance with the directives of the Operating Members of the Executive Committee, establish a Co-ordination Centre which will provide day-to-day information and administrative services to the Operating Members in order to assist them in the implementation of the Agreement between Operating Members.

11.5.6 Establish and oversee the implementation of common accounting procedures for transactions, capacity deficits and energy deficits to determine the inter-utility payments resulting from the Agreement between Operating Members.

11.5.7 Establish the methods, procedures and intervals of reporting scheduled and actual capacity and energy interchanges.

11.5.8 Establish methods and procedures for accounting and billing for capacity and energy interchanges.

11.5.9 Ensure the collection and analysis of the data relevant to the operation and planning of the interconnected system.

11.5.10 Ensure that suitable computer hardware and software and sufficient communication facilities are available to the Members and to the Co-ordination Centre to perform their duties.

11.5.11 Recommend to the Executive Committee the introduction of new Service Schedules, the removal of unnecessary Service Schedules and the revision as necessary, of existing Service Schedules.

11.6 CHAIRPERSON

The Committee shall elect a Chairperson who shall hold office for a period of at least one year, but not more than two (2) years. The Chairmanship shall rotate among the Members who are signatories of the Agreement between Operating Members.

11.7 DUTIES OF THE CHAIRPERSON:

11.7.1 The Chairperson shall provide an Agenda and preside over the Committee meetings.

11.7.2 The Chairperson shall bear overall responsibility for the Committee's activities and shall act as its spokesman.

11.7.3 The Chairperson shall decide whether the entire meeting or any part of it should be limited to those having Member status.

11.7.4 The Chairperson shall nominate a representative to serve as an observer at any relevant Committee meeting.

11.7.5 The Chairperson shall notify, in writing, all appointed Chairpersons and representatives to existing or new committees, working groups, or task forces created by the Management Committee.

11.7.6 The Chairperson shall invite participation of other utilities, organizations or experts as required.

11.7.7 The Chairperson shall maintain records of the proceedings of the Management Committee. After the establishment of the Co-ordination Centre, these records shall be retained at the Co-ordination Centre to be available to all Members on request.

ARTICLE 12 : DUTIES OF THE TECHNICAL AND ADMINISTRATIVE UNIT

The duties of TAU with respect to the SAPP shall consist of the following:

(i) To provide a secretariat to the Executive Committee.

(ii) To advise the Executive Committee of the relevant rules and regulations of SADC.

(iii) To assist the Executive Committee in achieving SADC objectives with regard to the establishment and development of the SAPP.

(iv) To report to the SADC Committee of Energy Ministers.

(v) To liaise with other SADC structures.

(vi) To seek and mobilise funds as recommended by the SAPP Executive Committee.

ARTICLE 13 : PLANNING SUB-COMMITTEE

13.1 REPRESENTATION:

The Planning Sub-Committee shall consist of a maximum of two representatives per Member and these representatives shall be of sufficient seniority in their own organisation to make all relevant decisions.

13.2 DUTIES OF THE PLANNING SUB-COMMITTEE:

The duties of the Planning Sub-Committee shall include, but shall not be limited to the following:

13.2.1 Establish and update common planning and reliability standards which have an impact on the SAPP.

13.2.2 Based on individual Member's plans, develop every two years, an overall Pool Plan to highlight the benefits and opportunities for cost savings that can be derived by the Members from the co-ordination of activities. The Pool Plans shall:

(i) Take into account the forecasted demand and energy consumption in each Member's system, including Demand Side Management.

(ii) Indicate the anticipated sales and purchases by each Member, including those with Electricity Supply Enterprises or Independent Power Producers Non-Member of the SAPP.

(iii) Contain the characteristics, location and commissioning dates of the new generating units and new transmission facilities of 110kV and above which are planned in each Member's system, when such facilities have a significant impact on the interconnected system.

(iv) Contain the characteristics, location and commissioning dates of the new telecommunication, telecontrol and supervisory facilities which are planned in each Member's system, when such facilities have a significant impact on the operation of the interconnected system.

(v) Identify and record new generation, transmission, telecommunication or telecontrol facilities to be installed in the systems of Members and Non-Members.

