Energy crisis in Southern Africa
future prospects

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Acronyms

AfDB	African Development Bank
CFL	compact fluorescent lamp
BPC	Botswana Power Corporation
COMESA	Common Market for Eastern and Southern Africa
CZI	Confederation of Zimbabwe Industries
EAPP	Eastern Africa Power Pool
ECOWAS	Economic Community of West African States
EDM	Electricidade de Moçambique
EIB	European Investment Bank
ERERA	ECOWAS Regional Electricity Regulatory Authority
ESCOM	Electricity Supply Corporation of Malawi
Eskom	national electricity supply utility of South Africa
GDP	gross domestic product
GNI	gross national income
GWh	gigawatt-hour
HCB	Hidroelectrica de Cahora Bassa, Mozambique
HDI	human development index
IMF	International Monetary Fund
IPP	independent power producer
IRENA	International Renewable Energy Agency
IRP	integrated resource planning
KWh	kilowatt-hour
LEC	Lesotho Electricity Corporation
MoZiSA	Mozambique-Zimbabwe-South Africa
MYPD	multi-year price determination
MW	megawatt
MWh	megawatt-hour
NamPower	Namibia Power Corporation
NEPAD	New Partnership for Africa's Development
PIDA	Programme for Infrastructure Development in Africa
PPA	power purchase agreement
PPP	public-private partnership
RERA	Regional Electricity Regulators Association
SADC	Southern Africa Development Community
SAPP	Southern Africa Power Pool
SEC	Swaziland Electricity Company
SERA	Swaziland Energy Regulatory Authority
SNEL	Société nationale d'électricité, national electricity company of the Democratic Republic of the Congo
TANESCO	Tanzania Electricity Supply Company Ltd.
ZESA	Zimbabwe Electricity Supply Authority
ZESCO	national electricity supply utility of Zambia

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It is intended that the present report will illuminate the issues and broaden our understanding of the challenges faced by the energy sector in Southern Africa. Moreover, it is hoped that the solutions and recommendations proposed will assist in addressing those issues and challenges.

Foreword

The present study is timely, as its focus is one of the Sustainable Development Goals enshrined in the 2030 Agenda for Sustainable Development, specifically, Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all. Adequate energy provision is central not only to improving the social welfare and livelihood of people but also in promoting sustained economic growth and transformation, especially in the developing world.

In their report of 2017, the World Bank and the International Energy Agency refer to energy as the "golden thread" that connects economic growth, social equity and environmental sustainability. Progress has been made in "lighting up" the world: between 1990 and 2010, the number of people with access to electricity increased by about 1.7 billion. Such "progress", however, is relative: one in seven people in the world still do not have access to electricity, a majority of whom are based in Africa and live in rural areas.

The energy crisis or, more specifically, the crisis in the provision of electricity in Africa is real and debilitating. It affects manufacturing production, increases the cost of doing business, retards the growth of the informal sector, reduces government revenue and decelerates the process of economic growth and development. In 2014, those with access to electricity in Africa represented 37 per cent of the population. In comparison, populations from other regions have achieved either universal access (for example, those in Europe, North America and Central Asia) or access at a level of 90 per cent and above (Asia-Pacific and the Arab region). In terms of the provision of electricity, about 32 countries in Africa are considered to be in dire straits. The supply of electricity across the entire continent of Africa is barely more than that of Spain. This example indicates the gross deficit in the sector in Africa. Yet, energy is the life wire of a modern economy and society. Progress and development are inconceivable without an adequate energy supply.

Three decades ago, the indicators for describing relative underdevelopment in Africa included high levels of poverty, illiteracy and disease. However, sustained economic growth over the last two decades has changed the narrative. Africa is now being described as the land where the "sun shines bright". In the current context, the metaphor for Africa's continued lagging behind is the energy crisis – or, more precisely, the provision of electricity. When a satellite view is taken at night of Africa compared with other parts of the world, Africa is seen to be in darkness.

This new discourse should challenge Africa to look beyond the present, into the future, to make strategic policy choices in achieving Sustainable Development Goal 7. Many African countries are reforming their energy sector and are promoting new investments in it, both public and private. Many African countries are unbundling centralized State energy providers and exploring different energy mixes to ensure that the supply of electricity is adequate and regular. Morocco, for example, has launched one of the most ambitious solar energy plans in the world, with an estimated investment of over US$ 9 billion. South Africa has a new energy plan: the Integrated Resource Plan 2018, which,

in order to meet the country's energy needs, combines different sources of energy such as coal, gas, wind, solar and hydroelectric.

The regional institutions form the foundation of a determined movement across the continent to resolve the energy challenge. Regional power pools have been developed, including the Southern Africa Regional Power Pool, joint investments are being encouraged by member States, and new regional regulatory regimes are being foisted. Under its new President, Akin Adesina, the African Development Bank has made "lighting up" Africa one of its five major priorities. Massive financing is being deployed to support African countries to turn the tide in the provision of electricity. A game changer is unfolding in Africa, through which Sustainable Development Goal 7 will be realized.

ECA, in its modest contribution to lighting up Africa, participates in different regional initiatives at addressing the problem in Africa and has been providing technical advisory services to member States in the form of the development of energy policies and the articulation of policy options in improving the performance of the energy sector. The present report by the ECA Subregional Office for Southern Africa looks at future scenarios of how Southern Africa will meet its growing energy needs.

