

THE IMPLICATIONS OF THE SADC ENERGY ACCESS
STRATEGY AND ACTION PLAN ON PEACE,
SECURITY AND DEVELOPMENT IN THE REGION

N. MAGAM

THE IMPLICATIONS OF THE SADC ENERGY ACCESS STRATEGY AND ACTION
PLAN ON PEACE, SECURITY AND DEVELOPMENT IN THE REGION

by



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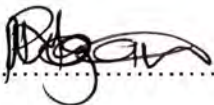


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Declaration

I Nolubabalo Magam, declare that this dissertation titled: The implications of the SADC Energy Access Strategy and Action Plan on Peace, Security and Development in the region, for Master of Social Science in International Relations at the North West University, hereby submitted, has never been submitted in part or whole for the award of any degree in any other institution. It is the work of my own design and all information contained herein has been fully acknowledged.

Signature. 

N. Magam

Date: Day 19 of MARCH 2013

Dedication

This paper is dedicated to the four important women in my life: Nontombi, Nandipha, Sindiswa and Rethabile.

Acknowledgements

My sincere gratitude and honour goes to the Almighty, my Comforter, for blessing me with an opportunity and strength to complete this paper. I extend my appreciation to my supervisor Prof Victor Ojakorotu whose patience, encouragement and constructive criticism led to the successful completion of this thesis.

I am greatly indebted to Mr. Kgame Molohe for his selfless guidance throughout the process of completing this work. Thank you to all my friends, including Mpho Chaka for their support. Lastly I lack words to express my appreciation to my sister Nandipha Magam, for her tolerance, patience and immense contribution through out the years of my studies, she truly is a blessing, I wouldn't have achieved all this without her support.

Abstract

The study addresses the issues related to climate change, energy production (traditional biomass and fossil fuels) as well as the potential of exploring renewable energy sources. The area of focus is the SADC region; this paper evaluates the implementation of the SADC Energy Access Strategy and Action Plan. It is an energy policy that was widely accepted and ratified by SADC member states in March 2010. The study is narrowed down to focus on the implementation of this policy in three SADC countries with different levels of energy consumption. These countries are South Africa with 80% of national energy consumption, Lesotho with 18% of national energy consumption and Mauritius which has 99.9% of national energy consumption.

This study argues that the SADC Energy Access Strategy and Action Plan has implications for peace, security and development in the region. This is evident in climate change being an issue of emergency, more emphasis has been put on the use of renewable energy as opposed to fossil fuels and traditional biomass, which affects the climate and contributes to global warming. Renewable energy reduces carbon dioxide emissions and global warming. SADC leaders had to come up with ways to adapt to climate change and its effects; this gave birth to the SADC Energy Access Strategy and Action Plan in March 2010. The Action Plan came in as a solution to the energy crisis and as a strategy to realign the SADC energy sector to that of the world.

The study further argues that Africa, and in particular SADC region has abundant renewable energy resources (solar energy, wind energy, hydro energy.etc), much of which are still untapped, yet have the capacity to supply the region with renewable energy for decades.

The findings of the study confirm that SADC Energy Access Strategy and Action Plan indeed has implications for Peace, Security and Development in the region. The lack of proper planning, commitment and funds, as well as investments into the energy sector hinder the development of the regional energy sector and energy access projects. The SADC region has the potential to meet the energy demands and to venture into the use of renewable energy.

Acronyms

BPC-Botswana Power Corporation
DRC-Democratic Republic of Congo
ECOWAS-Economic Community of West African States
EDM- Mozambique's Electricidade de Mozambique
ENE-Angola's Empresa Nacional de Electricidade
GDP-Gross Domestic Product
GHG-Green House Gases
LEC-Lesotho's Electricity Corporation
LPG-Liquefied Petroleum Gas
MDGs-Millennium Development Goals
MESC Malawi's Electricity supply commission
NamPower- Namibia Power Company
PV-Photovoltaic
RECs-Regional Economic Communities
SADC-Southern African Development Community
SAPP-Southern African Power Pool
SEB-Swaziland Electricity Board
TENESCO- Tanzania Electric Supply Company
WESTCOR-Western Corridor Project
ZESA- Zimbabwe Electricity Supply Authority (ZESA)
ZESCO-Zambia Electricity Supply Company
ZIZABONA-Zimbabwe, Zambia, Botswana and Namibia

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Chapter One

1.1. Background

Climate change cannot be written off as just another day of weird weather. It is the most serious threat facing people and the environment on which they depend. Global warming, rising sea levels, widespread flooding, droughts and the spread of tropical diseases, are already having a devastating impact. The poorer you are, the more likely you are to suffer from the effects of climate change. Yet, it is the poorest people, living in the countries that are least responsible for emissions of greenhouse gases, who are set to suffer most (Friends of the Earth, October, 2008). It is evident in the case of the United States of America, where The Kyoto Protocol, which became law in 2005 and set limits on the emissions of greenhouse gases from developed countries. Many countries signed up to the Protocol, but not the world's biggest emitter, the USA.

Climate change cannot be ignored; it has taken centre stage and requires urgent attention. Efforts to mitigate and adapt to climate change have been made and the search for solutions still continues. It is without doubt that the energy sector is a major contributor to global warming through the use of fossil fuels, nuclear power as well as the traditional biomass use of fire wood (cutting down trees) and cow dung (causing air pollution). Therefore, major changes have to be made in the energy sector, by introducing the use of renewable energy and giving the poor (rural areas) access to modern energy as opposed to the use of traditional biomass.

Africa faces enormous challenges of poverty alleviation, conflict resolution, unstable economies, including climate change and energy access as the most serious and requires urgent attention.

Energy is a basic need and all humans need access to some sort of energy, be it modern or traditional biomass. Africa's energy sector is dominated by traditional biomass, despite the health, environmental and safety problems associated with it. Most Africans are poor and biomass proves to be the most affordable as opposed to modern energy. Despite all these problems, traditional biomass makes up 80% or more of energy use in most African countries like Democratic Republic of Congo, Malawi, and Mozambique among others.

The effects of climate change and energy production necessitates the debate on renewable energy use. The African continent has abundant renewable energy sources such as wind energy, solar power, hydro power, Geo-thermal among others. Most of these sources are still untapped.

On the one hand, exploring these sources of energy requires investments into the renewable energy sector and has the potential of attracting investments into the "Green Market". On the other hand, the energy sector has to compete with other investments like those on schools, hospitals, infrastructure and reconstruction of conflict ridden countries in Africa.

Climate change has emerged as an important challenge facing Africa and indeed, much of the world in the 21st century. In the light of the mounting evidence of its causes and effects, expanding access to reliable energy supplies, particularly for the poor and promoting investment in clean energy and low-carbon approaches to economic development are urgent imperatives globally (The Global Urban Economic Dialogue Series, 2011).

Energy production contributes more to global warming, in support of this, the European Environment Agency (2008: 8), confirms that the production and consumption of energy places a wide range of pressures on the environment and on public health, some of which have been decreasing. Energy related greenhouse gas (GHG) emissions remain dominant, accounting for 80% of the total emissions, with the largest emitting sector being electricity and heat production, followed by transport.

The blanket of gases that keeps the planet warm gets thicker. This is because when humans burn fossil fuels and cut down trees they add greenhouse gases to the atmosphere that trap the sun's heat. More heat means more unpredictable weather and other big changes for life on Earth. When fossil fuels are burnt (oil, coal and natural gas) to make electricity, heat homes and offices, cook, or power cars, the main greenhouse gas carbon dioxide (CO₂) is released. Once released CO₂ can stay in the atmosphere for up to 200 years, heating up the planet.

The latest science from the Intergovernmental Panel on Climate Change IPCC, an independent global climate body, says most of the warming in the past 50 years has been caused by humans. It predicts a temperature rise of up to 6°C by the end of the century (Friends of the Earth, October 2008). The above confirms the threats that climate change poses to the environment.

According to many scientists, every additional ton of carbon dioxide, as well as five other greenhouse gases emitted by the burning of fossil fuels (coal, oil and gas) is warming the planet to potentially dangerous and irreversible levels. The primary culprit is the burning of copious quantities of fossil fuels for the production of electric power around the world (Ferrey, 2006:1).

Climate change is a major threat to sustainable development growth and especially development in Africa, as it hinders the achievement of the Millennium Development Goals. Nearly 2.4 billion people worldwide use traditional biomass for cooking and nearly 1.6 billion people do not have access to electricity. Without scaling up the availability of affordable and sustainable energy services, not only will the Millennium Development Goals (MDGs) not be achieved, but by 2030, another 1.4 billion people will be at risk of being left without modern energy. Conversely, by scaling up the availability of affordable and sustainable energy services, there is a greater chance of achieving the MDG's, as energy services have a multiplier effect on health, education, transport, telecommunications, safe water and sanitation services. It also affects investments and the productivity of income-generating activities in agriculture, industry, and tertiary sectors (Africa Partnership Forum, May 2007:3).

Most scientists studying the potential impact of climate change believe that Africa could face conditions more severe than other regions. They estimate that the continent is likely to experience higher temperature increases, rising sea levels that could affect much of its population, changing rainfall patterns, and increased climate variability due to proximity to the equator. The effects of climate change on individual countries depend on their location and attributes, although all countries are exposed to it and have reason for common cause. Africa's ability to adapt to these effects is lower than that of the rest of the world.

They could, if unmitigated, reduce arable land, worsen chronic hunger and even lead to social unrest. The climate change negotiations could offer unprecedented opportunities for Africa to strengthen its adaptive capacity and to move towards low-carbon economic development in a way that will use its comparative advantages. For instance, forests, hydro and solar power potential and land, attract investments from the private sector and benefit its nations (Grantham Institute for Climate Change, July 2009:3).

Africa therefore has a legitimate need to increase its energy supply. It is the wider global interest that Africa should be able to use clean energy sources. There is enormous potential for this, including through the development of Africa's huge hydro-power potential (Africa Partnership Forum, 2007:3).

Energy has been the pivot of economic development and this trend still persists, it is required for any change in a physical state and thus a prerequisite for all productive activity. The availability of energy has been the engine behind great economic prosperity and has led to advances in social and overall human development. Access to safe and affordable high quality energy sources improves agricultural productivity and will thus help to alleviate the problem of food shortages. It also ensures the viability of industrial and commercial sectors, since an agricultural surplus is needed to support growth in these sectors. Access to affordable energy is important in securing the competitiveness of local industries and their ability to participate in global markets (Alfstad, 2005: 1).

Energy is described as a dynamic indicator that shows the level of development level of a country. There is a strong positive correlation between energy production, energy consumption and economic development (Balat, 2008).

Energy is a basic need. Energy resources assist humans in meeting daily needs in pumping, transporting and heating water. It is also used in cooking, keeping warm or cool, promoting good health and transportation. Energy resources also enhance opportunities to become educated and in striving for improved security, by helping people achieve, at the very least, a minimal level of economic and social development. Many poor people live in rural areas where it is difficult to access modern energy forms. They thus rely on traditional fuels such as wood and agricultural and animal wastes.

The following are definitions of different types of energy sources

- **Energy**

There are different types of energy sources; this study focuses on the following:

- **Electrical Energy**

Energy comes mostly in the form of electricity and also referred to as modern energy. Nicholson(2009) explains electricity as the most widely available energy source and the only able to run the full range of household appliances. It can be used to power everything from the lights to the refrigerator as well as computers.

The Energy Information Administration defines electricity as the flow of electrical power or charge, which is both a basic part of nature and one of the most widely, used forms of energy. Electricity is actually a secondary energy source, also referred to as an energy carrier. That means that people get electricity from the conversion of other sources of energy, such as coal, nuclear, or solar energy, these are called primary sources. The energy sources used to make electricity can be renewable or non-renewable, but electricity itself is neither renewable nor non-renewable (Energy Information Administration, accessed, 19 March 2012).

- **Traditional Biomass Energy**

Traditional biomass includes wood fuels, agricultural and cow dung burnt for cooking and heating. It is mostly used in rural areas, as many people are poor and have limited or no access to modern energy.

According to the International Energy Agency (2008), biomass energy plays a vital role in meeting local energy demand in many regions of the developing world. Biomass is a primary source of energy for close to 2.4 billion people in developing countries (IEA, 1998).

- **Renewable Energy**

Renewable energy is a term used to describe energy that is derived from resources, like the sun and the wind, earth and water resources that are continually available to all over the world. Their use or capture does not inflict any material damage on the environment (American Council on Renewable Energy, 2011).

Energy is used by all humans and much of it comes in the form of electricity and gas, which is used in homes and workplaces. Most of this energy is sourced from 'nonrenewable' resources. These resources which are coal, oil, natural gas and uranium will eventually run out as the earth cannot renew them at the rate that they are consumed.

A much smaller amount of energy comes from renewable resources, such as the sun, wind, wood or hydro power. All these are known as primary energy (Nicholson, 2009:17).

The collection and use of various types of these fuels have devastating environmental impact. Usually households do not afford to consume the amounts of energy needed by modest income-generating activities. "Energy Poverty" is not restricted to households in rural areas. Even in built-up urban centers, it is not uncommon to find households without access to (grid or off-grid) electricity services, that are using coal and other 'dirty' and relatively expensive fuels to satisfy basic energy needs(*ibid*).

Energy demand is increasing at an exponential rate of world population. Developing countries make up 80% of the world's population yet consume only 30% of global commercial energy. Global energy demand will however continue to grow, particularly in

developing countries, where energy is needed for economic growth and poverty alleviation (Balat, 2008:25).

Since energy is fundamental to human existence, it should come as no surprise that the way mankind has been using it, is at the heart of many of the environmental problems that have emerged in recent years. There are many types of pollution, but the emissions from the combustion of fuels in power stations and cars are probably the most worrying, given the impact of air quality on health. The use of fossil fuels such as coal, oil and gas is increasingly seen as having major environmental impacts, such as global warming and climate change, thus necessitating the increased use of renewable energy (Elliot, 1997:1). The emphasis has been on the use of renewable energy, because the renewable resources are readily available and ecologically sound.