?.3 Evaluatate software and other tools which will enhance the value o:of planning activities such as load forecasting, the determimination of planning or reliability standards, cost-benefit-it analysis or system studies; submit proposals to the Managgement Committee.

following dududies shall be carried out only by the Operating nbers:

Submit proposals to the Operating Members of the Managgement Committee regarding new Service Schedulsles, removal of unnecessary Service Schedules and revision as necessary of existing Service Schedules.

Specify the reliability standards that shall be used to determinine the Accredited Capacity Obligation of each Operatinng Member.

Present a course of action which will enable each Operatimg Member to comply with its Accredited Capacity Obligaticon.

Establish the benefits attributable to each Operating Member resulting from the installation of relays, control equipmeent or any system study, improvement or facility required for the satisfactory operation of the interconmected system and make recommendations to the Operatimg Members of the Management Committee regarding the financial contribution of each Operating Member to the costs of such improvements.

Establish ffuture transfer capability limits between systems to enable the Operating Sub-Committee to prepare detailed Operating Procedures.

Identify specific reliability problems and recommend the generation or transmission additions or changes required to eliminate them.

13.2.10 Establish capacities of transmission plant in the system of Operating Members for the purposes of calculating wheeling rates and review these on an annual basis.

13.3 CHAIRPERSON

The Planning Sub-Committee, shall elect a Chairperson to serve for at least one (1) year term, but not more than two (2) years, after which the Chair shall rotate to other Members. The Chairperson shall be elected from the Operating Members of the SAPP.

13.4 ADMINISTRATIVE MATTERS:

The rules governing the meetings, minutes, decision procedures, duties, election and tenure of the Chairperson of the Planning Sub-Committee, shall be the same as for the Management Committee.

In case of disagreement between Members, the matter shall be submitted to the Management Committee. The report shall reflect the majority view and include a statement by the minority.

ARTICLE 14 : OPERATING SUB-COMMITTEE

14.1 REPRESENTATION:

The Operating Sub-Committee shall consist of representatives of Members which are signatories of the Agreement between Operating Members. It shall have a maximum of two representatives per Member and these representatives shall be of sufficient seniority in their own organisation to make all relevant decisions. The main representative shall also be a participant in the Management Committee.

14.2 DUTIES OF THE OPERATING SUB-COMMITTEE:

The duties of the Operating Sub-Committee shall be in accordance with the Agreement between Operating Members.

14.3 CHAIRPERSON:

The Operating Sub-Committee shall elect a Chairperson to serve for at least one (1) year term, but not more than two (2) years, after which the Chair shall rotate to other Members.

14.4 ADMINISTRATIVE MATTERS:

The rules governing the meetings, minutes, decision procedures, duties, election and tenure of the Chairperson of the Operating Sub-Committee, shall be the same as for the Management Committee.

In case of disagreement between Members, the matter shall be submitted to the Management Committee. The report shall reflect the majority view and include a statement by the minority.

ARTICLE 15 : ENVIRONMENTAL SUB-COMMITTEE

15.1 REPRESENTATION:

Each Member shall appoint one representative to the Environmental Sub-Committee.

15.2 MEETINGS:

The Environmental Sub-Committee shall hold an annual meeting in the first quarter of each calendar year and shall hold other meetings at the call of the Chairperson or at the request of any Member. At least one (1) month written notice shall be given of any meeting and shall state the time and place of the meeting and include an agenda of the items to be considered.

15.3 CHAIRPERSON:

The Environmental Sub-Committee, at its annual meeting, shall elect a Chairperson to serve for at least a one (1) year term, but not more than two (2) years, after which the Chair shall rotate to the other Members.

15.4 DUTIES:

Under the direction of the Management Committee, the Environmental Sub-Committee shall keep abreast of world and regional matters relating to air quality, water quality, land use and other environmental issues. Where Governments have in place related Environmental Organisations, this Committee shall liaise with them to assist one another on specific issues. The Sub-Committee shall present all findings and recommendations to the Management Committee, the Planning and Operating Sub-Committees and shall also carry out other functions and activities as assigned or approved by the Management Committee.

ARTICLE 16 : CO-ORDINATION CENTRE

16.1 CREATION OF THE CO-ORDINATION CENTRE:

The representatives of the Operating Members at the Management Committee shall propose the creation of a Co-ordination Centre to the representatives of the Operating Members at the Executive Committee. The functions and duties of the Co-ordination Centre when it is established, shall be in accordance with the Agreement between Operating Members.