The present report is the modest contribution of ECA to unlocking the future of Africa in the energy realm. The analysis and key recommendations of the report provide important insights and will assist policymakers, political leaders and technical experts to make strategic policy choices in developing the energy sector, specifically, the provision of electricity in Southern Africa. Moreover, the present report is commended to the general reader interested in Africa's concerted efforts to create a new future for itself and a better tomorrow for the continent's coming generations.

Said Adejumobi
Director of the Subregional Office for Southern Africa
Economic Commission for Africa

Executive summary

The Southern African Development Community (SADC) region is endowed with natural resources such as coal, water, biomass, solar and wind, used for energy. Unfortunately, the energy sector is plagued with challenges such as low access; power shortages; constrained and ageing infrastructure; lack of funding for infrastructure; low tariffs, poor project preparation; weak energy policy and regulatory instruments; overreliance on coal, which runs contrary to global efforts to curb greenhouse gas emissions; reliance on hydropower, which is highly susceptible to climate change, as demonstrated by the current drought; revenue collection, affordability and policy and regulatory shortcomings that impede the development of renewable energy.

The power crisis, which began in 2008, jolted the region into action, leading to the introduction of new policies and planning frameworks and development of new generation and transmission projects. For the first time, the region is giving serious thought to energy efficiency and other activities. The impact of the crisis was severe on economies, with huge losses in the gross domestic product (GDP), company closures, job losses, lack of investment, stemming from supply insecurity, delays in tackling the problem of energy access and credit rating downgrades. The rising cost of electricity following the introduction of new programmes and the procurement of expensive emergency power, mainly from diesel generation, will inhibit economic growth in the short-to-medium term.

The crisis has, however, brought the region closer, as all the countries are working together to take advantage of the benefits of pool planning and joint development of projects under the coordination of SADC institutions such as the Regional Electricity Regulators Association (RERA) and the Southern African Power Pool (SAPP). The newly formed SADC Centre for Renewable Energy and Energy Efficiency is expected to act as a regional platform for promoting the region's renewable energy and energy efficiency market, which has seen minimal involvement of energy sector private players.

The absence of enabling policies and regulations has impeded the entry of the private sector into the SADC energy sector. The South Africa renewable energy independent power producer procurement programme has shown that with the right policy framework, coordinated planning and government commitment, the private sector and capital could be drawn into the energy sector.

The following recommendations are intended for the member States, the SADC and Common Market for Eastern and Southern Africa (COMESA) secretariats, and SAPP and RERA.

Policy and regulatory issues

Member States should:

- Adopt a harmonized and competitive policy and legal and regulatory frameworks that will attract private investors to the power sector, including new and renewable energy technologies
- Continue reforming the utilities sector to increase efficiency, which, in some cases, may involve unbundling, to make it attractive to investors, and level the playing field for independent power producers (IPPs) and public private partnerships (PPPs)
- Enhance the capacity of ministries responsible for energy to develop or update energy master plans and integrated resource plans
- Expedite the creation of independent regulators where they do not exist
- Clarify and define government, private sector and regulator roles and responsibilities for long-term plans, implementation, financing and supervision
- Introduce cost-reflective tariffs and develop mechanisms to cushion the disadvantaged from the high tariffs
- Conduct due diligence before entering into a contract with multinational corporations
- Develop bankable energy project proposals
- Formulate evidence-based plans on energy demand and supply, backed by reliable and timely data to facilitate decision-making by relevant stakeholders
- Adapt best practices from other countries in order to shape responses to similar energy crises
- Encourage the media to be proactive in projecting opportunities available in the energy sector
- Use fiscal and other incentives to attract IPPs into the energy sector
- Develop one-stop shop service mechanisms to facilitate agreements, land acquisition, permits, licences, water access and other services
- Strengthen capacity for negotiating energy contracts and transactions
- Support research and development, and academic and training institutions to contribute in the design and implementation of workable energy policies and regulations
- Incorporate regional energy development plans into their domestic frameworks
- Develop policies, plans and road maps on energy, including rural electrification
- Establish observatories (websites) with validated data (on energy) to provide up to date information

Energy generation, transmission and distribution

Member States should:

- Invest in quantifying and delineating renewable energy resources within their national boundaries
- Encourage utilities to invest in new technologies to reduce generation, transmission and distribution losses
- Facilitate regional transfer of technology
- Address the challenge of non-payment of electricity bills, particularly by public sector institutions, as this adversely affects the performance of utilities
- Develop new regional transmission infrastructure to facilitate connection of new industrial loads
- Diversify energy sources to address both short- and long-term energy requirements
- Promote mini-grids and virtual power in rural and isolated areas

Demand management

Member States should:

- Develop and implement energy efficiency policies
- Invest in advocacy on energy efficiency and conduct energy audits
- Develop institutional support frameworks for energy efficiency
- Implement participatory energy efficiency action plans and define the targets, indicators and key actors
- Accelerate rural electrification programmes through subsidies to households to achieve universal access
- Raise awareness on renewable energy sources and set renewable energy access targets

The SADC and COMESA secretariats should:

- Empower RERA to become an authority, enabling it to effectively address the cross-border regulatory challenges
- Make use of the SAPP project preparation facility to prepare and package renewable energy projects for incorporation into the Programme for Infrastructure Development in Africa (PIDA) priority projects list for possible financing
- Develop regional integrated resource plans for the regional power market
- Leverage regional energy cooperation to generate an optimal energy mix

- Ensure that Angola, Malawi and the United Republic of Tanzania are connected to the SAPP grid
- Formulate the SADC regional energy and renewable energy policy
- Enhance regional institutions and structures such as the parliamentary forum, to monitor the adherence of national plans to regional plans
- Collaborate more on energy issues and share experiences on policies and the development of energy projects
- Monitor the operations of IPPs or contractors in the energy sector

The Southern African Power Pool should:

- Encourage member States to make use of the project preparation facility to package projects for submission to potential investors
- Enhance the efficiency of the energy market through an aggregate generation regional strategy, using an average regional price

I. Introduction and background

The paper is divided into four sections, starting with the "Introduction and background", which analyses the socioeconomic environment in all SADC countries, and ending with an assessment of the institutional structure within which the energy sector in the region operates in. From section II onwards, the focus is on the member States of SADC since they are interconnected or are in the process getting interconnected through electric infrastructure making the analysis much more comprehensible. The paper focuses on electric energy, a prominent sector for all the national economies.

Section II, "Understanding the energy crisis in Southern Africa", unpacks the crisis by analysing its impact and the measures undertaken collectively and individually to manage it. The section also assesses how the private sector attempts to address the crisis, and concludes by analysing electricity tariffs, how they contributed to the crisis, and the impact of cost reflectivity on the crisis.

Section III, "Planning for the future", scrutinizes and presents the different measures, instruments and features that create a robust, efficient and responsive power infrastructure that not only addresses the current crisis and shortcomings of the current infrastructure, but offers a dynamic system to help meet the SADC development agenda and the African Union Agenda 2063. The section presents an overview of best practices in policy and governance frameworks, the role of sustainable energy technologies, cross-cutting issues, such as gender and climate change and the role of international cooperation in technology transfer. It concludes by assessing the financial instruments that can help bring in the infrastructure needed.

Section IV provides the conclusions and recommendations to member countries, the SADC secretariat and its agencies.

It is extremely difficult to obtain access to data from energy institutions in Zimbabwe. While some countries had no energy data at all, others had incomplete data.

A. Historical narratives, situational analysis and development trends

The SADC is a 15-member[1] economic bloc, formed in 1992, with the key goal to achieve "development, peace and security, and economic growth, to alleviate poverty, enhance the standard and quality of life of its peoples and support the socially disadvantaged through regional integration[2]. Regional integration is crucial to achieving these objectives, by leveraging the region's diversified natural environment, natural and acquired resources and human capital. The countries are interconnected by road, rail, air and power infrastructure. Botswana,

[1] Angola, Botswana, the Democratic Republic of the Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, the United Republic of Tanzania, Zambia and Zimbabwe are the mainland countries, while Madagascar, Mauritius and Seychelles are the island States.
[2] Available from http://www.sadc.int/about-sadc/overview/sadc-objectiv/.

Lesotho, Malawi, Swaziland, Zambia and Zimbabwe are landlocked, and import their petroleum products by rail and road, and in the case of Zimbabwe, additionally by pipeline from Mozambique.

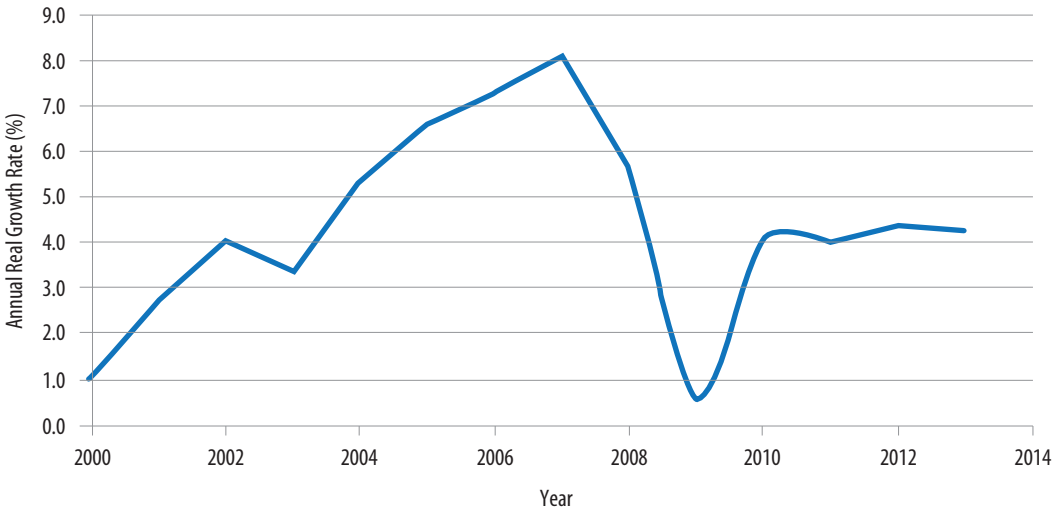
SADC is a successor to the Southern African Development Coordination Conference, established in 1980. As at 2013, the population of the bloc stood at 292 million. The population grew by approximately 2 per cent per annum from 2001 to 2013 (SADC, 2013).