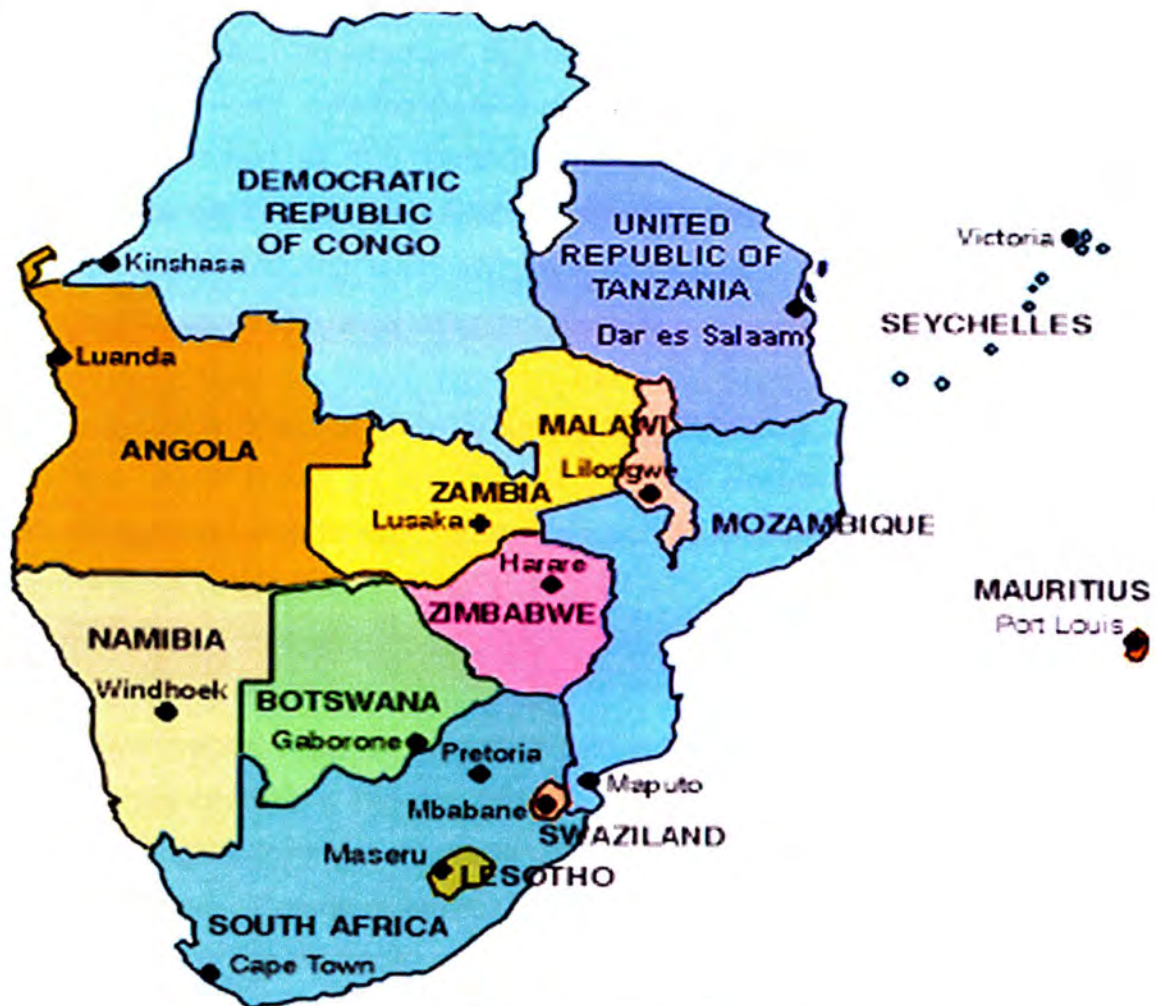
Renewable energy is a key concept for the 21st century. No other area of technology is accompanied by so much optimism and hope that humanity can meet the challenges of a climate change and a secure energy supply in an intelligent manner. The increasing number of wind power plants, solar collectors and photovoltaic installations demonstrate perceptibly that many innovations for tapping renewable energy sources have matured. Hydroelectric plants with their dams and reservoirs have long been part of the landscape (Buhke&Wengenmayr, 2008:1).

Energy supply in most African countries has been a major problem, because of poor infrastructure and the high cost of energy production. Efforts have been made to improve this situation both at the national and regional level. In the case of Economic Community of West African States (ECOWAS), some projects in the energy program have been expanded including the West African Power Pool (WAPP) and the ECOWAS Regional Policy on Energy Access. The ECOWAS Regional Policy on Energy Access, adopted in 2006, planned to increase access to energy services for rural and peri-urban populations. The East African Power Master Plan in the East African Community (EAC) is planning a seven year regional power system program with a power pool as its

central feature. The discovery of oil in the Albertine Graben, Uganda, will allow the construction of a top-up oil refinery to exploit oil for local use. Tanzania has discovered gas at Songo Songo and Mnazi Bay and is already using it to generate electricity and fuel. Rwanda generates methane gas annually in Lake Kivu. Burundi explores petroleum in Rusizi and Tanganyika Basins and Kenya is developing the geothermal potential in the Great Rift Valley (United Nations Economic Commission for Africa, 2010:27).

The Southern African Development Community (SADC) focuses on energy supply. According to statistics, the SADC region will continue to face power deficits until around 2012. The situation has forced the region to commence a major project to supply an additional 400 megawatts from Hidroelectrica de Cahora Bassa to restore other generators in Botswana, the Democratic Republic of Congo, South Africa, Zambia and Zimbabwe (*ibid*).

The SADC Member States



Map by World Investment News, 2004.

SADC is a treaty organization comprising 15 member states from the Southern African region. Its main objectives include regional integration, peace and security, maximizing productive employment, promoting economic development and achieving sustainable utilization of natural resources (Southern African Alternative Energy Association, 2011).

The SADC region is rich in natural energy resources; it has vast coal resources that can serve the region in the long-term period. Consequently, the continued dependence on coal for electricity generation contradicts the current global thinking of decarbonizing the world to reduce Green House Gases (GHG) emissions.

On the other hand, SADC has vast hydro potential and natural gas resources, most of which have not been explored yet hydroelectricity resources are concentrated in the countries of the north, with the Democratic Republic of Congo having the bulk of the resources, estimated at 100 Giga Watts (GW). The other major hydroelectricity resources are on the Zambezi River basin bordering Zimbabwe, Mozambique and Zambia (33,8GW) and Angola (16GW). In 2005 only about 5% of the estimated 163GW was exploited, implying a large untapped potential (Zhou, 2005:137).

With the exception of South Africa, Mauritius and Seychelles, the countries in the SADC region are characterized by low national rates of electrification and high levels of traditional Biomass use. In the region's most populous country, Democratic Republic of Congo, traditional biomass makes up 95% of all energy consumption (Johnson and Rosillo, 2007).

In the power sector, regional integration and bulk power trading substantially reduce power system costs and reserve can be shared. System expansion costs can be reduced through planning on a regional basis (Vedavalli, 2007: 319). Most of the Regional Economic Communities (REC's) have established sub-region power pools and interconnection of the electricity grids of their member states as a means of promoting cross-border electricity trade and fostering regional economic integration (Economic Forum for Africa,2008).

In this regard, Southern Africa is the most highly interconnected region in Africa. Created in 1995, the Southern African Power Pool (SAPP) aims to link SADC countries into a single electricity grid. The SAPP provides a framework for regional electricity trading and coordination. The national utilities currently participating in the SAPP are Angola's Empresa Nacional de Electricidade (ENE), the Botswana Power Corporation (BPC), Lesotho's Electricity corporation (LEC), Malawi's Electricity supply commission (MESCOM), Mozambique's Electricidade de Mozambique (EDM), Namibia's Nam power, South Africa's Eskom, the Swaziland Electricity Board (SEB), Tanzania Electric supply

company (Tanesco), Zambia Electricity Supply Corporation Limited (ZESCO) and Zimbabwe Electricity Supply Authority (ZESA). SAPP has been serving as a model for the establishment of free zones for energy in other parts of Africa (*ibid*).

Regional electricity trade in Southern Africa has a history dating back to the early 1950's, when a 220kv interconnection was built from the Katanga province in the Democratic Republic of Congo to the Zambian copper belt. In more recent years, network interconnections and associated exchange arrangements have multiplied, particularly following the creation of the Southern African Power Pool. By 1997, the volume of electricity traded in Southern Africa had increased massively (Marumo, 2001:94).

The Southern African Power Pool (SAPP), the first formal international pool to be set up outside North America and Western Europe, was inaugurated in 1995. While the utilities of southern Africa had been importing and exporting electricity for four decades, these trades occurred through bilateral contracts that were complex and often difficult to administer. The objective of shifting to the pool was to create a more efficient regional market (O'Leary, Charpentier & Minogue, 1998).

The SAPP came into effect on 28 September 1995 after the governments of SADC signed a memorandum of understanding. The Pool moved towards implementation in December 1995 when the national utilities of nine SADC member countries signed the Inter-Utility Memorandum of Understanding. At present its members are the utilities and ministries involved in energy usage in Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, The Democratic Republic of Congo, Zimbabwe, Zambia and South Africa. The SAPP is based on co-operative principles, i.e. the utilities coordinate and cooperate in the planning and operation of their systems to minimize cost and maintain reliability (Trade and Regional Development, 2010).

It sets out certain rights and obligations to member utilities covering aspects of quality, capacity, operations and access. The positive results of the formation of the SAPP led

to the possibility of reduced generation costs and furtherance of a long held vision in the electricity supply industry: the Southern African Power Grid. An ingenious and effective way of countering crippling shortages of electricity by moving power around the sub-continent, the Southern African Power Grid has long been seen as a vital tool to improve relations between African states and encourage economic and social advancement (Trade and Regional Development, 2010).

Since its creation, most of the regional economic communities have considered the establishment of sub-regional power pools and the interconnection of national electricity grids. This is to promote cross-border electricity trade and foster regional economic integration. SADC has been a pioneer and encouraged ECOWAS to create the West African Power Pool, among others (Economic Commission for Africa, 2004:156).

The bulk of the power is generated from coal, concentrated in South Africa's Northern provinces, eastern Botswana, and western Zimbabwe. South Africa also has a nuclear power plant in the Western Cape and hydro in the Drakensburg Mountains. The generation in the rest of the SADC countries is predominantly hydro-based, with power stations being located in the Zambezi Basin countries of Zambia, Zimbabwe, Mozambique and Malawi, at Inga in the Congo, in central Angola, Northern Namibia and also in Tanzania. The current operational statistics give the following generation mix for SAPP: 74.3% coal, 20.1% hydro, 4% nuclear and 1.6% diesel and gas. The trading arrangements between members have continued to operate predominantly under the pre-SAPP-type bilateral and multilateral contracts.

SAPP's focus has thus been:

- To improve the reliability and security of the existing regional grid;
- to facilitate the expansion of the grid to connect non-operating members; and
- to introduce a short-term energy market (STEM) to facilitate the trading of surplus energy not committed under existing contracts.

The SAPP Coordination Centre, which is located in Harare, Zimbabwe, was created in 2000 as an arm of the Operating Subcommittee to take charge of these immediate operational tasks (Economic Consulting Associates, 2009:2).

South Africa is historically the major driver of regional electricity imports and exports, although other SADC countries, particularly the DRC, Zambia and Zimbabwe have also traded power for decades. South Africa's massive coal-fired base load capacity is a good complement to the hydro-based power sectors elsewhere in SADC, where seasonal rains affect water flows and the reliability of electricity generation coordinated from Harare. The SAPP has three main generation nodes; South Africa with its coal-fired load capacity in the south; Mozambique with the CahoraBassa dam in the east, and DRC with the Inga Dam in the west. Zambia and Zimbabwe have sizeable hydropower capacity with the Kariba North and Kariba South (Vedavalli, 2007).

Over the last two decades, Southern African Regional Community (SADC) has outlined its energy strategy and policy in several documents: the SADC Protocol on Energy (1996) being the first, followed by the Energy Cooperation Policy and Strategy (1996). There was also, the SADC Energy Sector Action Plan (1997) and the SADC Energy Activity Plan (2000) among others. Comprehensive as they appear, these policies and strategies (before being fully implemented) have been overtaken by developments in the sector regionally and globally. This led to the continuous change in energy use patterns and ever growing energy demand that outstrips the supply (as in February 2008, SADC combined electricity demand stood at 47,067 MW as opposed to the available capacity of 43,518 MW). As a result these documents needed to be revised and updated. SADC then formulated the Regional Energy Access Strategy and Action plan (March, 2010), as a step towards realigning the energy sector to emerging issues (Matupa, 2011). The review is in response to concerns raised by many stakeholders that the current energy governance instruments should be updated to align them with current developments such as the climate change discourse (SADC Energy Thematic Group Bulletin, 2010).

Energy in the SADC region is generated mainly through thermal (coal) and hydroelectric resources (with nuclear facilities in South Africa); the region is dependent on good and regular rainfalls to supply the dams. In periods of severe drought (as in 1991/1992) the region easily falls short of its electricity (Lang, 2010).

The SADC Protocol on Energy (1996) was one of the first to be signed in 1996 and ratified in 1998. Its main objectives were to harmonize the national and regional energy policies:

“To ensure the availability of sufficient, least cost energy services that will assist in the attainment of economic efficiency and the eradication of poverty, whilst ensuring the environmentally sustainable use of energy.”

The SADC Protocol on Energy was drafted to place an obligation on member states to use energy as a means of supporting economic growth and development, alleviating poverty and improving the standard and quality of life throughout the region. The protocol was to ensure that the development and use of energy are environmentally sound and created an environment conducive for private sector participation in energy development in the region (Van der Linde, 2006). The goals of this protocol were not achieved and this gave birth to many other protocols on energy, over the years.

The SADC region has made so many efforts to expand the energy capacity and venture into renewable energy, to meet the growing energy demand. There is still much to be done in the energy sector as the majority of people still lack access to modern energy.

1.2. Statement of the problem

In March 2010, SADC formulated a Regional Energy Access Strategy and Action Plan (herewith referred to as the Action Plan) in an effort to realign the regional energy sector to emergent issues of climate change.

Although improving energy access is a national responsibility rather than a regional one, there is a potential for regional arrangements to harness available resources for the

collective benefit of member states, thus igniting them to implement the Action Plan nationally. This requires investments into the renewable energy production in each country, thus posing a challenge for member states, which lack funding for development of infrastructure. This is evident in the case of Lesotho and Malawi, which still has 3% - 4% of energy use in rural areas and a national consumption less than 20% (SADC Action Plan, 2010).

Furthermore, all energy investments have to compete for scarce funding with other infrastructure investments like those on schools, hospitals and roads. This threatens energy security in the region as the demand for energy continues to outstrip the supply and strain the resources in use. In 2007/2008, South Africa experienced shortage of electricity supply. This led to massive load shedding which affected development and investments in the country. This was caused by high demand which outweighed the supply.

Millions of SADC citizens still have limited or no access to energy and therefore many still use traditional methods like biomass, paraffin and fire-wood. All these methods are a threat to the environment; they contribute to deforestation, soil erosion and global warming. Food security also becomes a problem as climate changes result in unfavourable conditions for farming (soil erosion makes the land infertile) and other ways of food production. Scarce resources create the potential for conflict which has implication for peace. Climate change and environmental disasters that threaten human security can induce forced migration and lead to competition over scarce resources among communities, with potential for political instability and conflict. Competing for scarce resources could aggravate territorial and border disputes and then complicate conflict resolution processes. Dixon (1994:5) also confirms that degradation and depletion of agricultural land, forests, water, and fish contributes more to social turmoil. Scarcity of resources (food) leads to rural-urban migration and people would then move

to countries with better opportunities. Economic migrants in the SADC region are known to face rejection from the host country especially in South Africa.

Based on the researcher's observation the goals of the Action Plan appear to be very comprehensive, yet funding and investment is a major setback in the region. Over the years in previous Energy Protocols, many of the proposed projects that were aimed at increasing the energy capacity and meet the demands are still not completed. For instance, DRC Inga Dam Project was started in 1997 and still not completed. Consequently, the region has to achieve the goals of the Action Plan. It therefore has to be implemented, as it came in as a solution to energy crisis in SADC.

Failure to comply means the region will face enormous challenges as well as negative implications for peace, security and development.

Given these realities, the Energy Access Strategy and Action Plan appear to have far reaching implications which are likely to impede its implementation for the benefit of all. There appears to be areas of concerns of human security and development with a direct bearing on the plan.

1.3. Rationale of the study

The study evaluates the implications of SADC's Regional Energy Access Strategy and Action Plan. With climate change being a major of concern globally, the world seeks to shift from the use of energy sources that pose a threat to the environment and rather introduce methods that are less polluting and ecologically sound.

Energy access and the need for sustainable energy is a concern, especially in SADC as the available capacity does not meet the demand. Energy access being one of the

drivers of economic development, promote better living conditions. Sustainable energy development therefore requires urgent attention especially in the SADC Region as millions are still with limited or no access to energy.

The Regional Action Plan is meant to realign the energy sector to emerging issues (such as climate change and the increased demand of energy supply) in the interest of development and energy security in the region. However, the Action Plan faces the challenge of implementation in SADC member states. The challenges include lack of funding and commitment by political and other key stakeholders into energy development which in turn inhibits the implementation of the Action Plan. The study highlights the implications of this on development, security and peace in the region.