16.2 CONTRIBUTIONS TO COSTS BY NON-OPERATING MEMBERS:

Since Members which are not signatories of the Agreement between Operating Members will nevertheless benefit from the Co-ordination Centre by obtaining information and other services from it, they shall contribute to the costs of the Co-ordination Centre in accordance with the rulings of the Management Committee. Non-Members may also receive information from the Co-ordination Centre, but shall pay market rates for such information.

ARTICLE 17 : AMENDMENTS

This MOU may be reviewed from time to time, but no modification shall be of any force or effect unless reduced to writing and approved by the Executive Committee.

ARTICLE 18 : ASSIGNMENT

Each Member shall have the right to assign this MOU to any successor to all or substantially all of its electric properties, whether by merger, consolidation, sale or otherwise, without the consent of the other Members, provided such successor shall agree in writing to assume the obligations of such Member. This provision shall be applicable to assignees in succession.

ARTICLE 19 : NOTICES AND DOMICILIUM

19.1 COMMUNICATION:

Any communication or documents given or sent by any Member or TAU to any other Member or TAU shall be in writing and shall be deemed to have been duly delivered to the party to which it is addressed at its respective address, namely:

19.1.1 For BPC:

Chief Executive	Telephone:	+267-3603000
Botswana Power Corporation	Telefax:	+267-373563
Motlakase House		
Macheng Way		
P O Box 48		
GABORONE, Botswana		

19.1.2 For EdM:

Director Geral	Telephone:	258-1-42-2071/2
Electricidade de Mocambique	Telefax:	258-1-42-2074
Ave Agostinho, Neto 70		
Caixa Postal 2447		
MAPUTO, Mozambique		

19.1.3 For ENE:

Director Geral	Telephone:	+244-2-326582
Empresa Nacional	Telefax:	+244-2-323433
de Electricidade		
Predio Geominas- 6,7, Andores		
LUANDA, Angola		

19.1.4 For ESCOM:

General Manager	Telephone:	+265-622000
Electricity Supply	Telefax:	+265-622008
Commission of Malawi		
P O Box 2047		
BLANTYRE, Malawi		

19.1.5 For ESKOM:

Chief Executive	Telephone:	+27-11-800-5510
Eskom	Telefax:	+27-11-800-5583
P O Box 1091		
JOHANNESBURG, 2000		
South Africa		

19.1.6 For LEC:

Managing Director	Telephone:	+266-312236
Lesotho Electricity	Telefax:	+266-310093
Corporation		
P O Box 423		
MASERU 100, Lesotho		

19.1.7 For SEB:

Chief Executive	Tel.	+268-42548/42521/46638
Swaziland Electricity	Telefax:	+268-42335
Board		+268-41931
P O Box 258		+268-48274
MBABANE, Swaziland		

19.1.8 For SNEL:

Président Délégué Général
Société Nationale d' Electricité (SNEL)
B.P. 500
Avenue de la Justice 2381
KINSHASA, Zaire

Telex:	63400 RCNF	
	(Attn: DMS Zaire SNEL 10)	
Telephone:	+243-12-33736	+871-682622676
Telefax:	+243-12-33657	+871-682622677
	+260-2-313835 (SNEL Shaba c/o Merzario)	

19.1.9 For SWAWEK:

Chairman & Managing Director
SWAWEK
Swawek Centre
Corner Robert Mugabe
and Martin Luther Streets
P O Box 2864
WINDHOEK, Namibia

Telephone: 261-2-31830
Telefax: 261-2-32805

19.1.10 For TANESCO:

Managing Director
Tanzania Electricity
Supply Company (Ltd.)
P O Box 9024
DAR ES SALAAM, Tanzania

Telephone: +255-51-46242
Telefax: +255-51-44668
+255-51-36247
+255-51-26704

19.1.11 For TAU/SADC:

Regional Co-ordinator
TAU/SADC Energy Sector
CX. Postal No. 2876
Rua Gil Vicente No. 2
LUANDA, Angola

Telephone: +244-2-35288/
+244-2-345147
Telefax: +244-2-343003

19.1.12 For ZESA:

Chief Executive
Zimbabwe Electricity
Supply Authority
Electricity Centre
25 Samora Machel Avenue
P. O Box 377
HARARE, Zimbabwe

Telephone: +263-4739033
Telefax: +263-4739854/5

19.1.13 For ZESCO:

Managing Director
Zambia Electricity
Supply Corporation
Stand 6949
Great East Road
P O Box 33304
LUSAKA, Zambia

Telephone: +260-1-225074
Telefax: +260-1-222753

19.2 DELIVERY TIME:

19.2.1 If a communication is delivered by hand, it shall be deemed to have been received by the addressee on the date of delivery.