The region has experienced rapid economic growth, as shown in figure 1, which illustrates the gross domestic product (GDP) at market prices, expressed as annual real growth rates between 2000 and 2013. The steady growth rate was sharply interrupted in 2009 as a result of the global recession at the time, which hit the commodities market hard. The power crunch dawned in 2008 with massive electricity load shedding in South Africa and the rest of the region. The approximate yearly average GDP growth was 5.2 per cent.

There are huge differences in economic development among the countries in SADC. For instance, although GDP at market prices in 2000 was $256,577 million, South Africa, with $136,450 million, accounted for more than half that figure. The GDP more than doubled to $686,212 million in 2013 and the disparity still remained the same. By comparison, the GDP of Lesotho, for instance, at market prices, was $776 million in 2000, increasing to $2,426 million in 2013, albeit low in absolute terms, compared to the largest economy.

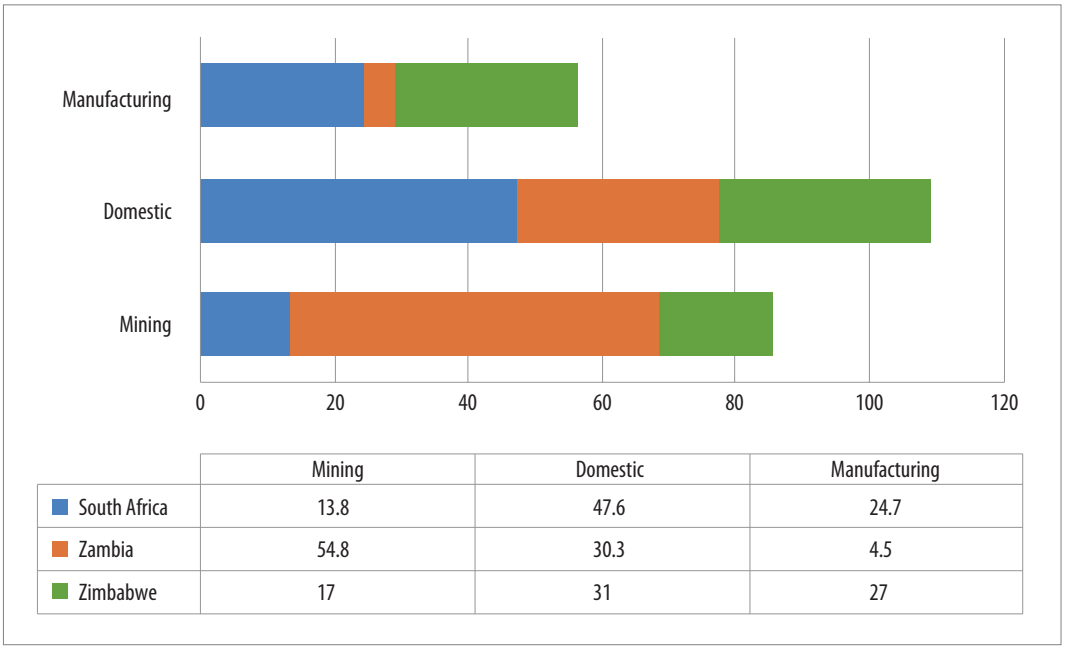
The domestic sector consumes more electricity than the manufacturing sector in several countries. Figure 2 shows the 2013 share of electricity consumption by the main economic sectors in selected countries. In Zambia, mining is the biggest consumer, while manufacturing is a mere 4.5 per cent, reflecting a small manufacturing and industrial base.

Figure 1: GDP at market prices, annual real growth in SADC



Source: Derived from SADC Statistics Yearbook 2013.

Figure 2: Share of electricity consumption by sector for selected countries



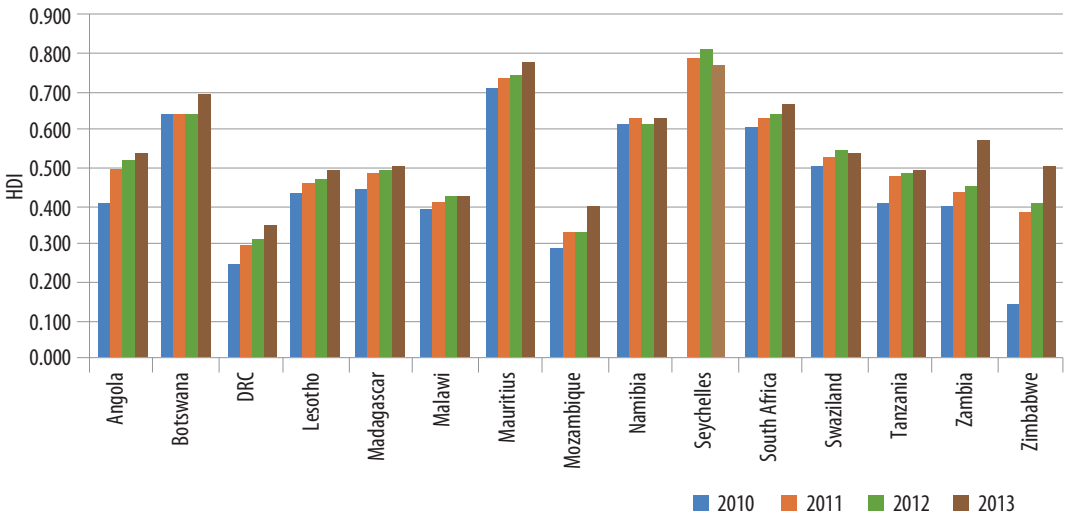
	Mining	Domestic	Manufacturing
South Africa	13.8	47.6	24.7
Zambia	54.8	30.3	4.5
Zimbabwe	17	31	27

Source: Author's compilation.