1.4. Aim of the study

The aim of the study is to evaluate the Regional Energy Access Strategy and Action Plan and its implications for peace, security and development (energy, environmental and human security).

1.5. Objectives

The study has the following objectives:

- To evaluate the challenges facing the implementation of the Action Plan in SADC member states.
- To examine the implications that the Action Plan has for development, peace and security in the region.
- To identify the challenges facing the region in reducing the dependency on fossil fuel-energy production to the use of renewable energy.

1.6. Research Questions

- What implications does the Action Plan have on peace, security and development?
- How committed are SADC members to achieving the goals of the Action Plan/renewable energy?
- Will energy access ensure the reduction of Carbon dioxide emissions and reduce the impact of climate change in the SADC region?

1.7. Significance

The selection of the SADC region as a case study stemmed from many considerations. One being that the researcher is from the SADC region and therefore directly affected by the energy crisis as well as issues related to such. SADC has an absolute potential to meet the energy demands of its members, yet it has experienced and continues to experience (as predicted by the SAPP) massive power cuts which threatens energy security. The 99.9% of national energy consumption in Mauritius and Seychelles as reflected in the Action Plan, while other SADC countries are characterized by very low levels of energy access raised concern. All the above prompted the need for study.

Studies have been undertaken on the importance of environmentally sustainable energy production/sustainable use of energy resources in the region. Energy strategies and policies have been analyzed and reviewed, but not much has been done on the implications of the Action Plan, as it is a new policy document that still has to be implemented. The study adds new information on the growing body of literature on sustainable energy access in SADC.

The study will also be invaluable to researchers and policy makers specializing in energy production in the region, as well as officials in member states seeking to implement this policy. Students specializing in Regional Development and Energy and ordinary SADC members as well as the millions still seeking access to energy (electricity) will find this study useful.

1.8. Scope of the study

The study focused specifically on the implications of SADC Regional Energy Access Strategy and Action Plan on peace, security and development in the region. The study was an analysis of the March 2010 SADC Action Plan and focuses on the SADC region, making specific reference to a few SADC countries.

1.9. Research Methodology

Methodology is a set of procedures applied in conducting a study and it is necessary because it describes the methods used. These include research instruments and the population studied. Theoretical framework, on the other hand, is necessary for every research because it defines the theoretical underpinnings of a specific study. Its purpose is to identify and label the important variables that are relevant to the research problem. This enabled the researcher to connect the dependent variables with the independent variables and if possible elaborate any moderating variables.

The research method adopted for this study was the qualitative research method, as it is the most suitable and it allowed for an in-depth study of data. The approach generated a comprehensive study of SADC energy policies as well as the issues related to sustainable energy access for the region. In this regard the study best suited the case study research design. The research method adopted for this study was the one case study method, which is an in-depth study of a particular situation and a method used to narrow down a very broad field of research into one easily researchable topic.

The case study method gives indications and allows further elaboration and hypothesis creation on a subject (Shuttleworth, 2008). The SADC region was selected as a case study from all the Regional Economic communities in Africa, these are; the Community of Sahel-Saharan States (CEN-SAD), Economic Community of Central African States (ECCAS), Common Market for Eastern and Southern Africa (COMESA), East African community (EAC), Economic Community of West African States (ECOWAS), Intergovernmental Authority for Development (IGAD) and the Union du Maghreb Authority for Development (UMA).

This method was appropriate for this study in that it assisted the researcher concentrate on the implications that the SADC Regional Energy Access Strategy and Action Plan has for the region. In that light, it is an important method which excels in revealing an understanding of the complex issue of energy access and sustainable energy development in SADC and added strength to what is already known in previous researches. Case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. It emphasizes detailed contextual analysis of a limited number of events or conditions and their relationships. Social scientists, in particular, have made wide use of this qualitative research method to examine contemporary real-life situations and provide the basis for the application of ideas and extension of methods.

According to Yin (1984:23) this method is an empirical inquiry that investigates a contemporary phenomenon within its real life context especially when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used. This captures the energy access situation in SADC as well as the energy policies and strategies more so the recent Action Plan. The research was based on different SADC countries and the energy policies.

The study drew extensively on relevant empirical studies based mainly on literature review. This was augmented by internet sources and relevant SADC and SAPP reports.

1.9.1. Data Collection methods

The study limited the techniques of data collection to documentation review, which is a critical qualitative method of data collection so as to ensure that the study does not lose sight of the original purpose. It also entailed an analysis of previous regional energy strategies and policies and deductive reasoning from facts of evidence as well as the assessment of qualitative data and therefore the type of data collection method adopted in this research was largely qualitative. Data was collected both from primary and secondary sources (SADC conference reports, presentations, documents). Primary sources data provided first-hand information of the problem under study.

Primary data was derived from a number of sources including relevant documents from the SADC countries websites, public statements, speeches and conference papers and reports from the SADC secretariat. The listed sources offered credible first-hand insight on SADC's energy policies and energy access in the region. Reference was made to the report of the 32nd SADC Energy Ministers meeting held in Gaborone, Botswana (26 May, 2011), a presentation made by the then Chairperson of the SAPP Mr. V. Simelane in Namibia (21 September 2005) and by the current Chairperson of the SAPP, Dr. Musaba, was also consulted among others. In addition to the above, SADC energy Protocols from 1996-2000 were consulted.

Secondary data included a wide-range selection of journal, published articles, books, newspaper articles (Mail and Guardian), internet/electronic sources and magazines (The Africa.org and New Africa). The above sources contained invaluable information relevant to the study and related to energy development, energy consumption

statistics, sources of energy in SADC and the regional energy potential including untapped resources. Reference was made to a broad range of academic texts.

1.9.2. Data Analysis Methods

There are several techniques normally used in analyzing the multiple sources of data which a case study research like this engenders. Considering that data was collected mainly from documentation review, information was categorized and tabulated to address the initial propositions and purpose of the study and conduct cross checks of facts and discrepancies in accounts. Content analysis is the most suitable as it looks at documents, text, speeches and presentations then sees what themes emerge. The data collected was analyzed using this method, which also assisted the researcher to analyze and interpret the content of the speeches by the former and current Chairperson of the SAPP. Throughout the research process, another research analysis method that was used was discussing the information with other students conducting similar studies in order to gain advantage provided when a variety of perspectives and insights are applied to the same data. These were students from the Energy Research Center at the University of Cape Town, most of which were Engineering Master's students. In order to strengthen the conclusions and findings, a system of triangulation was applied for the purpose of validating the data. This method of triangulation uses multiple methods to ensure that a single phenomenon is examined thoroughly from different perspectives.

1.10. Limitations of the study

The researcher was unable to travel to all SADC countries due to financial constraints and limited time given before completing the dissertation. Travelling to SADC countries would have exposed the researcher to the pressures and challenges faced by countries in providing citizens with energy as well as the hardship facing people without access to sustainable energy. The researcher was also unable to

interview officials from the Southern African Power Pool, due to the officials' commitments; they were unable to go through with the interviews as scheduled.

Their input would have enhanced the quality of this paper, as they are the most relevant. The information collected from SAPP reports and presentations as well as the readily available data from secondary sources assisted the researcher in surmounting these limitations. The SAPP has not yet released an official document on the progress made by SADC members since the implementation of the Action Plan. This posed a major challenge as the researcher was not able to determine whether there is any progress made towards ensuring the success of the Action Plan.

Chapter Two

Literature Review and Theoretical Framework

2.1. Introduction

This chapter comprises of the literature review and theoretical framework. The purpose of literature review is to present a critical and in-depth evaluation of previous research related to the topic. It also ensures that the works of others are not copied and goes further to identify gaps in literature which may be explored in further studies (Denscombe, 2007). A theoretical framework, on the other hand, is necessary for every research because it defines the theoretical underpinnings of a specific study. Its purpose is to identify and label the important variables that are relevant to the research problem. This will enable the researcher to connect the dependent variables with the independent variables and if possible elaborate any moderating variables.

2.2. Literature Review

The world is concerned with the intensifying issue of climate change. World leaders have been trying to come up with ways to reduce the impact of climate change and control Green House Emissions. The burning of fossil fuels for the production of energy, contributes more to global warming. Therefore, the use of renewable energy has become essential, more so in third world countries which are hit hard by climate change as compared to industrialized countries which contribute more to climate change and SADC is no exception. The SADC region is faced with the shortage of energy as the available capacity does not meet the energy needs of all and the energy demand continues to grow by 3% every year. It therefore has a legitimate need to increase its energy supply and should also develop sustainable and clean energy sources. The demand that outweighs the supply in the region necessitated the evolution of the

Regional Energy Action Plan to meet the demand and for sustainable energy development through the use of renewable resources found in the region.

Iwayemi (June 2008:17) highlights that Africa is well endowed with renewable and non-renewable energy resources that far exceed its energy demand requirements for the next century. Yet most African countries are characterized by energy poverty and poor energy access, a reflection of their low income and general state of economic underdevelopment.

Africa's energy sector is best understood as three distinct regions. North Africa, which is heavily dependent on oil and gas, South Africa, which depends on coal and the rest of Sub-Saharan Africa, which is largely reliant on biomass (Karekezi, 2002). IEA (2001) claims that figures for Eastern and Southern African countries indicate high proportion of total national energy supply derived from biomass energy. Biomass energy, which refers to a wide range of natural organic fuels such as wood, charcoal, agricultural residues and animal waste and is often used in its traditional and unprocessed form. Even oil-rich sub-Saharan African countries continue to rely on biomass energy to meet the bulk of their household energy requirements. In Nigeria, it is estimated that about 97% of the household energy needs are met by biomass.

Nair (2009) argues that one billion Africans, though only one sixth of the world populations, use a mere 4% of global electricity. The author continues to say that African states struggle to build their energy infrastructure leaving hundreds of thousands of people with no means of clean, safe and convenient energy. Nair (*ibid*) asserts that Africa as a continent, far from poor (that is in terms of resources), is rich in renewable resources that could power its development. That is from geothermal heat within its rift valleys, to the dozens of rivers and tributaries that could run micro scale within its interior, literally, tons of bio-waste that could be digested and utilized each day, and miles upon miles deserts filled with some of the world's most potent solar radiation,

enough to meet the entire world's current energy needs within a minor percentage of the Saharan desert.

Al-Herbish (2008:40) believes that energy supply is given as a target indicator for achieving the seventh objective of the Millennium Development Goals, which is to ensure environmental sustainability. The author then highlights that Africa is energy poor, which is a situation that has diminished the continent's productive capacity. Sub-Saharan Africa in particular, depends largely on inefficient traditional biomass used mainly for cooking and heating water in households. Traditional biomass accounts for over 80% of primary energy demands. These sources of energy, for example, firewood and charcoal burn inefficiently, give rise to energy loss. The surrounding environment is also degraded, through the depletion of forest resources. Pollutants (carbon monoxide, benzene, nitrogen oxides, etc.), which are also health-damaging substances, are emitted when these forms of energy sources are used indoors. Hence there's a need for the increased use of renewable energy to reduce pollution and save the continent from the effects of climate change.

Although there is no doubt that progress has been made in Africa's energy sector, Mabungu (2008:228) suggests that Africa continues to rely significantly on traditional fuels consumed as domestic energy biomass, particularly for cooking and heating. Due to increasing population and poverty trends coupled with sluggish economic growth, the use of these fuels leads to high incidences of health problems because of associated indoor air pollution. The author further notes that the increased use of these alternative fuel sources not only contribute to increased desertification but they are closely linked to various health-related, especially respiratory diseases.

In support of the above, Karekezi and Kithyoma (2002) believe that traditional biomass energy use has serious environmental drawbacks. The indoor air pollution from unvented biofuel cooking stoves is a major contributor to respiratory illnesses in highland areas of sub-Saharan Africa. Reliance on biomass (especially in the form of charcoal) also encourages land degradation. In some areas, for example, around major

cities like Lusaka in Zambia, Dar-es-Salaam in Tanzania and Nairobi in Kenya, charcoal demand appears to contribute to degradation of the surrounding woodlands and forests (Karekezi, 2002, Kantai, 2002) as cited in Karekezi and Kithyoma, 2003).

On the other hand Smith and Taylor (2008) argue that most African countries do not have policies in place to encourage renewable energy efficiency and they probably will not begin development of the renewable energy sector without international assistance. The two believe that even then, the economies of many African countries will likely have to improve and the basic needs of citizens will need to be met before renewable energy can become a major priority.

According to The World Future Council (2010), Africa is already suffering the negative impacts of climate change and its heavy reliance on burning wood and charcoal to meet basic energy needs, means the continent continues to suffer intense deforestation. Renewable energy is essential for Africa to develop sustainably.

Holland and Mayer-Tasch (2007) assert that many parts of Africa suffer from a lack of generating capacity, which poses a threat to their energy security and restricts energy access. These problems can be mitigated by joint development of energy resources and increased cross-border trade in electricity. The authors believe that the regional power pools that have gradually been established in all regions of Africa are playing a crucial role in laying the basis for cost-effective regional electricity supply and successful grid extension programmes in rural and peri-urban areas. However, investment in major regional generation projects, interconnections and transmission lines alone will mainly benefit large industrial consumers and those already connected to the grid (e.g. urban elites). Such investments therefore need to be complemented by local investments in grid extension and off-grid access to energy.

Al-Herbish (2008:44) notes that there is an urgent need to integrate energy policies into broader development strategies in African countries, while at the same time encouraging regional integration, with the West, South, East, Central African and Nile Basin power-pool schemes as ready examples. For instance, the West African Power

Pool (WAPP) was planned as a joint power-pooling mechanism of the West African countries, to help integrate the various national power systems into a unified electricity market. The South African Power Pool (SAPP), on the other hand, is a unified energy market for the members of the Southern African Development Community. It has been highlighted by energy experts that the best solution to energy poverty in the long run would be for nations to cooperate on regional power solutions by building few large plants, which could supply power more cheaply and efficiently, than dozens of smaller ones.

The World Bank (2005) asserted that the SAPP covers 6 million square miles and 200 million people. Utilities in the region had been trading electricity for decades through bilateral contracts, but these were cumbersome to administer, hence the need to establish an efficient regional market like the power pool.

Peters (2010: 174), points out that majority of people in the SADC region are not yet connected to the electricity grid as they live in rural areas, which in most SADC countries have been neglected in terms of infrastructural development and in underdeveloped urban areas. Their major source of energy is fuel wood which has contributed to deforestation and soil degradation in the region. Peters continues to highlight that the promotion of renewable energies (solar, wind, biogas) would thus not be a cost effective option for rural (off-grid) electrification programmes, it would be a way to halt the rapid environmental destruction through the overuse of natural resources.

According to Bazilian and Nussbaumer (2010:1), energy services have an effect on productivity, health, education, safe water, and communication services. Therefore, access to energy has a strong correlation to social and economic development indices (e.g. Human Development Index, life expectancy at birth, infant mortality rate, maternal mortality, and GDP per capita). Energy services, such as lighting, heating, cooking, motive power, mechanical power, transport and telecommunications, are essential for

socio-economic development, since they yield social benefits, and support income and employment generation.

In support of the above, the International Energy Agency (2009), believes that access to sustainable, modern, affordable, and reliable energy service is central to addressing many of today's global development challenges, including poverty, gender inequality, climate change, food security, health and education. Yet, nearly one-third of humanity lacks access to modern energy forms and services.

Swatuk (2002: 139) believes that energy is important as he states that power is seen as the necessary means to industrialization and diversification of economies overly dependant on primary products for export and saddled by the high cost of fuel imports. The author continues to say that cheaper, reliable sources of hydro-power can assist the "fuel transition" in SADC countries, unlike most of the rest of the world; urban areas in SADC are experiencing "backward fuel switching" instead of a continuing transition to modern fuels. That is to say, as electricity supplies continue to be unreliable, urban dwellers increase their consumption of traditional sources of energy.