19.2.2 If posted by pre-paid registered post, it shall be deemed to have been received by the addressee on the fourteenth (14) day after postage.

19.2.3 If sent by telex, telegram or facsimile, it shall be deemed to have been received by the addressee one (1) day after dispatch.

19.3 CHANGE OF ADDRESS:

Any Member may, by written notice to all of the other Members, change the address to which any notice or request intended for the Member giving such notice, shall be addressed.

ARTICLE 20 : SIGNATORIES

IN WITNESS whereof the said Operating Members have hereto set their hands:

20.1 SIGNED ON BEHALF OF BPC AT ______________________ ON THIS

__________ DAY OF ______________________________________

SIGNED: __________________ WITNESS: ______________________

NAME: __________________ NAME: ______________________

CHIEF EXECUTIVE TITLE: ______________________

BOTSWANA POWER CORPORATION

20.2 SIGNED ON BEHALF OF EdM AT ______________________ ON THIS

__________ DAY OF ______________________________________

SIGNED: __________________ WITNESS: ______________________

NAME: __________________ NAME: ______________________

DIRECTOR GERAL TITLE: ______________________

ELECTRICIDADE DE MOCAMBIQUE

20.3 SIGNED ON BEHALF OF ENE AT ______________________ ON THIS

__________ DAY OF ______________________________________

SIGNED: __________________ WITNESS: ______________________

NAME: __________________ NAME: ______________________

DIRECTOR GERAL TITLE: ______________________

EMPRESA NACIONAL

DE ELECTRICIDADE

ANGOLA

20.4 SIGNED ON BEHALF OF ESCOM AT ____________________ ON THIS

__________ DAY OF ______________________________________

SIGNED: __________________ WITNESS: __________________

NAME: __________________ NAME: __________________

GENERAL MANAGER
ELECTRICITY SUPPLY COMMISSION
MALAWI

TITLE: __________________

20.5 SIGNED ON BEHALF OF ESKOM AT ____________________ ON THIS

__________ DAY OF ______________________________________

SIGNED: __________________ WITNESS: __________________

NAME: __________________ NAME: __________________

CHIEF EXECUTIVE
ESKOM OF SOUTH AFRICA

TITLE: __________________

20.6 SIGNED ON BEHALF OF LEC AT ____________________ ON THIS

__________ DAY OF ______________________________________

SIGNED: __________________ WITNESS: __________________

NAME: __________________ NAME: __________________

MANAGING DIRECTOR
LESOTHO ELECTRICITY COMMISSION

TITLE: __________________

20.7 SIGNED ON BEHALF OF SEB AT ____________________ ON THIS

__________ DAY OF ______________________________________

SIGNED: __________________ WITNESS: __________________

NAME: __________________ NAME: __________________

CHIEF EXECUTIVE
SWAZILAND ELECTRICITY BOARD

TITLE: __________________

20.12 SIGNED ON BEHALF OF ZESCO AT ______________________ ON THIS ___________ DAY OF ____________________________

SIGNED: ____________________ WITNESS: ________________________

NAME: ______________________ NAME: __________________________

MANAGING DIRECTOR
ZAMBIA ELECTRICITY SUPPLY
CORPORATION

TITLE: ___________________________

—oOo—

PJR/Mab/MOUPIE2 (MSO311[g])
16 May 1995

APPENDIX F. LETTER OF LANGUAGE EDITOR

Cape
Peninsula
University
of Technology

August 28, 2008

To Whom it may Concern

This certifies that I worked with Mr LUKAMBA MUHIYA-TSHOMBE and on his doctoral thesis for purposes of logic, English and format.

I am satisfied his corrected thesis meets the required standard of excellence.

AP Simmonds BSc(Hons)Econ
Lecturer, Communications,
Dept of Electrical Engineering