Despite a positive economic performance and a relatively stable political environment, the region faces high levels of poverty, inequality and unemployment, and high HIV/AIDS prevalence rates. Figure 3 illustrates the human development index (HDI), a composite statistic of life expectancy, education, and income per capita indicators for all SADC countries from 2010 to 2013.

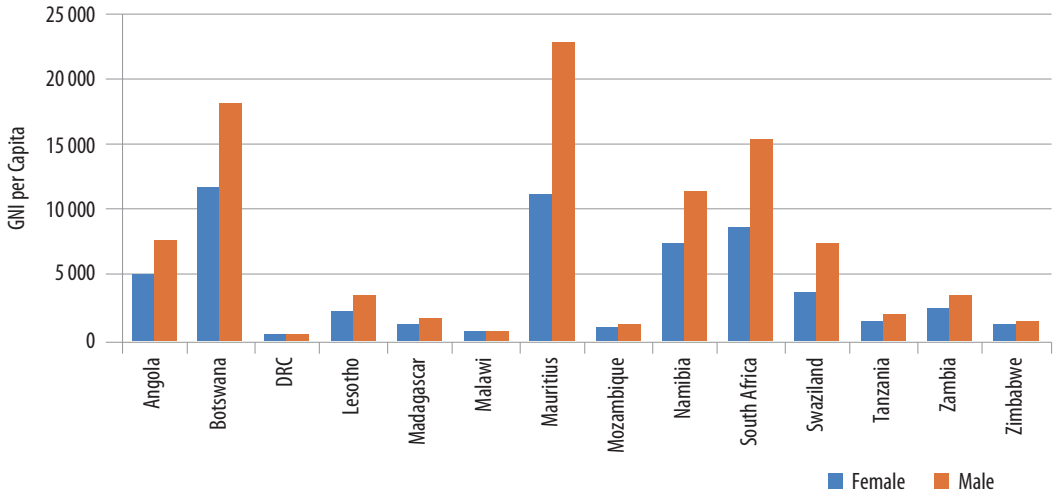
Only Botswana, Mauritius, Namibia, Seychelles and South Africa showed consistent HDI values above 0.5 during the accounting period.

Figure 3: Human Development Index in SADC countries



Source: Derived from SADC Statistics Yearbook 2013.

Figure 4: Estimated GNI per capita



Source: Derived from SADC Statistics Yearbook 2013.
(data for Seychelles are missing).

Although SADC has acceded to several international conventions on gender equality, including the Declaration on Gender and Development, which has been in force since 1997, there is still a yawning gap between males and females in terms of the gross national income (GNI) per capita[3] (see Figure 4). On a positive note, most countries have made strides in tackling gender inequality, as witnessed by the representation at the political level and in some sectors of the economy.

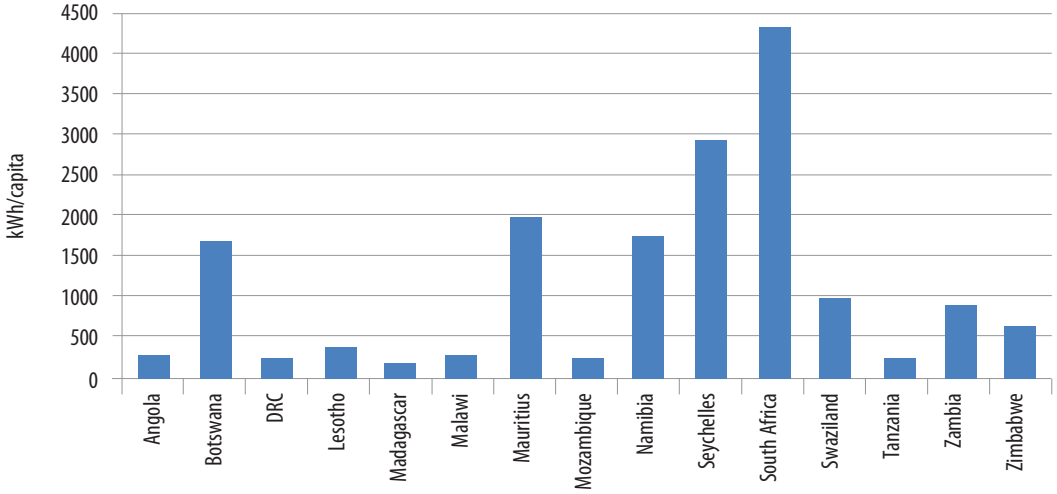
Energy consumption per capita varies across the countries in the region, with South Africa leading the way followed by Seychelles and Mauritius. Angola, the Democratic Republic of the Congo, Madagascar, Mozambique and the United Republic of Tanzania have values below 200 kWh per capita. Figure 5 illustrates electricity consumption per capita in all SADC member countries for the year 2013.