Ganther (2011:11) asserts that the dependency on non-renewable energy sources such as coal, oil and gas had developed over a short period within the past century. Emissions from fossil energy sources underpin what is generally acknowledged as causing major environmental impacts such as Green House Gases and global warming.

When fossil fuels are used, Carbon Dioxide, which is the main Green House Gas that should be regulated, is released into the atmosphere. Most of the energy that drives the economies of industrialized countries is based on these carbon-emitting fossil fuels (Vrolijk, 2002: 6). The author continues to highlight the disasters related to climate change, he refers to the floods in Bangladesh, floods around Yangtze river in China, forest fires in Russia and Hurricane Mitch, were that worst climate change disasters in 1998. According to Vrolijk(*ibid*), the ever-increasing costs of weather related losses have grabbed the attention of many countries and businesses worldwide. Other

disasters include Cyclone Elinewhich hit Mozambique and Madagascar in 1999. Even the “quiet” year of 2000 saw a series of floods in the United Kingdom and mainland Europe, causing great disruption and financial loss.

The Economic Commission for Africa (March, 2006:3) states that the majority of citizens in Southern Africa suffer from energy poverty as they lack sufficient access to adequate, affordable, effective and environmentally sustainable energy services that could support economic and human development.

It is essential to remember that providing reliable and secure energy services to those currently without access is not simply about supplying electricity for lighting or improved cook stoves. To promote economic development and growth, these energy services need to be put to productive uses which positively affect livelihoods, providing power for industry, improving health care and education, and improving transportation. Furthermore, simply supplying the power source will be insufficient if the necessary equipment and appliances are not deployed. Electricity not only provides lighting that permits children to study at night, it allows for the refrigeration of perishable agricultural products, and increased value added through the first steps of industrialization (Yumkella, Bazilian and Gielen, 2010:4).

On the other hand, Zhou (2010: 136) argues that electricity plant investments have contributed to the regional debt, which is in excess of 50% of Gross Domestic Product (GDP). For the transport sector, petroleum import bills are estimated to range between 20% and 40% of the national export earnings. Therefore, energy supply expansion continues to expend the scarce foreign incomes and thus limit allocation of financial resources to other critical development and social sectors. Zhou continues to highlight that donor funding has been slow coming into the region, as reflected by the SADC electricity projects which were approved in the early 90's but are still waiting for funding.

Foley (1990) believes that if rural electrification programmes were profitable, there would be no great problem in funding them, as the money required for investment could

be borrowed from the financial institutions at commercial rates and would be repaid out of the revenues.

However Mbewe (1992) views that in countries like Zambia, even financial viability does not ensure project sanction because of the lack of local and foreign exchange funds. He strongly believes that the major reason for slow progress in rural electrification has been dependence on foreign donors for financing. It is not possible for governments to fund all electrification projects due to the weak economies in the SADC region. Government therefore approach donor countries or opt for loans.

Nangammbi and Mosomane (2010) highlight that the extent of national access to electricity in urban and rural areas is frequently viewed as one of the important indicators of development. The majority of the populations of developing countries live in rural areas and these areas are often poorest. They also recognize that access to energy services contributes to the betterment of livelihoods. Due to this many governments seek to enhance rural electrification programmes.

According to O'Keefe and Kirkby (1994), raising capital for energy projects, particularly electricity projects, is difficult because of the long gestation periods involved in bringing supplies on stream. He believes that energy planners have tended to overestimate and then over-provide for future energy supplies so that within the region, the essential critical task is now to deploy existing energy supplies rather than building new capacity.

Furthermore the US Department of Energy (April 1997) reported that the development of renewable resources in Africa has been impeded by barriers to the availability of financing and resources. In the area of Photo Voltaic (PV), however, African nations have made considerable advances. For instance, in Kenya, a series of rural electrification and other programmes has resulted in the installation of more than 20,000 small-scale PV systems since 1986. These PV systems now play a prominent role in decentralized, sustainable electrification. Other examples of PV use in Africa are:

- A programme to supply PV systems to 100 rural homes began in Namibia in April 1996;
- A Norwegian engineer built a cheap, self-contained, village-sized PV desalination plant in Eritrea in late 1995; and
- the Independent Development Trust, a rural electrification project in South Africa, installed PV systems for clinics in remote areas.

Clark and Drimie (2002) on the contrary, believe that electricity access may contribute to local economic development and perhaps to local economic growth and poverty alleviation. They opine that it does not necessarily contribute towards environmental sustainability. Hence the researcher emphasizes the need for not only increased energy access but the need for clean and renewable energy access, which will be beneficial in all aspects.

The reviewed literature discusses the issues related to energy access in the region but fails to emphasize the importance of awareness; governments need to inform citizens about the importance of saving the environment and the reality of climate change especially in rural areas as many of them still use traditional methods such as wood fuel which causes deforestation. People continue to use their traditional methods even after they access electricity. This is due to the high costs that come with the use of electricity, and many people cannot afford that hence they continue to use traditional biomass which is cheaper. The impact of energy on development and peace in the region is also not fully addressed. The Action Plan is a new policy document and not much has been written on it. This study will therefore address these gaps in literature and has the potential to contribute new information in the SADC energy sector.

Against this backdrop, it is safe to conclude that electrification in the SADC region is a major challenge that still needs to be addressed and an ongoing phenomenon which will continue to impact on the development of the region as a whole as well as the achievement of Millennium Development Goals. The issue has become even more urgent in the face of the recent spate of severe power cuts in 2007/8 as well as the

growing demand that outweighs the supply. Despite these gaps and the fact that until the coming into force of the SADC Regional Energy Access Strategy and Action Plan regulation for a coherent methodological framework has not been fully developed. The Action Plan has the advantage of producing research that is current and relevant.

2.3. Theoretical Framework

Theoretical framework is necessary for every research as it defines the theoretical underpinnings of a specific study. Its purpose is to identify and label the important variables that are relevant to the research problem. This will enable the researcher to connect the dependent variables with the independent variables and if possible elaborate any moderating variables. The process of selecting the most appropriate theory, which explains the research, involves an analysis of the most relevant theories of international relations. Amongst them neo-functionalism as well as the resource curse theory proved to be more appropriate.

2.3.1. Neo-Functionalism

Neo-functionalism provides a comprehensive explanation of regional integration, the positions of member states within a region as well as their guiding principles and policies. It goes on to explain how regional integration can enhance collective growth (economic and social) and how regional goals and policies can be achieved through collective efforts.

Regional integration generally involves a somewhat complex web of cooperation between countries within a given geographical area. It demands harmonization of policies in such sectors as trade, investment, infrastructural development, as well as monetary and fiscal policies of member states. The overall objective is essentially to ensure stability and sustainable economic growth and development within the integrating area. The success of any integration scheme be it free trade area, customs unions, common/single markets, monetary union or even political union, enhances

competition and efficiency within the integrated area, through increased specialization, and generally ensures better allocation of scarce resources into the most productive areas (Anadi, 2005:26). Although a comprehensive theory is unattainable, theories of regional integration would better explain this phenomenon.

Neo-functionalism by Haas (1958), explains the process of regional integration making reference to how growing economic interdependence between nations and organizational capacity to resolve disputes and build international legal regimes and supranational market rules, interact with each other. This better explains the integration of countries in Southern Africa (SADC). SADC has policies and principles that guide its members. It has since outlined its energy policies in 1996, which addresses the energy situation and the way forward. In enhancing integration, the regional power grid was formed Southern African Power Pool (SAPP) and has since increased the energy capacity of the region. It also paved way for energy exports and imports among member states.

Vedavalli (2007:319) supports the theory when he states that in the power sector, regional integration and bulk power trading substantially reduce power system costs and that reserves can be shared. System expansion costs can be reduced through planning on a regional basis. The author emphasizes the importance of integration among countries as it is economically sound and allows countries to share revenue and reduce cost.

In support of the above Craig (2011) emphasizes that the central tenet of neo-functionalism is the concept of "spillover" that has both a functional and political dimension. The spillover is an idea based on the interconnectedness of the economy. This is evident in SADC as efforts have been made to create a trade free zone. The energy sector plays a major role in economic development in the region and collectively SADC countries can achieve its goals.

2.3.2. Resource Curse theory

The suitability of this theory is influenced by its explanation of how abundant resources turn to impede development in resource rich countries. This theory proves to be more relevant to the study as it explains the curse caused by abundant resources that are not properly used or not profitable to society.

Several empirical studies led by the seminar works of Sachs and Warner (1995-2001), have found that considerable resource endowments tend to impede economic growth. In this regard, it is thought that the abundance of natural resources does not directly harm growth, but acts to crowd out the activity that is driving growth within a country (Dunn, 2008: 8).

The resource curse refers to the paradox that countries and regions with an abundance of natural resources, specifically point-source non-renewable resources like minerals and fuels, tend to have less economic growth and worse development outcomes than countries with fewer natural resources. This is hypothesized to happen for many different reasons, including a decline in the competitiveness of other economic sectors (caused by appreciation of the real exchange rate as resource revenues enter an economy), volatility of revenues from the natural resource sector due to exposure to global commodity market swings, government mismanagement of resources, or weak, ineffectual, unstable or corrupt institutions (Krantz, 2011).

According to Di John (2010), one of the more influential ideas in recent development discourse and policy is the "resource curse". The big idea behind the "resource curse" is that mineral and fuel abundance in less developed countries (LDC's) tends to generate negative developmental outcomes, including poor economic performance, growth collapses, high levels of corruption, ineffective governance and

greater political violence. Natural resources, for most poor countries, are deemed to be more of a curse than a blessing.

This is evident in the case of SADC, as it has abundant renewable energy resources that can sustain the region for years, yet it is still characterized by very low levels of energy access. The DRC has a potential hydro-electric capacity of 100,000 MW. The Inga III Dam alone has a potential generation capacity of 39,000 MW, which could supply all of Southern Africa's electricity needs. Of this, only a small portion of it has been developed. One could link the energy problems in resource-rich DRC to the instability in that country, as it continues to interrupt the flow of energy as well as possible developments in the energy sector. The other factor of DRC being rated among top 15 corrupt countries in the world by Transparency International Corruption really hinders the success of the Inga Dam which was started in 1997 and 85% of DRC energy consumption is biomass. This explains the curse attached to the abundance of resources.

Just as with other SADC countries, Mozambique faces severe and interrelated problems of energy and environment linked with the massive consumption of fuel wood biomass. The electrification rate is less than 20% and 85% of the energy consumed in the country comes from biomass. Mozambique has vast renewable energy resources that can play an important role in the process of development in the country. It is also well-endowed with resources, but lacks advanced technology and skills, financing and incentives, as well as diversified suppliers for rapid internal development of this potential (Southern African Alternative Energy Association, February 2011). People continue to live under terrible conditions with limited or no access to energy. All of which can be avoided by making use of readily available resources.

According to the theory natural resources instead of being the catalyst to development, rather inhibit economic growth leading to underdevelopment in resource-rich countries, in some cases these resources generate conflict rather than

promoting peace, security and development. The “Resource Curse” best fits in explaining the energy situation in SADC.

Chapter Three

Data Presentation, Analysis and Findings

3.1. Introduction

Even though it is now widely accepted that access to modern energy services is fundamental to the process of poverty eradication, energy deficiency continues to limit the development of millions of poor people around the world, as well as affecting their health and causing environmental degradation. Finding ways to increase access to affordable, adequate and reliable modern energy services for the poor, remains a major challenge for developing countries (Global Network on Energy for Sustainable Development, 2002). This is evident in case of SADC countries.

At the heart of any sustainable energy strategy lays policies which help to widen access to reliable and affordable modern energy supplies and reduce the negative health impacts related to energy use. In Africa firewood and charcoal make up 67% of primary energy use and the use of such fuels is associated with indoor air pollution from toxic substances such as carbon monoxide (Mak&Soltau, 2005: 215).

The authors' further highlight that Africa's power sector faces problems such as small size, limited exploitation of opportunities for interconnections, poor management performance, and inability to mobilize the funds needed for expansion, weak maintenance capacity, inappropriate tariff rates and inadequate revenue collection mechanisms. These mentioned are just a few of the serious challenges facing the energy sector in Africa. Due to high cost of grid extension, other sources such as solar and Liquefied Petroleum Gas (LPG), are being highly considered.

This chapter discusses some of the efforts made by SADC to extend grid power. This includes SADC's expansion projects.

Definitions

- **Fossil Fuels total** is the energy consumed from the use of crude oil and natural gas liquids, coal and coal products, and natural gas.
- **Coal** and coal products refer to coal and all coal products, such as peat and coke.
- **Crude oil and natural gas liquids** refer to liquid fuels such as crude oil or natural gas liquids, including motor and aviation gasoline, kerosene, diesel oil, and petrochemical feedstocks. Feedstocks include all oil products used as raw material in the petrochemical industry for steam cracking, and aromatics plants, such as naphtha, liquefied petroleum gases, light and heavy gasoil, reformat, among others.
- **Natural gas** refers to natural gases that occur in underground deposits, whether liquefied or gaseous, consisting mainly of methane. Natural gas includes both non-associated gas originating from fields producing hydrocarbons only in gaseous form, associated gas produced in association with crude oil, and methane recovered from coal mines (colliery gas). (http://earthtrends.wri.org/searchable_db/variablenotes_static.cfm?varid=559&themeid=6)
- **Nuclear Fuels** shows the primary heat equivalent of the electricity consumed from nuclear power plants. Heat-to-electricity conversion efficiency is assumed to be 33%. (http://earthtrends.wri.org/searchable_db/variablenotes_static.cfm?varid=275&themeid=6).
- **Hydroelectric** refers to the energy content of the electricity consumed from hydroelectric power plants, which convert the potential and kinetic energy of water into electricity. This variable excludes output from pumped storage. (http://earthtrends.wri.org/searchable_db/variablenotes_static.cfm?varid=276&themeid=6).
- **Solar energy** is harnessed using two primary methods. *Solar-thermal power* exploits solar radiation for hot water production and electricity generation by flat plate collectors (mainly of the thermo-siphon type, for domestic hot water or for the seasonal heating of swimming pools) or solar thermal-electric plants. **Solar power from photovoltaics** involves the conversion of solar energy to electricity in photovoltaic cells. Passive solar energy for the direct heating, cooling and lighting of dwellings or other buildings is not included in this category.



- **Wind power** exploits the kinetic energy of wind in wind turbines to generate electrical power. Tide, wave, ocean power captures the mechanical energy from tidal motion or wave activity and transforms it into electrical power (Earth Trends, 2003).

3.1.1.THE SADC ENERGY SUPPLY PROJECTS

SADC has developed many projects over the years as to increase the energy capacity in the region. The region has so much potential and abundant resources to reach its target of halving the number of people with no access to modern energy by 2020. Over the years, there have been many projects by member states nationally, bilaterally and regionally, in an attempt to expand the energy capacity. Unfortunately, due to the scarcity of funds and proper planning, not all the projects have been successful. Many of the projects have been done through the Southern African Power Pool.

The Westcor transmission interconnector is a regional initiative that is still lagging behind. The project was conceived in 1996 through the combined initiative of the SADC Secretariat and the power utilities of Angola, Botswana, DRC, Namibia and South Africa, but little has been done to bring it to fruition (SADC Today, 2008).

Interconnection of natural electricity grids contributes considerably to the development of an integrated power system and the operationalization of a power pool within a given subregion. In SADC, the completion of the 400kv Matimba-Insuka-minipower line linking South Africa to Zimbabwe in October, 1995, was of utmost importance in operationalizing the SAPP (Economic Commission for Africa, 2008: 47).