B. Institutional architecture

All SADC member States are part of the African Union, the continental body, while most of its members belong to the Common Market for Eastern and Southern Africa (COMESA) headquartered in Lusaka. SADC member States: Botswana, Lesotho, Namibia, South Africa and Swaziland, also belong to the Southern African Customs Union (SACU). There is a working relationship between SADC, the African Union and the New Partnership for Africa's Development (NEPAD). NEPAD was formed as a programme of action to support Africa's development, now anchored on Agenda 2063. It is currently implementing the Programme for Infrastructure Development in Africa (PIDA), a framework for tackling the infrastructure deficit in Africa, through coordinated regional and interregional development of large-scale energy, water, transport and information and communication technology projects.

[3] Gross national income (GNI) per capita based on purchasing power parity is the GNI converted to international dollars, using purchasing power parity rates.

Figure 5: Electricity consumption per capita in 2013



Source: Author's compilation.

Box 1: Agenda 2063

Agenda 2063 is a strategic framework for the socioeconomic transformation of the continent over the next 50 years. It builds on and seeks to accelerate the implementation of past and existing continental initiatives for growth and sustainable development.

For more about Agenda 2063, see: http://www.au.int/en/agenda2063/about.

The Regional Indicative Strategic Development Plan and the Strategic Indicative Plan for the Organ on Defence, Politics and Security remain the guiding frameworks for SADC regional integration, providing its member States, the SADC secretariat and other SADC institutions with consistent and comprehensive programmes of long-term economic and social policies. For the energy sector, strategic plans have been put in place, starting with the Protocol on Energy (1996), the SADC Energy Cooperation Policy and Strategy (1996), the SADC Energy Action Plan (1997), the SADC Energy Activity Plan (2000), and the Regional Infrastructure Development Master Plan and its Energy Sector Plan (2012). These strategic frameworks and plans cover the entire energy sector and its subsectors of wood fuel, petroleum and natural gas, electricity, goal, renewable energy, and energy efficiency and conservation. Their implementation is coordinated by the SADC secretariat based in Botswana, the Southern African Power Pool (SAPP) and the Regional Electricity Regulators Association (RERA).

SAPP, which is based in Harare, was established in 1996, primarily to provide reliable and economical power supply to consumers in SAPP member countries[4], as part of the rational utilization of natural resources to minimize the effect on the environment. The SAPP comprises national utilities, one independent power producer and one

[4] The SAPP utilities and their countries are: ENE (Angola), BPC (Botswana), SNEL (Democratic Republic of the Congo), LEC (Lesotho), ESCOM (Malawi), EDM & HCB (Mozambique), NamPower (Namibia), Eskom (South Africa), SEC (Swaziland), TANESCO (United Republic of Tanzania), ZESCO (Zambia) and ZESA (Zimbabwe).

independent transmission company, both from Zambia, in continental SADC. The Eastern Africa Power Pool (EAPP) is the SAPP counterpart in COMESA.

RERA was established in 2002 in Windhoek, as a formal association of electricity regulators, with a mission to facilitate the harmonization of regulatory policies, legislation, standards and practices and serve as a platform for effective cooperation among energy regulators within the SADC region. Through its energy programme, COMESA is also establishing the Regional Association of Energy Regulators for Eastern and Southern Africa, which is an umbrella body of all energy regulators in COMESA member States.[5]

SADC is currently setting up the Southern African Centre for Renewable Energy and Energy Efficiency, to be hosted in Namibia, as a regional platform to promote renewable energy and energy efficiency in the region.

[5] Angola, Burundi, the Comoros; the Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius; Mozambique, Rwanda, Seychelles, the Sudan, Swaziland, Uganda, Zambia and Zimbabwe.

II. Understanding the energy crisis in Southern Africa

A. Current crisis

1. Background

The current energy sector crisis in mainland Southern Africa is better described in the context of the structure of energy systems across the value chain in the various countries. Angola is the only oil producer in the region. Angola and the United Republic of Tanzania produce natural gas, while South Africa produces gas and liquid fuel from coal, and has limited offshore gas reserves. Recent finds of natural gas in Mozambique will make the country a competitive player. Most of the region's countries are net importers of oil and gas, thereby compromising their energy security.

The region, however, has huge coal and hydropower resources. Table 1 shows the electricity generation mix of the national utilities and IPPs in SAPP.