“Southern African countries could meet their combined projected energy demand in 2016, if 12 electricity generation and transmission projects presented at a Southern African Development Community Energy Investor Roundtable, in Zambia, in July, came to fruition, New Partnership for Africa’s Development Secretariat energy expert Professor MosadElmissiry stated. Twelve energy generation and transmission projects from the Southern African Power Pool member countries were presented at the roundtable as part of plans to deal with the energy deficit in the region and to meet the expected energy demand growth in the region. These projects included the proposed 2 000-MW Benga thermal coal power station, the 2 400-MW Moatize thermal coal power station and the 1 500-MW MphandaNkuwa hydropower station, in Mozambique. The 120-MW ItezhiTezhi hydropower station and the 350-MW Kariba North Bank Extension hydropower project, in Zambia, would also contribute to the region’s energy provision capabilities. Zimbabwean electricity generation projects, such as the extension of the Hwange thermal power station, the extension of the Kariba South hydropower plant and a new independent power producer thermal power project, Gokwe North, would contribute a further 1 400 MW of electricity for the region. “Assuming that these projects are implemented according to schedule, we will have sufficient energy by 2016 to supply the current and expected increase in energy consumption levels,” assured Elmissiry” (Pringle, September, 2008).

3.1.1.1. WESTCOR Project and the Inga Hydro-electric project

The SADC Council of Ministers resolved that the crucial Western Corridor Project (Westcor) should be extended to all 13 member states. The energy project is a joint venture currently involving Angola, Botswana, the Democratic Republic of Congo (DRC), Namibia and South Africa and its aim is to strengthen the flow of electricity through the region by tapping the huge potential of the Inga rapids on the Congo River (SADC Today, 2005).

The WESTCOR Steering Committee was formed under the auspices of the SAPP to initiate studies determining the viability of the Western Power Corridor with source at INGA III. The WESTCOR Joint Venture Company was registered in Botswana to fund the engineering and financial studies, and build, own, and operate the infrastructure should the project prove to be viable. Each utility contributes \$100, 000 as start-up capital to fund the first phase of development (SAPP, 2005).

The objective of the Westcor project was to harness the hydro resources in the Democratic Republic of Congo, linking it to five countries. Its objective was to transport 3500MW power from the DRC to South Africa and to assist in developing the power export potential in Angola as well as to connect it to the power grid, which formed part of the Southern African Power Pool. The feasibility study was carried out between 2005 and 2007. Five countries and their respective utilities are involved in the project: ENE of Angola, BPC of Botswana, SNEL of the Democratic Republic of Congo, Nampower of Namibia, and Eskom in South Africa(Talkadmin, 17 May 2007).

The purpose of the Westcor project is to exploit the environmentally friendly, renewable, hydroelectric energy of the Inga rapids site in the Democratic Republic of Congo (DRC). SNEL owns and operates the two existing power stations, Inga 1 and 2, which have a combined output of 1770MW. Inga 3 is the next phase of the development at the Inga site, with a rated output of 3500MW (*ibid*).

SADC supported the conceptualization of the Westcor project which was supposed to develop hydro-electrical plants at the Inga Dam and build connecting power lines from the DRC via Angola, Namibia and Botswana to South Africa. Construction of a new phase on the Inga dam was supposed to have started in 2009 but the project is on the verge of failure because the DRC government decided, in 2009, to develop Inga III on their own (Peters, 2010:174).

- **Inga project**

Countries in SADC have the long term potential to triple existing power generation capacity to 150 000 MW, much of which will be supplied by the Inga III hydropower project in the DRC. South Africa provides about 80% of Southern Africa's capacity, but the completion of all the phases of the Inga Dam (I, II and III) on the Congo River, will make the DRC the region's single biggest power generator. The final Grand Inga which involves constructing a small dam on the world's second biggest river, is a long term project with potential rated output of 39 000 MW, almost equal to South Africa's existing capacity (X-kit, 2007: 138).

Eskom is heavily committed to participating in the rehabilitation of Inga 1 and Inga 2. The DRC has failed to rehabilitate the smaller Inga 1 and 2 projects, which both require huge financial investment and by 2007, there was still no funding for this project (Kabemba, 2007: 547). The Inga 2 plant and the Grand Inga facility were intended primarily for power exports to Southern Africa (Omorogbe, 2004: 132).

The development of the Inga III hydro-electric power project on the Congo River close to the Angolan borders with DRC, is potentially an excellent vehicle for regional co-operation. It could also have a number of benefits for Angola by allowing it to cooperate with the DRC and Congo Brazzaville on projects that emphasize new economic sectors. The project has been spearheaded for some years by South African power utility ESKOM in a Westcor consortium which would allow power to be transmitted across DRC, Angola, Namibia and Botswana to South Africa. However, its conceptual structuring did not account for any co-operation with Congo-Brazzaville on the other side of the Congo River, nor include considerations for DRC's energy needs (OECD, 2011:58).

This project has so much potential to put this region on another level regarding energy. It is suitable for the environment and will also address the shortage of energy in the region, which is what the Action Plan requires. It was started in 1996 and is still not

completed. Apart from lack of funding and poor planning, there are other problems related to the delay of the project.

The first sign of failure is that Inga is taking place in one of the most volatile regions of the continent, and the possibility of political instability interrupting the flow of energy is a serious threat to the project's viability. In 1997, when Rwanda and Congolese rebels launched their attack to oust Laurent Kabila, the first thing they did was to seize control of the Inga Dam, more precisely DRC's energy system and its various components are at risk of being attacked by non-state actors as well as national armies. The fact that corruption is endemic in the DRC undermines the project's efficiency. Finances for building the Grand Inga were estimated at US\$50 billion. Given the DRC's rating among top 15 most corrupt countries by Transparency International Corruption's list, it raises a lot of concerns regarding the success of the project and its benefit to the region (Kabemba, 2007: 547).

3.1.1.2. ZIZABONA PROJECT

The SAPP Chairperson, Dr Musaba in his 2008 speech said: "The central corridor has been overloaded since the beginning of this year resulting in the SAPP grid operating as three separate islands and so the Zizabona interconnector project will provide an alternative transmission route that will help decongest the existing central transmission corridor which passes through Zimbabwe".

In 2008, four SADC countries signed a memorandum of understanding to develop an electricity transmission interconnector, which will result in an increase in power trading among the participating utilities. The project, which is called ZIZABONA and is represented by Zimbabwe, Zambia, Botswana and Namibia, the four participating countries, was to provide an alternative power transmission route and help decongest the existing central transmission corridor that currently passes through Zimbabwe. The countries' respective utility companies had to finance parts of the project that fall within their national boundaries. These are the Zimbabwe Electricity Supply Authority (ZESA),

Zambia Electricity Supply Company (ZESCO), Botswana Power Corporation (BPC) and Namibia Power Company (NamPower) (SADC Today, October 2008).

At the commissioning of the Caprivi link Interconnector Transmission line, President Hifikepunye Pohamba of the Republic of Namibia in his address said:

"I wish to emphasize that optimal utilization of this transmission line, which connects theZambian and Namibian electricity networks, will be further enhanced by the completion of the envisaged ZIZABONA Interconnection, which will link Zimbabwe, Zambia, Botswana and Namibia. In this regard, I would like to underline the vital need for SADC Member States to continue supporting measures aimed at the implementation of the ZIZABONA Interconnector, which has been registered as a priority SADC project. I believe it is in our common best interests to market and motivate this project to potential investors and financiers".

The above statement indicates that by November 2010, the ZIZABONA Project that was started in 2008 was not yet completed as anticipated. Yet, other projects with similar goals were being negotiated. The construction of the first phase of the ZIZABONA project is expected to start in 2013, while the region is still seeking funds from investors as well as the Development Bank of South Africa, African Development Bank and the World Bank.

3.1.1.3. Other SADC Energy Projects

- DRC-Zambia interconnection

This project aims to strengthen the existing interconnection between the DRC and Zambia. It also includes the refurbishment of the converter station at Kolwezi and the AC Transmission lines to Karavia and up to the border with Zambia.

- Malawi-Mozambique interconnection

The work in Malawi and Mozambique includes the construction of a 400kV transmission line, which will initially be energized at 220kV, for about 219-km from Tete in

Mozambique to north of Blantyre in Malawi, and construction and extension of related substations in the two countries.

- Zambia-Tanzania-Kenya interconnection

The objective of the interconnector is to export between 100 to 200MW from ZESCO (Zambia) to TANESCO (Tanzania) and later to connect with Kenya. The project will also help to strengthen the ZESCO 66kV networks and interconnect TANESCO to the SAPP grid.

- 2nd 400kV Zimbabwe-Botswana-South Africa Interconnector

The project aims to increase the capacity of the existing interconnector up to 650MW by constructing a second line from Insukamini substation in Zimbabwe via Phokoje substation in Botswana to Matimba substation in South Africa.

Comprehensive as all these projects seem, the area of concern is whether or not they will be successful. Over the years good ideas have been put on paper but most times have failed to bear fruit. There are many projects still pending, others are long overdue, yet there are new ones being planned and some started already. One would then conclude that the region lacks proper planning, hence it has abundant resources to meet the demands and make a success of every project they plan. This then raises the question of how committed are the SADC members to the success of the Action Plan (2010), this would then question the feasibility of the Action Plan. This already paves way for negative implications of the Action Plan in the region, which would have a direct bearing on peace, development and energy security in the region.

OVERVIEW OF THE SOUTHERN AFRICAN POWER POOL

Transmission Projects: Cost USD 5.6 billion

2010 - 2011: ZIZABONA

2012: Mozambique Malawi

2014: Zambia - Tanzania

2015: DRC - Angola

2015: Mozambique Backbone

2015-2025: 765 kV Strengthening

2015: RSA Strengthening

2015: Botswana Strengthening



3.2. Introduction

The region, where the member states of the Southern African Development Community (SADC) lie, is located between the latitudes 5° and 40° S; this means inside the “Sunbelt” 40° north to 40° south. Therefore, one of the energy resources, which can contribute to the enhancement of sustainable development in the SADC region, is solar energy. Both active and passive use of solar energy has a role to play in sunny regions. The advantage of the solar option is that solar energy systems may be installed in isolated villages, without connections to a central electricity grid.

Another important advantage is linked with environmental issues: Renewable energy systems do not cause many negative burdens to the environment, compared to the conventional fossil fuel technologies.

This section includes a comparison between South Africa which has 80% national energy consumption, Mozambique which has 18% and Mauritius which has 99.9%. The researcher will also make reference to other SADC countries apart from the above mentioned. This will give light to the setbacks and failures of other countries and highlight changes that countries with very low levels of energy consumption can make (Cuamba, Chenene, Mahumane, Quissico, Lovseth and O'keefe, November 2006:76).

3.2.1. Electrification in South Africa

Energy is critical to virtually every aspect of the economic and social development of South Africa. Depending on the way it is produced, transported and used it can contribute to both local environmental degradation, such as air pollution, and global environmental problems, principally climate change. Providing affordable, adequate, and reliable modern energy supplies to most South Africans remains a major challenge, even though access to electricity has increased from one-third to two-thirds of the population since 1994. Current methods of producing and using energy have environmental and health effects that increasingly endanger welfare, and the key challenge is to move to cleaner energy supply and more efficient use, while continuing to extend affordable access to modern energy services, in particular for poor rural and urban communities.

With its urbanization and industrialization, South Africa is the largest user of motor vehicles and consumers of energy in the region. Almost all the energy used in the country derives from fossil fuel burning, mainly in large (3600 MW) coal-fired power stations. Coal is relatively abundant in South Africa, Zimbabwe and Mozambique. In South Africa, only 49% of electrical energy is derived from hydroelectric renewable sources. Even where electricity is available, there is a high dependence on biomass fuels (wood, maize cobs and stalks and cattle dung) for domestic energy needs. Half of

the households in South Africa use wood as a primary fuel (Tyson, Odala, Schulzer and Vogel, 2002:4).

South Africa uses coal, its major indigenous energy resource, to generate most of its electricity and a significant proportion of its liquid fuels. Because of this, the country is the 14th highest emitter of greenhouse gases. Nonetheless, South Africa is committed to reducing emissions, and is a signatory to the UN Framework Convention on Climate Change and the Kyoto Protocol. Eskom has said it is committed to reducing coal's current 88% share of South Africa's primary energy mix to 78% by 2012 and to 70% by 2025. The power supply crisis has accelerated the need to diversify Eskom's energy mix and its move towards alternative energy sources such as nuclear power and natural gas, as well as various forms of renewable energy (SouthAfrica.info).

South Africa is the sixth largest coal producer globally. It has a highly developed synthetic fuel industry which includes Sasol's oil from coal processing. It is responsible for more than one-third of the continent's Carbon Dioxide emissions, as a direct result of electricity generation from abundant coal supplies (Africa Geographic, 2007:87). This then brings up the emergent issue of the need for South Africa to find ways to reduce carbon dioxide emissions.

South Africa is also a major producer and consumer of energy, using eight times more electricity per capita than any other country in Africa. The country consumes nearly 20% of its energy in the form of electricity, over 85% of which is produced by coal-fired power stations. South Africa is the world's third largest Uranium producer, ranking behind the United States of America and Canada (Study Commission on U.S. Policy toward Southern Africa, 1981).

Climate change, caused by Carbon Dioxide emitted from the burning of fossil fuels, has emerged as the defining challenge of this age and has forced governments to act. Emissions-reducing treaties, such as the Kyoto Protocol, are not technically applicable to developing nations like South Africa. Nonetheless, as a major producer, consumer and exporter of coal, the country is in an awkward position. The government's foremost priority is the growth of the economy and the eradication of poverty. At the same time, the South African government understands that it must be a responsible member of the global community, both because South Africa itself will be affected by climate change and because investors, especially those from the European Union, are increasingly likely to withhold money from enterprises with unsound environmental credentials (Oxford Business Group, 2008: 90).

Harmful gases released into the air when burning fossil fuels combine with other gases and form acid. This acid falls to the earth as acid rain and fish that swim in lakes and rivers polluted by acid rain, die. People and animals that drink the water also die. Just breathing in gases from coal is dangerous; South Africa is under pressure to explore sources of energy that are less harmful. Solar energy can be used more so is wind power/energy, especially along the coasts where windmills are becoming a common sight (Clark, 2009: 31).

Africa Geographic (2007:87) argues that the rapid adoption of wind energy in the renewable energy mix has been widely used in some of the industrialized nations in the past decade. In an emerging market such as South Africa, there are abundant renewable resources including wind energy, yet there is a very low adoption. In support of the above, Ganter (2011:15) asserts that South Africa ratified the Kyoto Protocol (2002), giving the opportunity to develop and implement renewable industries through the Clean Development Mechanism (CDM).

In 1994, the Reconstruction and Development Programme (RDP) announced its plan to increase access by the poor to modern energies. The programme outlined an accelerated electrification programme to connect 2 500 000 more people to grid electricity between 1994 and 2000, thereby radically increasing the level of access to electricity to about 70% of all households. This programme was successful to some extent through the help of the state owned electric utility Eskom (Clark and Drimie, 2002:9). But, there's still more to be done, as millions are still with no access to modern energy. The situation gets worse as the emphasis is on the use of renewable energy as the poor need access to affordable renewable energy, which is ecologically sound.

Clark and Drimie highlight the importance of energy when they assert that increased access by the poor to electricity does extend their opportunities to undertake income-generating or productive activities. The authors believe that access to electricity reduces the time spent by women in securing sufficient environmental resources, to satisfy household energy needs and access to electricity, enables learners to study after dark.

3.2.2. Renewable energy in South Africa

The Department of Minerals and Energy (DME) announced that renewable energy sources, other than biomass (the energy from plants and plant-derived materials), have not yet been exploited optimally in South Africa. The Department has also strengthened international relationships in this area through partnerships established during the World Summit on Sustainable Development in 2002. DME believes that such partnerships will overcome market barriers and promote widespread use of sustainable energy solutions. These include the Global Village Energy Partnership and the Renewable Energy and Energy Efficiency Partnership.

South Africa is significantly lagging behind in the implementation of renewable energy despite an over-dependence on coal for electricity generation, and a well-known generation capacity shortfall. A target of 10 000 GWh of renewable energy per annum by 2013, was set by the Department of Energy, which would entail the commissioning of some 4000 MW of installed wind, Concentrating Solar Power (CSP) and solar Photo-Voltaic (PV) plant capacity. Eskom investigated various wind and CSP projects, but never proceeded due to shortcomings in the policy, legal and regulatory framework. In April 2011, the national integrated resource plan for energy (IRP 2010 - 2030) set a further ambitious target of 21,5 GW of new installed renewable energy generation capacity by 2030, comprising 9200 MW of wind capacity, 8400 MW of solar PV capacity, 1200 MW of solar CSP capacity and 2600 MW imported hydro capacity by 2030 (SAAEA, 2011). The target has a slim chance of being met, because very little has been done to date.

The national energy policy of South Africa is contained in the White Paper on Energy Policy that was published in 1998 and 2003.

- **White Paper on Energy Policy of 1998**

The policy has five objectives for energy sector which are: Increased access to affordable energy services, improving energy governance, stimulating economic development, managing energy related environmental impacts and securing diversity. The fifth objective addresses the need to provide alternative sources of energy, including renewable energy. It recognizes the potential of renewable energy in securing supply through diversity. The White Paper further noted that Government should not only increase its capacity to address the need of the day, but also improve long term issues, such as development of renewable energy resources to achieve a more sustainable mix (World Future Council, 22 June 2010).

- **White Paper on Renewable Energy Policy of 2003**

The Policy has a number of objectives that include: Ensuring that equitable resources are invested in renewable technologies; directing public resources for implementation of renewable energy technologies; introducing suitable fiscal incentives for renewable energy and creating an investment climate for the development of renewable energy sector. Renewable energy as indicated in White Paper of 2003 set a target of 10 000 GWh to be generated from renewable energy by 2013. The objectives of the White Paper on renewable energy are considered in six focal areas, namely, financial instruments; legal instruments; technology development; raising awareness; capacity building and education; market based instruments and regulatory instruments (*ibid*).

The South African White Paper on renewable energy 2003:

“South Africa relies heavily on coal to meet its energy needs because it is well-endowed with coal resources; in particular, the country has developed an efficient, large-scale, coal-based power generation system that provides low-cost electricity, through a grid system which is being extended to rural areas, to millions of residential, commercial and institutional consumers.

As a result, coal is and is likely to remain, from a financial viewpoint, an attractive source of energy for South Africa. However, at the same time South Africa recognizes that the emissions of greenhouse gases, such as carbon dioxide, from the use of fossil fuels such as coal and petroleum products has led to increasing concerns worldwide, about global climate change. While South Africa is well endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, so far these have remained largely untapped”.

The above was by the Department of Energy, and clearly indicates that South Africa recognizes the dire need for renewable energy and has the potential, yet not much has been done.

The fundamental reason for using renewable energy is that it is precisely renewable. Renewable energy sources derive from energy flows through Earth's ecosystem (UNDP, UNDESA and WEC, 2000) primarily from solar insolation, and to a lesser extent from Earth's geothermal energy. On a time-scale, they will not be exhausted, unlike the effectively limited stocks of fossil fuels (coal, oil, gas), which have been laid down over geological time and are not being renewed at the rate at which they have been consumed since the Industrial Revolution (Winkler, 2003).

The World Energy Assessment found that, if applied in a modern way, renewable energy sources are "highly responsive to overall energy policy guidelines and environmental, social, and economic goals" (UNDP et al., 2000, 221). They can assist in diversifying energy carriers, improving access to clean energy sources, limiting the use of fossil fuels (thus saving them for particular applications), reducing pollution, and lowering dependency on imported fuels. Many renewables are particularly suited to off-grid applications and, certainly in South Africa, could improve the flexibility of the grid by distributing generation across the country, closer to some key loads. Using renewable energy sources for electricity generation in South Africa, would have tangible environmental benefits, given that 93% of electricity generation is currently based on coal (*ibid*). In 2001, Eskom power stations burned 94.1 million tons of coal and emitted 169.3 million tons CO₂ (carbon dioxide), 2 154 tons N₂O (Nitrous oxide), 1.5 million tons SO₂ (Sulphur dioxide), 684 000 tons NO_x (nitrogen oxides) and 59 640 tons of particulates.

The renewable resource with the greatest potential in South Africa is solar energy. There are two main technologies for producing electricity from solar radiation: Concentrating solar power (CSP), also known as solar thermal energy, and solar

photovoltaic (PV). CSP technology uses mirrors to concentrate the thermal energy of the sun and heat a transfer fluid. The heat energy is then used to produce steam, with which electricity is generated in conventional turbines. Photovoltaic panels normally use silicon to convert the solar radiation directly into electricity. The total area of high radiation in South Africa amounts to approximately 194,000 km², including the Northern Cape, one of the best solar resource areas in the world (Pegels, 2009:14).

In support of the above the South Africa White Paper on Renewable Energy, 2003 states that:

“The widespread installation of solar water heating in industrial and commercial buildings and houses has the potential to defer the need for building new power plants, as the combined heating requirements consume the energy produced by three average power stations”.

- **Solar power in South Africa**

With an average of more than 2,500 hours of sunshine every year, South Africa has the perfect climate for solar panels. South Africa's solar radiation output is over twice that of Europe, making it one of the highest in the world and is the most readily accessible resource available. This immense energy resource lends itself to a number of potential uses and the country's solar-equipment industry is growing with a number of companies in South Africa selling solar panels and other related solar energy products (Total solar energy, undated).

The implementation of large Concentrating Solar Power (CSP) plants has been proposed as one of the main contributors to greenhouse gas emission reductions in South Africa. Studies by Energy Research Centre, 2007; Banks and Schaffer, 2005) envisage an installed CSP capacity of above 20GW by 2035. In the South African energy debate, it is usually assumed that CSP plants would be located in the Northern Cape Province, because of its excellent solar resource and its vast, sparsely populated areas. Also, skeptics are quick to presume that those potential sites in the Northern Cape are far from transmission lines, load centers and access to water (Fluri, 2009).

The South African government organized a solar park conference in October 2010. Local and foreign investors were presented with a preliminary feasibility study and called upon to consider putting their money into building a solar park capable of generating 5,000MW of power as much as one coal-fired power station. Initial projections show that the park, probably to be situated in Upington (Northern Cape), would cost about R150 billion. South Africa is counting on private investors to foot the bill. If the project generates enough interest, the construction could start in 2012 and last ten years (Lana, December 2010).

With its abundant sunshine and a good track record in innovative technologies, including solar technologies, South Africa is ideally positioned to be in the forefront of developing clean and renewable energy sources. It is hoped that an initial 1,000 MW of the solar park could be up and running by 2012, with some of the biggest investors probably coming from China. So far, several companies have announced readiness to invest in solar and renewable energy projects in South Africa (*ibid*).

This project is expected to cost up to R200 billion and aims to achieve an annual output of five gigawatts (GW) of electricity (by the end of its first decade), currently one-tenth of South Africa's energy needs. Giant mirrors and solar panels are to be spread across the Northern Cape Province, which the government says is among the sunniest 3% of regions in the world with minimal cloud or rain. The government hopes the solar park will help reduce carbon emissions from Africa's biggest economy, which is still more than 90% dependent on coal-fired power stations. In April, the World Bank came in for sharp criticism from environmentalists for approving a \$3.75 billion (£2.37bn) loan to build one of the world's largest coal-fired power plants in the country (Smith, October 2010).

3.2.2.1. Renewable energy sources in South Africa

South Africa's unique situation, gives the country access to many reliable renewable energy sources, they include wind and solar among others. These are some of the projects that as on the table already:

- Eskom has a 3.2 MW demonstration wind farm at Klipheuwel in the Western Cape.
- The 4-turbine, 5.2MW Darling wind farm in the Western Cape started producing electricity in 2008 and remains the country's only commercial wind farm.
- Irish company Mainstream Renewable Energy, in partnership with local outfit Genesis Eco-Energy, are planning to build some 18 wind farms in the Eastern, Western and Northern Cape, including 30 and 40 MW projects near Jeffrey's Bay and Colesberg, respectively.
- Eskom has proposed a 100 MW wind farm at Koekenaap near Vredendal in the Western Cape.
- Belgian company Electra winds recently announced a partnership deal for a 25-turbine wind farm at Coega in the Eastern Cape.
- The Nelson Mandela Bay municipality plans to build a wind farm with at least 10 turbines.
- UK-based Renewable Energy Systems has proposed to install around 300 MW of wind energy projects in the Western and Eastern Cape.
- The planned St Helena Bay wind farm on the West Coast is expected to produce 50 to 80 MW of electricity.
- A 300 MW wind farm project near Caledon in the Western Cape was announced earlier this year.
- The Tsitsikamma Community Wind Farm project in the Eastern Cape aims to produce about 40 MW by 2013.
- In October last year, government and the Clinton Foundation signed an agreement to establish the country's first "solar park", which is to deliver up to 5 000 MW of solar electricity to the national grid.

- Cape Town start-up Aurora Power Solutions is developing a 200 MW portfolio of solar power projects.
- Eskom is planning a 100 MW concentrated solar power demonstration plant near Upington.
- A factory for thin-film solar panels is to be built in Paarl (Cape Water Solutions, 2010).

Conclusively, the South African government's intention to promote the development of renewable energy is motivated by the need to ease South Africa's power deficit woes, on one side, and to help shift the country from its energy mainstay, coal, towards clean sources.

The driving force for energy security through diversification of supply in South Africa has remained one of the White Paper on Energy Policy's key goals, since a major portion of the nation's energy expenditure is through dollar-denominated imported fuels that impose a heavy burden on the economy. Furthermore, the South African economy, which is highly dependent on income generated from the production, processing, export and consumption of coal, is vulnerable to the possible climate change response measures implemented or to be implemented by developed countries. At the same time there are now increased opportunities for energy trade (White Paper on renewable energy, 2003).

"Given increased opportunities for energy trade, particularly within the Southern African region, Government will pursue energy security by encouraging diversity of both supply sources and primary energy carriers" (Department of Minerals and Energy, 1998).

Replacing nuclear with renewable energy sources removes the problem of over-centralization. Multiple and localized energy sources, easily repaired at local level, would create considerable jobs, spread over many communities, instead of requiring small numbers of highly skilled nuclear engineers and reactor operators. It has been estimated, that if South Africa were to generate 15% of total electricity from renewable

sources by 2020, it would create 36400 direct jobs at no additional cost to the economy (Agama Energy, 2003: 237).

Despite South Africa's shortcomings in "clean energy", many of its efforts are promising and it has made enormous progress in terms of renewable energy. Although there is still much to be done in rural electrification in South Africa, many of the SADC countries with very low national levels of energy access could learn more and use some of the strategies adopted by South Africa.

3.2.3. Electrification in Mozambique

Mozambique is still a young country, having become an independent republic 37 year ago, after a long period of colonial rule by Portugal. For about two decades after independence, the country followed a communist/socialist pattern of political system and economic development model with centralized planning.

Immediately after independence, the new republic plunged into a 16-year civil war that killed or uprooted huge number(s) of people and caused extensive damage to social and economic infrastructure and economic development. This in itself is indicative of the difficulties Mozambique has experienced since independence. The current status of the country's energy sector is indicative of many of the specific difficulties that the country has suffered, which have delayed its economic development (Chambal, 2010: vii).

Only 10% of Mozambique's population has access to the country's electricity grid. Without electricity, subsistence farming is less viable, students cannot study at night, and hospitals cannot store vaccines (Brockway & Salhotra, July 2011).

The cooking fuels in Mozambique comprise mostly woof fuel (firewood, charcoal) fossil fuels and electricity. While the modern cooking fuels (electricity and fossil fuels) are

mainly used in the urban areas, the traditional fuels are used by the large majority living in the rural areas. In 2004, the primary energy consumption in Mozambique was about 7.9 million tons of oil equivalents to about 0.425 toes per capita. Of this, firewood and charcoal accounted for 89.94%, petroleum products and natural gas 8.03% and hydroelectricity and coal 2.03% (African Development Bank and Organization for Economic Co-operation and Development, 2004).

The use of traditional sources of energy has been associated with health and environmental draw backs. According to Organization for Economic Co-operation and Development (2005), in developing countries, including Mozambique, about 1.3 million people die every year because of exposure to indoor air pollution from biomass. Also, valuable time and effort is devoted to fuel collection instead of education or income generation. This also causes environmental damage in form of land degradation and regional air pollution.

The national energy administration is divided into a number of different sectors. The coordination and planning of electricity supply is the responsibility of Electricidade de Mozambique (EDM), which a state enterprise. Two major private companies exist, the CahoraBassa Hydropower Company and the Revue Hydro Electric Society. In addition, a number of companies possess their own generating capacity such as the sugar companies in the center of the country. Local authorities also have their own electricity plants and these are run by the municipal governments. All these are coordinated by the EDM as the largest state enterprise in the electrical energy sector (Simoes, 1984: 141).

Large areas of the country are covered by forests, mainly in the central and northern provinces. Fuel wood is used as a source of energy by one main sector, rural and urban households, essentially for cooking.

Some industries use fuel wood, mainly the tea factories, for drying tea. Special attention is being given to afforestation programmes with the support of FAO, mainly concentrated on the central region of the country (*ibid*).

Mozambique has proven gas and coal reserves. It has 39 rivers emptying into the Indian Ocean, including the Zambezi, the fifth largest river basin in the world. Moreover, Mozambique has a wealth of unexploited biomass, solar and wind resources. Like many African countries, Mozambique has followed a centralized approach to electricity supply, selecting power sources according to criteria that are largely determined by cost and ease of financing. Its current supply focuses on large scale energy projects and is directed primarily at electricity both for industry and export to SAPP, which has rapidly increasing demands for power (Hankins, 2009: 7).

The CahoraBassa Dam went into operation in the fall of 1975 in Tete Province. In 1977, Mozambique started selling substantial quantities of electricity to South Africa, but the transmission line has been sabotaged repeatedly by the Mozambique National Resistant (MNR) since 1981. Work started on a national power grid in 1980, including plans to add to CahoraBassa's generating capacity, which was 2,078,000 kW in 1994. In 2001, total installed capacity was 2,388,000 kW. Electric power production in 2000 totaled 7 billion kWh, of which 96.4% was hydroelectric and 3.6% was from fossil fuels. Consumption of electricity in 2000 was 925.8 million kWh. Sabotage of the main power line pylons prevented the exporting of electricity to South Africa during the early 1990's. Mozambique imports all of its petroleum supplies, though oil prospecting is pursued both on and off shore. Mozambique's largest domestic fuel source is the Moatize coalfield near Tete, with an estimated two billion tons of reserves, but lack of infrastructure prevents further development (international Rivers).

Mozambique has among the lowest uses of electricity in the world. Yet, virtually all of the electricity it does produce from CaboraBassa Dam on the Zambezi is shipped to its wealthy neighbour, South Africa. As the government prepares to build another costly large dam on the Zambezi, that will also power South Africa rather than homes and businesses in Mozambique, a new report lays out a saner plan for developing renewable energy sources across the nation that would share the energy wealth more equitably; diversify the national electricity grid to help the nation adapt to climate change (which is expected to significantly affect large hydro), and build a clean energy sector that would also spare the Zambezi (International Rivers, undated).