Table 1: SAPP generation mix

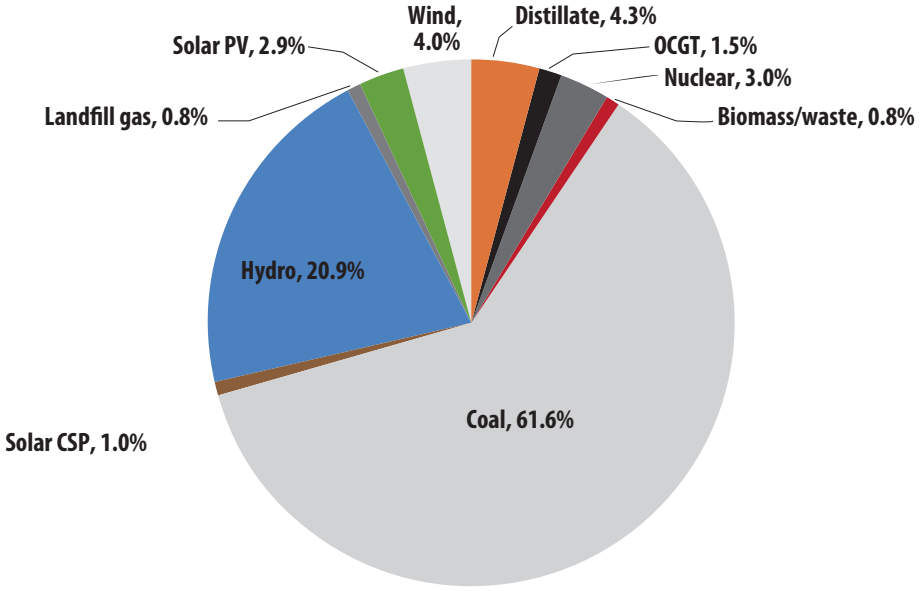
Technology	SAPP utilities												
	ENE	BPC	SNEL	LEC	ESCOM	EDM & HCB	Nam Power + IPPs	Eskom & IPPs	SEC & IPPs	TANESCO	ZESCO & IPPs	ZESA & IPPs	Total	
Hydro	1 528		2 442	74	351	2 573	348	2 000		61	717	2 156	756	13 006
Coal	492	732					132	35 721		10			1 295	38 382
Nuclear								1 860						1 860
OCGT	190	160			1						585			936
Diesel						151	21	2 409			78	50		2 709
Wind								2 492						2 492
Solar CSP								600						600
Solar PV							5	1 821						1 826
Landfill gas								18						18
Biomass								42		89			96	227
Total	2 210	892	2 442	74	352	2 724	506	46 963		160	1 380	2 206	2 147	62 056

Source: Adapted from SAPP 2015 Annual Report and other sources.

The electricity mix in SAPP is still dominated by coal, at 62 per cent or 38,382 MW, followed by hydro at 21 per cent or 13,006 MW. Renewable energy, excluding hydro, represents less than 10 per cent and the bulk of it is installed in South Africa. Figure 6 illustrates the percentage generation mix in SAPP.

South Africa dominates the generation of electricity in the region. Nearly all the power generated is for domestic consumption. In all countries, generation is largely carried out by State-owned utilities, focusing on large hydro and coal while IPPs, which have recently joined the sector, are active in renewable power generation. Electricity production is largely coal based, with South Africa again dominating with up to 75 per cent of the fossil resource in its generation mix. The Democratic Republic of the Congo, Lesotho and Zambia are almost 100 per cent hydro. Table 2 provides information on various indicators in 2014/15, comparing the performance of different utilities and countries from installed generation capacity, maximum (although suppressed) demand, units sent out, electric energy imported, transmission losses, average tariffs and electricity access rates. All the countries trade with each other in electricity, except for Angola, Malawi and the United Republic of Tanzania, which are not yet interconnected to the SAPP grid. Transmission system losses are relatively high for Angola, the Democratic Republic of the Congo, Lesotho and Malawi. Although not shown in the table, technical and non-technical losses are very high, in the range of 20 per cent, at the distribution level.

Figure 6: **SAPP generation mix in 2015**



Source: Adapted from SAPP 2015 Annual Report and other sources.

Table 2: National electricity general information in 2014/15

	Installed capacity (MW)	Maximum demand (MW)	Generation sent out (GWh)	Net imports (GWh)	Transmission system losses (%)	Average tariff (USc/kWh)	Electricity access rate (%)
Angola	2 210	1 599	5 613	-	10	6	30
Botswana	893	610	372	1 207	4	7	66
DRC	2 442	1 381	8 185	95	10	4.8	9
Lesotho	74	150	486	175	11	5.9	28
Malawi	352	326	1 809	-	9	6.8	9
Mozambique	2 724	830	390	1 004	6	7.5	39
Namibia	506	629	1 305	1 337	3	8.6	34
South Africa	47 163	36 170	237 430	542	3	8.7	85
Swaziland	160	221	288	889	6	11.5	50
Tanzania	1 380	935	3 034	-	6	8.2	34
Zambia	2 249	1 987	11 381	165	5	5.7	26
Zimbabwe	2 147	1 671	6 951	979	4	9.8	40

Source: Adapted from SAPP 2015 Annual Report and from various sources.

Angola will be connected to the SAPP grid through the Democratic Republic of the Congo and Namibia, while Malawi will be connected through Mozambique, and the United Republic of Tanzania through Zambia (see Figure 7). Work is already under way to connect the United Republic of Tanzania to Kenya, thus completing the interconnection between EAPP and SAPP.

2. Shortages of bulk power, water and coal

Bulk supply challenges: The 2001 SAPP pool plan had already predicted that the region would start experiencing electricity shortages by 2007 if no investment was made in new generation and transmission interconnection projects. The shortages would stem from economic growth and increased connections in rural areas and the subsequent economic spinoffs.