Mozambique is poorly served by electricity infrastructure, and at less than 50 kWh/capita/annum, it has among the lowest per capita use of electricity in the world. This country is unable to extend or build power stations in remote regions, and its planned transmission infrastructure forces most of the power it produces to be exported to South Africa, before re-importing at higher cost. It relies on international donors to fund over 75% of its slow-moving rural electrification programmes. Its rural areas have poor access to communication, roads and income generation, in large part because there is little economic activity or ability to process agricultural products. The country is energy-rich with a vast potential for decentralized clean electricity and fuel production. Mozambique has virtually unlimited solar power across the entire country and large biomass resources that could be used for electrical production in strategic areas. The country has over 1000 MW of mini-hydro potential, much of it in areas that are currently electricity starved. It has the second largest coastline in Africa, with unexplored wind resources that could contribute to the national grid (Hankins, 2009: 11).

3.2.3.1. Renewable Energy in Mozambique

Just as with the other Southern African Development Community (SADC) countries, Mozambique faces severe and interrelated problems of energy linked with the massive consumption of fuel wood biomass. The conventional power grid provides less than 10% of the energy needs for the country's 22 million inhabitants. The electrification rate

is estimated at 20% of urban areas and 2% of rural areas. About 85% of the energy consumed in the country comes from biomass. Mozambique has vast renewable energy (RE) resources that can play an important role in the process of development of the country. This country is well endowed with resources, but lacks required technology, skills, financing and incentives, as well as diversified suppliers for rapid internal development of this potential. The role of external funding and technical assistance will thus remain important for many years to come for the successful development and modernization of the energy sector (SAAEA, February 2011).

In Mozambique, almost 90% of the population lacks access to electricity. This country has significant undeveloped hydro power resources. Hydro power development can contribute to poverty reduction indirectly, for instance, through increased industrialisation, increased revenues from power exports and greater employment opportunities. More immediate benefits are a potential for increased access to electricity for parts of the population relying on traditional biomass with its detrimental effects on health and limited development potential (Norwegian Agency for Development Cooperation, 2011).

Phaesun has started a €300,000, two-year rural electrification project in Mozambique in order to provide electricity to the people of Pessene, located around 50 kilometers from the country's capital, Maputo. The project partners say they are also planning to establish solar shops. The project, which started in July of this year, has already fitted a primary school and two accommodations for teachers with 15 solar lamps, installed through small off grid systems (Pico systems) with up to 10 watts. The project will run for two years and 50% of the investment is covered by Deutsche Investitions-und-Entwicklungsgesellschaft (German Investments and Development Association) (SAAEA, September 2010).

In an article by Reuters (09-June-2011), efforts to expand the energy sector in Mozambique are highlighted. This is a sign that this country is willing to meet its energy demand.

"Mozambique plans to invest \$2-billion in a new power distribution and transmission line in the next three years, the energy minister said on Wednesday. The line, which will cover 1 500 km and transport about 9 200 MW of power generated at the CahoraBassa hydroelectric dam to the capital of Maputo, is expected to be commissioned by 2014. Currently there is no line linking the dam with Maputo. The capital is supplied via a line which connects the dam with South Africa and then transmits back to the Mozambican capital. "This project is vital to develop Mozambique's energy potential," Energy Minister Salvador Namburete told Reuters on the sidelines of an annual meeting with the energy sector. He said the government will finance 51% of the project, with the remainder to be funded by the private sector. The final financial agreements are expected to be signed by the end of June, Namburete said"

Namburete continues to say that currently, 30% of Mozambicans have access to electricity, being 20% from the expansion of the national grid and the remaining 10%, about 2.1 million Mozambicans, through renewable energy sources, including solar panels, wind turbines, small and medium-size dams and biomass, which generate electricity with the same quality as that of the CahoraBassa dam. Beyond the sources listed above, Mozambique's renewable energy projects under development include a number of biofuel facilities utilizing sugar cane bagasse and jatropha seedcake under the government's recently approved strategy for renewable energy. The most widely used renewable energy resource is solar power, with small facilities scattered across the nation to meet the needs of rural populations, particularly in remote areas, where traditional electrical resources would be both difficult and expensive to deploy (Peixe, undated).

In light of the above, 30% of national energy access is still very low despite the government's initiatives to electrify the country. This is an indication that Mozambique has a very slim chance of achieving the Millennium Development Goals as well as reaching the target by SADC (to halve the number of people with no access to modern energy by 2016). Yet, the efforts made through renewable energy are appraisable and this indicates that this country can reach a very high level of energy access which is a catalyst to poverty reduction in the next coming years.

On the other hand, the impact of energy use on the environment in Mozambique makes the promotion of energy efficiency an important issue. In this regard, it is of paramount importance to promote the efficient use of energy resources, but also to carry out awareness campaigns, mainly with local communities or people living in rural areas, where inefficient energy use is apparent, causing damage to the environment. These activities must be accompanied by a process of harmonization and coordination among the different government entities in order to merge the various policies and strategies, especially regarding the use of natural resources. Although many countries are using voluntary labeling to promote energy efficiency, reduce emissions and achieve negative impact on the environment, for countries like Mozambique this is still far from being a reality. However, some measures that can be more easily implemented in the country such as technical regulations and standards are important tools to increase the efficient use of energy and reduce greenhouse gas emissions (Chambal, 2010: 4).

Mozambique has emerged as one of the leading countries in Africa using renewable energy sources as part of a courtesy expansion programme that made it possible for over two million Mozambicans to access electricity via renewable sources. The country's renewable energy projects under development also include a number of biofuel facilities utilizing sugarcane bagasse and jatropha seedcake under the government's recently approved strategy for renewable energy. The most widely used renewable energy resource is solar power, with small facilities scattered across the nation to meet the

needs of rural populations, particularly in remote areas, where traditional electrical resources would be both difficult and expensive to deploy. Mozambique now also has a number of micro hydropower dams, with a generating capacity of up to 15 megawatts of electricity, which are being used to supply power to small communities.

In light of the above, 30% of national energy access is still very low despite the government's initiatives to expand energy access in the country. This is an indication that Mozambique has a very slim chance of achieving the Millennium Development Goals as well as reaching the target set by SADC (to halve the number of people with no access to modern energy by 2016). Investments and financing are still major challenges to energy development. Chambal elaborates more on this in the discussion to follow.

Mozambique is endowed with a considerable hydropower potential and is rich in modern energy resources. However, more than 80 percent of the country's population is not connected to the national grid because of inadequate basic infrastructure, the lack of investment, the lack of a market network, and the huge cost of installing an energy grid, among others. The country's natural resources are fundamental to the socio-economic development of the country, but must be utilized in a sustainable manner in order to benefit the different stakeholders, including communities living in rural areas (Chambal, 2010).

3.2.4. Energy supply in Mauritius

Mauritius has no known oil, natural gas or coal reserves, and therefore depends on imported petroleum products to meet most of its energy requirements. Local and renewable energy sources are biomass, hydro, solar and wind energy. Biomass energy consists mainly of biogases, a by-product of the sugar industry, and contributes about 22% of the primary energy supply. Fuel wood and charcoal are minimally used. Hydropower plants, with a combined installed capacity of 59MW, are virtually the entire hydro potential. Furthermore, Mauritius has a good solar regime with a potential

average annual solar radiation value of some 6 kWh/m²/day. The wind regime in Mauritius is very good in some areas, with an annual average speed of 8.1 m/s at 30 m above ground level (Ministry of Energy and Public utilities).

Government policy is to encourage a greater use of sources other than oil for the generation of electricity, through the optimisation of the use of local and renewable energy sources. Furthermore, the government has initiated action to reform the power sector (ibid).

Mauritius plans to double the share of renewable sources of energy to produce electricity to around 40% within the next decade. There are intentions to explore local sources of renewable energy in the form of wind farms, solar panels, burning solid waste, land filled gas and air-conditioning from the Land Based Oceanic Industry (LBOI) (Trade Invest Africa, May 2010).

In December 2010, Mauritius launched an initiative asking the population to produce electricity from renewable sources. Energy and Public Utilities Minister Dr R. Beebeejaun says the aim is to reduce the island's greenhouse gas emissions and enhance energy resilience and stated that Mauritius are being transformed into a sustainable island and making it into a model of ecological sustainability.

A partnership between Omnicane Limited (OL) and Aerowatt Mauritius, will install 22 wind turbines to produce electricity from wind power. The Energy and Public utilities Minister, added that the electricity produced will be sufficient for the consumption of 75,000 households and that the final aim will be to produce 37.4 kilowatt of electricity yearly (Africa Press Agency, November 2009).

In 2008, 25 000 houses were equipped with solar water heaters and with the implementation of the MID Fund; the number of households equipped with solar water heaters has more than doubled. Prime Minister of Mauritius Dr Ramgoolam believes that another way of moving towards greater autonomy is by democratising the energy sector.

The Mauritian government has introduced a scheme which will allow households and businesses to produce their own electricity through renewable sources and sell up to 70% to the Central Electricity Board (CED). *"This project has attracted significant interest from individual households as well as from commercial entities,"* the delegates were told by the Prime minister (Business Mega Mauritius, June 2011).

According to the SADC's Action Plan (2010: 27), the experience of Mauritius serves to emphasize the symbiotic relationship between energy access, energy usage and overall economic development. It is no coincidence that, as the Mauritian economy grew and diversified; the population acquired greater access to modern forms of energy and used higher levels of energy in their income-generating activities and more sophisticated applications of energy in their homes. The Mauritian success was based on careful coordination by the government of national economic and energy development, coupled with a precisely designed subsidy strategy, which was fine-tuned during its implementation.

Mauritius has been successful in its electrification projects, as many of its citizens have access to modern energy. This country continues to expand its energy sector by exploring its renewable energy potential, which is a good move towards reducing Green House Gas(GHG) emissions that are currently a threat to the environment. It is also good effort towards saving the world from the effects of climate change and global warming. The initiatives and the successes of Mauritius as well as its supportfor the

production of renewable energy, provides a model for other countries to follow suit, especially SADC countries.

3.3. Kyoto Protocol and SADC Countries

As African countries are least responsible for climate change, all of them are Non-Annex (I) countries under the Kyoto Protocol, exempted from mandatory emissions reduction targets. Africa, however, is particularly vulnerable to climate change, including current climate variability risks, lower agricultural production levels, worsening food security, increased frequency of natural disasters, increased incidence of both floods and droughts, spreading of vector borne diseases and higher risks of conflicts over scarce land and water resources. African countries, therefore, have a strong vested common interest in contributing moral and diplomatic capital, towards galvanizing international commitment to meaningful reductions of emissions to stabilize atmospheric GHG concentration in order to limit the negative impacts of global warming and climate change (Veit, 2008:15).

All SADC countries have ratified the United Nations Framework Convention on Climate Change (UNFCCC) as well as the Kyoto Protocol, to show their support to reducing GHG emissions and the enormous effects of global warming.

The Protocol provides for the following:

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These, amount to an average of 5% against 1990 levels over the five-year period 2008-2012.

The major distinction between the Protocol and the Convention is that, while the Convention encouraged industrialized countries to stabilize GHG emissions, the Protocol commits them to do so. Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities" (www.unfccc.int).

The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable Certified Emission Reduction (CER) credits, each equivalent to one ton of CO₂, which can be counted towards meeting Kyoto targets. The mechanism is seen by many as a trailblazer. It is the first global, environmental investment and credit scheme of its kind, providing standardized emissions offset instrument, CER's. A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers. The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets (UNFCCC, undated).

The Kyoto Protocol was initially directed to developed countries, but later involves developing countries like SADC countries. Due to the fact that the emphasis of the Protocol and the Convention is industrialized countries many developing countries have ignored the goals and principles of this protocol and are therefore less effective.

3.4. Millennium Development Goals

The Millennium Development Goals (MDGs) are the international community's bold commitment to halving poverty in the world's poorest countries by 2015. While some of the world's poor countries have seen tremendous success in poverty reduction over the past decades and are on track to achieve the MDG's, many others are lagging.

To achieve the poverty reduction goals set out in the United Nations Millennium Development Goals, one billion people (that is half of the two billion people estimated to be living on less than one US \$ a day), would need to have access to modern energy services, as this is an important precondition for the eradication of poverty. Assuming an average figure of five persons per household, this goal can be translated into the provision of:

- First, a basic level of energy service that can meet, at least, basic requirements for home lighting, fans, radio, television, efficient appliances for cooking and fuel needs.
- Second, further services that could facilitate people's engagement in income generation activities (Gururaja, 2005:224).

Achieving all of the MDGs will require much greater energy inputs and access to energy services. Failure to include energy considerations in national MDG strategies and development planning frameworks will severely limit the ability to achieve the MDG's. As such, the following key recommendations point to priority energy interventions which national governments should take to support achieving the MDG's at the national level.

They should:

Place the issue of energy services at par with other MDG's.

- Integrate energy within national development strategies by adopting a goal-oriented approach to address the combined energy needs of social institutions and productive activities for cost-effective energy service delivery. This will require both flexibility in prioritizing programs and coordination across ministries of finance, economic management, energy, industry, health, education,

agriculture (or rural development), water and sanitation, and transport (Modi, McDade, Lallement, & Saghir, 2006 :2).

Eradicating poverty is the greatest global challenge facing the world today and an indispensable requirement for sustainable development, particularly for developing countries. This would include actions at all levels to accelerate the access of the poor to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services (World Summit for Sustainable Development, 2002).

Poverty reduction remains the core issue of Africa's development agenda. For African countries, economic and social development cannot be achieved in the absence of adequate energy supplies. Therefore, access to modern energy services is necessary for productive activities and essential services (UNDP, 2005-08). SADC countries are bound to expand the region's energy capacity and giving the poor access to modern energy, this is a requirement for achieving the MDG's.

3.5. The SADC Energy Access Strategy and Action Plan

The current SADC Energy Strategy and Action Plan was guided by, among other documents, the Protocol and the SADC Energy Cooperation Policy and Strategy, all of which have also been overtaken by new developments such as climate change as well as the renewed thrust towards energy access, renewable energy and energy efficiency.

In March 2010, SADC put together their energy development ideas in an official document, as the strategy that would guide energy initiatives in member states. Countries were required to reduce their Carbon Dioxide emissions in every way possible; hence the Action Plan requires the increased use of renewable energy as opposed to fossil fuels.

Previous SADC protocols on energy had no relevance to the current issues that are facing the energy sector, they were very much outdated, and therefore needed urgent attention and reviewing. The Action Plan came in as a solution and as a source of change in the SADC energy sector. The Action was widely accepted across the region and adopted by all SADC countries.

The SADC Energy Access Strategy and Action Plan, has its main objectives and goals. It is guided by the following goals:

- Strategic goal: The harnessing of regional energy resources to ensure (through national and regional action) that all people of the SADC region have access to adequate, reliable, least cost, environmentally sustainable energy services.
- Operational goal: To endeavour to halve the proportion of people without such access within 10 years for each end use and halve again in successive 5 year period until there is universal access for all end uses.

These goals appear to be comprehensive and if achieved could lead to development in the region as well as the achievement of the Millennium Development Goals. The chances, however, are very slim as the region is still struggling to get investments into the energy sector as well as proper funding to date.

The United Nations Industrial Development Organization (January 2009:16), supports the above by asserting that, the extent to which renewable energy can contribute to efforts to address the energy challenges facing Africa needs to be closely analyzed. In general, the role of renewable energy in meeting Africa's energy demand has been undermined by bad experiences, misinformation, technology push, and consequent negative perceptions. The balance between energy services for meaningful economic growth, on the one hand, and general welfare gains, on the other, continues to be a

source of unnecessary conflict among stakeholders, as both are essential and complementary. So far, certain technologies have been disseminated in circumstances that compromise their further adoption, as beneficiaries have been dissatisfied. The mismatch between energy service provision and income generation to meet the cost of services has been particularly disadvantageous to the promotion of renewable energy.

Energy has a direct bearing on all aspects of the lives of people especially the poor. Access to affordable, clean and reliable energy is essential and will allow for development.

3.6. Discussion of Findings

The findings of the major results of this study are based on the following key questions:

- What implications does the Action Plan have on peace, security and development?
- How committed are SADC members to achieving the goals of the Action Plan/renewable energy?
- Will energy access ensure the reduction of Carbon dioxide emissions and reduce the impact of climate change in the SADC region?

The findings are based on the researcher's observation as well as primary data collected from presentations and speeches (through the use of content analysis) from key personnel in energy access and secondary data from documentation review as specified in Chapter One 1.10.1.

3.6.1. Findings

The social and economic systems and conditions in SADC countries are diverse. Similarly, the energy needs, income and population distribution and technology associated with production modes vary. Energy plays a crucial role in the production of

economic output, and economies would not be able to develop without adequate supplies of energy. Once energy is in short supply, it becomes more costly and depresses the economy, leading to increases in unemployment and compromising development prospects (Nkomo, August 2007:10). This is the challenge facing the region.

Energy and economic development are inseparable. Without access to affordable energy, long-term development cannot take place. Historically, the most used energy sources have been those nearest and easiest to consume. This has resulted in a global reliance on fossil fuels, initially coal but with increasing amounts of oil. It was not until the end of last century that attention was drawn to the fact that by burning fossil fuels and emitting greenhouse gases (GHGs), people are contributing to a change in the planet's atmosphere and a resultant change in climate (Haw and Hughes, February 2007).

The impact of the above led to the review of previous protocols on energy in order to address these issues. It is without any doubt that climate change is interrelated to population growth, energy supply and the environment.

Sigh (*in* Brauch. et. al., 2009) asserts that the movement of people in trans-border areas generates environmental insecurity and conflict over natural resources. Involuntary migration of people across numerous SADC region borders over decades not only dislocated people and local governance systems, it also caused environmental insecurity. This author confirms the researcher's observation that continued damage to the environment leads to scarcity of resources. People then migrate in search of better living conditions, most of whom are rejected by host countries and this has the potential for conflict. Competition over scarce resources threatens peace; this is already happening in SADC due to climate change and its effects (drought, worsening food security). Moyo (2009: 908) confirms the researcher's findings when he posits that economic depression and drought in some SADC countries have escalated migration to South Africa, causing the resurgence of xenophobia and as some migrants claim shares of natural and socio-economic resources.

In support of the above, Gnacadja (2009:4) points out that scarcity of resources (due to the effects of global warming), sets in motion a train of events leading from poverty to migration to conflict and to disastrous effects. Traditional ways of life are eroded, disputes are erupted and further disputes continue over land and natural resources. Furthermore, mass displacement of people, particularly in cases of severe food shortage, can place enormous strain on the existing social structures, leading to social unrest. The researcher found that the above has already happened in some SADC countries (Zimbabweans in South Africa) and that led to social unrest. This is likely to occur more often in SADC if the current situation of lack of access to energy (electricity) continues and climate change worsens.

The countries in SADC, prepared a regional program in 1999, to assess their needs in the area of clean energy technology. This effort was designed to identify the clean energy technologies that have the greatest potential across the SADC region for meeting sustainable development needs, while reducing greenhouse emissions through accelerated private investment and to assist countries in mobilizing that investment (National Renewable Energy Laboratory, October 1999). Through this the researcher found that SADC countries have made efforts in the past to increase energy access in the region, the lack of funds has been a hindrance.

In support of the researcher's findings above, Mak and Soltau (2005) assert that affordability in the energy sector is a problem. This is evident in the case of South Africa; its oft-cited off-grid solar voltaic electrification program requires the government to subsidize the capital cost of the equipment and to break even the consumers would have to be charged 30times more the residential electricity tariff. The same problems with affordability are experienced elsewhere in SADC and the African continent, leading to the call for a more diversified renewable energy policy, one that emphasizes solutions that catalyze income generation. One would make reference to the SADC Energy Strategy and Action Plan but implementation and progress is still pending.

The study made reference to three SADC countries in 3.2., namely, South Africa, Mozambique and Mauritius. It is without any doubt that SADC countries have neither the same national energy consumption nor energy access needs. Mauritius is leading with 99.9% of energy access; it is the opinion of the researcher that if SADC countries would adopt some of Mauritius energy access strategies.

Countries like Mozambique, Lesotho and Malawi are lagging behind the other countries in the region. A lot still needs to be done as these countries have very low levels of energy access and are poor (in terms of development). It is therefore a huge challenge to get investments into the energy sector in these countries. To date, majority of people still use traditional biomass as energy. This affects their health and the climate. These countries need to adopt the SADC Action Plan, implement it and ensure the achievement of its goals.

The implementation and success of the Action Plan requires funding and investment, which is a major challenge to many countries. The project requires new projects and the expansion of existing ones. Therefore funds are key to the achievement of these. Mbewe (1992) asserts that in other SADC countries like Zambia, even financial viability does not ensure project sanction because of the lack of local and foreign exchange funds. The author believes that one of the reasons for slow progress in rural electrification has been, and still is, the dependence on foreign donors for financing. Due to the weak economies of many SADC countries, it is difficult for governments to fund all the electrification projects; hence governments opt to approach donor countries for loans and investments. Financing is therefore central to the success of any project including the Action Plan.

Total commitment by countries is a major requirement to achieving the goals of the Action Plan. The researcher found that other SADC countries turn to misuse available funds that could be invested in renewable energy. Fig (2007: 238) confirms this in the case of South Africa when he points out that "instead of exploring renewable energy options more rigorously, the state prefers to devote taxpayer's money to the

unsustainable development of the Pebble Bed Modular Reactor (PBMR). This amounts to R 1.5 billion, including an extra amount of R 500 million agreed to by the Minister of Finance, and is envisaged to total R 15.9 billion for the pilot plant, which is planned for the Koeberg site, as well as a fuel fabrication plant at Phelandaba and some costs of commercialization". By way of contrast, Fig believes that the amount of money devoted to the promotion of and development of renewable energy sources has been derisory.

According to an article by Fig (September 2010), the aim of the Pebble Bed Project was to deliver energy to industry and households, both locally and for export. However, the technology has proven difficult for the company to master and the building of the demonstration model was delayed repeatedly. The completion date was set for 2003 but the company deferred this and in 2009 announced the completion to be 2020. The design of the reactor itself has also been modified five times. The cost of the project was estimated in 1998 (that the cost of getting the pilot reactor and fuel plant running) to be R 1.1 billion. By May 2005, this had escalated to R 14.9 billion, estimates doubled within four years and reached R32 billion in August 2009.

All these costs were the tax payer's money, for a project that later failed and wasted money. The US-based nuclear reactor operator company withdrew from the project as well as all other investors and the project was cancelled.

In Namibia, commitment has led to success, and although the country has a relatively high level of income amongst its SADC peers, its relative success in energy access has more to do with commitment and organization than finance (SADC energy strategy and Action Plan). This proves that commitment is important and without which failure is anticipated even if funds are available.

Access to clean and affordable energy will ensure the reduction of Green House Gases and reduce global warming. According to the researcher, this will require countries to educate their citizens about climate change and how it affects their livelihood; especially in rural areas as many still use traditional biomass.

Through observation the researcher found that people continue to use fire wood and cow dung as their source of energy, even after they have access to electricity. This is due to the high costs of electricity and limited or no knowledge of the health risks and the damage they cause to the environment by using them. Energy should therefore be affordable.

The researcher also discussed the information with other students conducting similar studies in order to gain advantage provided when a variety of perspectives and insights are applied to the same data. This was helpful as the researcher got to know different perspectives relating to energy access in South Africa. An engineering student conducting a study in "Renewable Energy Resources in South Africa" shared in some of his observations regarding South Africa's commitment to renewable energy. This enabled the researcher to draw some conclusions based on that study. Most of the students the researcher had discussions with, are concerned about the commitment of countries especially South Africa to renewable energy and more so the impact of climate change in the region. Many believe that the SADC Action Plan was a well thought policy document, with very good goals but question the implementation and as well as the time set for the achievement of the goals.

In response to the first research question: What implications does the Action Plan have on peace, security and development?

The study found that the Action Plan will have negative implications for peace, security and development for the region if none of its goals are achieved within the set time frame. Energy is a basic need and all humans need to have some sort of access to energy, be it modern or traditional. It is without doubt that millions of people in the SADC region still use traditional biomass as their main source of energy. This method affects the environment negatively, the very same environment that produces food for

them. As the land gets infertile due to deforestation, acid rain and soil erosion among others, food security becomes a major challenge. People then start competing for scarce resources (food) and migrate in search of such.

This is evident in the case of Zimbabwe, a country that was once referred to as “the bread basket of Africa”; it is now importing food from other countries. Due to unfavourable conditions as well as instability, Zimbabwean citizens started to migrate and seek refuge in other countries. This had negative implications for peace, as they were rejected by the host countries and violence erupted (Xenophobic attacks in South Africa) due to the competition over scarce resources. Food security is already a problem in the SADC region, because of unfavourable conditions to farming mainly caused by the changing climate (global warming), competing over resources is inevitable and leads to conflict. Therefore, the implementation of the Action Plan and the achievement of its goals will possibly reduce these challenges in order to maintain peace in the region.

Development is essential and is needed to show growth in the region. Peace cannot be maintained if there is no development. Giving people access to modern energy is part of development but it does not end there, people need to use this energy to their benefit and to develop themselves. In some rural areas in the region, people have access to energy but still use their traditional ways of producing energy. This is because they cannot afford the costs that are tied to the use of modern energy. It is therefore important for governments to give people access to affordable and easily accessible energy. South Africa's power utility, Eskom, has been increasing the energy tariffs yearly. The majority of the citizens (rural areas) cannot afford the cost of electricity; hence they opt to use the readily available biomass as was also the case in Namibia. This hinders development. The adoption of the Action Plan will ensure development in SADC countries and the region as a whole.

The commitment of SADC members in implementing the Action Plan will bring change and move a step forward in achieving the goals of this policy. The use of renewable energy will reduce the pressure on the environment and encourage investments into the "Green Market". Not only will it be a good attempt to adapt to climate change but will also create employment in the "Green Market" and give people access to "clean" affordable energy. This would be a step towards development, energy and food security and ensure peace and stability in the region.

Chapter Four

Conclusion and Recommendations

This chapter is divided into two sections mainly, the conclusion and recommendations. The conclusion is drawn from an analysis of the implications that the Action Plan has for peace, security and development in the region and the attendant variables. The recommendations are geared towards dealing with the emergent issue of climate change, worsening food security, the growing energy demand which exceed supply and pose a threat to energy security in the region, as well as the scarcity of resources that threaten peace and development.

4.1. Conclusion

Poverty reduction remains the core issue of Africa's development agenda. For African countries, economic and social development cannot be achieved in the absence of adequate energy supplies. Therefore, access to modern energy services is necessary for productive activities and essential services. While reliable energy services, by themselves, are not sufficient to eradicate extreme poverty, they are necessary for creating the conditions for economic growth and improving social equality. Access to modern energy services can help reduce spending; because of the inefficiency of traditional energy forms, the poor often pay higher unit costs for energy than do the rich. In addition, a large number of women and girls in Africa spend large amounts of time fetching wood and water, thereby losing time that they could otherwise devote to schooling and revenue generating activities. Furthermore, indoor air pollution from low quality solid cooking fuels (wood, charcoal, dung, waste) poses a major health hazard for those who spend time close to the cooking area, again, women and girls (United Nations Industrial Development Organization, January 2009:10).

In view of their modular nature and availability at the local level, renewable energy technologies can contribute to sustainable development. They can also assist in addressing the Millennium Development Goals (MDG's) by increasing access to modern energy services to the majority in rural areas. This is particularly true for small-scale renewable energy systems that provide affordable energy to the poor, and help in creating employment by powering enterprises for both the rural and urban poor. The localized nature of many renewable energy resources makes them attractive for decentralized systems that can be used in remote and rural areas, which currently have no access to grid electricity and pay higher prices for energy services delivery. On the other hand, large-scale renewable energy systems could diversify energy supply, reduce energy imports and help in providing significant local and global environmental gains (ibid: 10).

Lacking access to clean and affordable energy has a tremendous socio-economic impact on education, income, health, water, food and air quality, all of which have negative implications on development in the region and the whole continent. Development requires the eradication of poverty and stability (peace).

Climate change remains an utmost important issue and requires the use of renewable resources. Since energy is a contributing factor; renewable energy access is the solution to the enormous impact of global warming. SADC Energy Access Strategy and Action Plan came in as a good solution to high energy demand and the need for renewable energy. The researcher concludes that the goals of the Action Plan are too far-fetched and impossible to achieve in the recommended time frame.

- **Strategic goal:** It is the harnessing of regional energy resources to ensure (through national and regional action) that all people of the SADC region have access to adequate, reliable, least cost, environmentally sustainable energy services.

- **Operational goal:** It is to endeavour to halve the proportion of people without such access within 10 years for each end use and halve again in successive 5 year period until there is universal access for all end uses.

The achievement of these goals will ensure development, peace and security in the region. Through extended time, total commitment and availability of funds, the above could be achieved. It is unfortunate that to date, the Southern African Power Pool and the SADC Secretariat, have not officially released the one year progress report of the developments made in countries since the adoption of the Action Plan in March 2010. There is no doubt that the SADC Energy Access Strategy and Action Plan have implications for Peace, Security and Development in the region.

If the current energy situation (demand that exceeds the supply and use of fossils and traditional biomass) continues, then the region will have more problems to solve. Global warming will lead to scarcity of resources including the basic needs such as food and water, then lead to migration in search of a better life, which would in turn pose a threat to peace as it has the potential for conflict over scarce resources, threatening security and development as well. Therefore, the SADC leaders have to abide and respect the Action Plan and commit to reducing the impact of climate change through renewable energy.

4.2. Recommendations

Goodwin (2008:19) posits that the human race cannot ignore the potential long-term impact on the earth that may arise from continued hydrocarbon combustion and Carbon Dioxide production which contribute to increased global temperatures. Alternative sources are required of energy density similar to that provided by petroleum, but which when consumed, are free of negative environmental impact.

This means that the world cannot ignore the impact of climate change and has to align all sectors to the climate change issue, as it continues to worsen.

It is not just improved access that counts in the SADC region, but also energy-efficient use. Additionally, productive use must be included in energy investment plans so as to boost economic development and reduce poverty (European Union Energy Initiative, undated).

The use of energy from fossil fuels and clearance are the main causes of anthropogenic emissions of Carbon Dioxide. These economic activities are therefore the main causes of human-induced climate change. They are also at the very basis of people's economic lives. It is Vrolijk's (2002: 6) recommendation to reduce emissions in order to mitigate climate change and states that "the world community is confronted with a radical challenge of a totally new kind". Countries should stabilize Green House Gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. This author emphasizes the need for renewable energy use.

According to the SADC Energy Access Strategy and Action Plan (March 2010), Southern African countries should adopt appropriate pricing and subsidy. This is a requirement to ensure that electricity is affordable.

The study recommends that countries should honour their commitments as members of SADC, as the regional access strategy and Action Plan provides an opportunity for shared revenue and combination of more resources to be used. Regional integration

also allows the exchange of experience and ideas in energy access especially from countries like Mauritius, Seychelles, South Africa, Namibia and Botswana. SADC countries must ensure that the energy they provide to citizens is not only ecologically sound and clean but must be affordable and easy to access.

The abundance of renewable energy resources in Southern Africa, political will and enthusiasm should therefore be ensured. Without commitment by governments, none of the goals would be achieved. Political will is therefore of the utmost importance.

Feasible financing mechanisms (foreign investments) are needed to enable access to renewable energy technologies. The region should seek financial assistance from International financing institutions as well as the private sector to invest in the "Green Economy" and fund renewable energy projects.

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