True to that prediction, in January 2008, Eskom, the South African State-owned utility, introduced load shedding and rolling blackouts. Those power shortages stemmed from the long-predicted shortfall and the subsequent generic annual events that normally occurred between December and March:

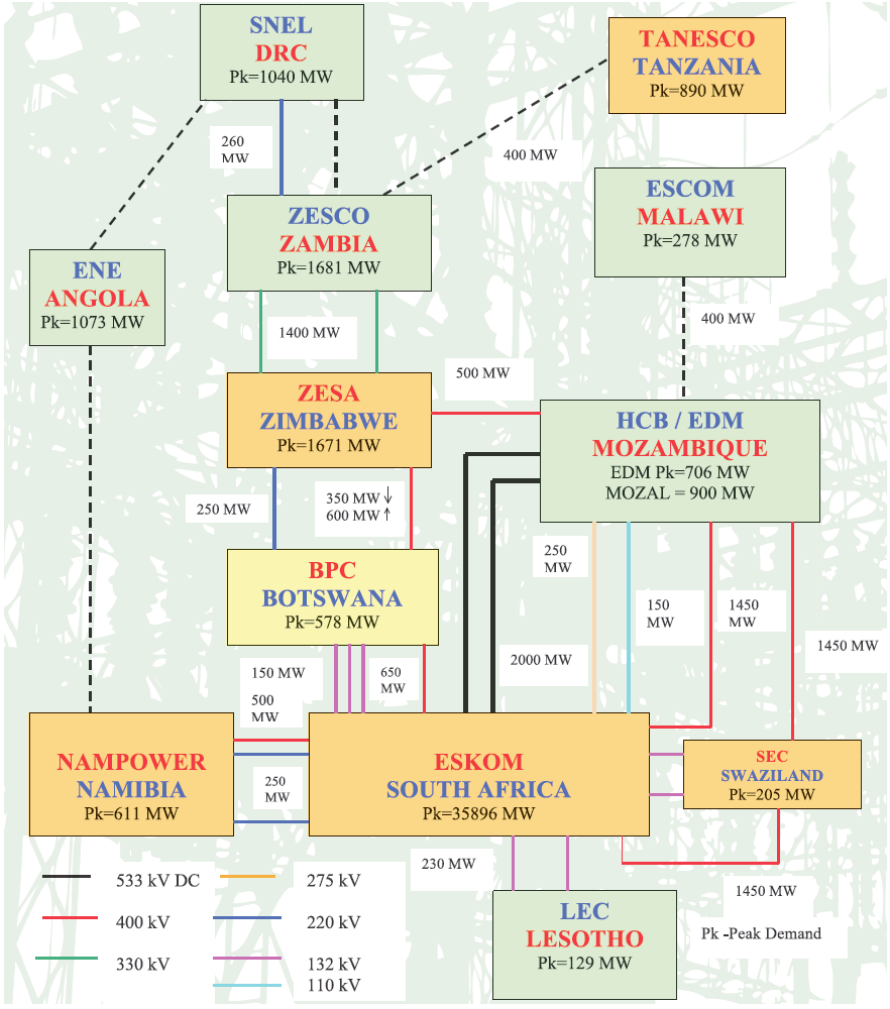
(a) The festive season, characterized by low electricity demand;

(b) It is a season of low electricity demand; hence utilities normally schedule generation, transmission and ancillary equipment maintenance;

(c) Since it is the rainy season in Southern Africa, system disturbances and outages caused by lightning, falling trees, etc. are generally high.

In South Africa, December 2007 and January 2008 were associated with heavy rains that flooded and muddied the coalmines and silos, rendering it difficult to handle the coal for the power plants. The power supply challenges were exacerbated by growth in

Figure 7: SAPP grid



Source: SAPP 2015 Annual Report.

electricity demand, ageing equipment, coal and water shortages and glitches with the new-build projects.

Coal supply challenges: Unlike South Africa, Botswana, Mozambique, South Africa, Swaziland, Zambia and Zimbabwe have abundant coal deposits that are yet to be fully tapped. Moreover, there are supply challenges with the developed fields. Supply contracts and transportation infrastructure continue to affect the mine-to-power plant coal supply in South Africa. Similarly, Zimbabwe's main coal supplier, Hwange Colliery, is failing to deliver adequate supplies to the country's four coal power plants.

Water challenges: Southern Africa is a water-stressed region. This has affected the operation and future development of thermal power plants. About 21 per cent of the regional power supply is from hydro. Climate change-induced drought in recent years has affected the water level of major rivers such as the Zambezi, Kunene and Vaal, to the extent that most of the hydro power plants have had to be ramped down to as low as 25 per cent of rated capacity. There are indications that Kariba power station (both the north and south banks) may be shut down in the second half of 2016 for lack of water.

Grid extension: The general access rate to electricity across the region is below 25 per cent. Efforts are being made to extend the grid to rural areas, to improve livelihoods and ensure equity. This has increased electricity demand somewhat. In the past five years, electricity access rates in countries such as Mozambique, Swaziland and the United Republic of Tanzania have almost doubled. In South Africa, 11 million households now have electricity, twice as many as in 1994, bringing the current national electricity access rate to 85 per cent.

Economic growth: SADC, as a bloc, has been experiencing a bullish economy, with annual GDP growth rates averaging 4 per cent in the past five years. Countries such as Angola, the Democratic Republic of the Congo, Mozambique, the United Republic of Tanzania and Zambia have all registered growth rates above 7 per cent at one time or another, against commodity price rises in international markets. New mining developments include Namibia, ($2.5 billion Husab Uranium Mine, B2Gold Otjikoto Mine), Democratic Republic of the Congo (Kalimbi Tin Mine), Mozambique (Moatize and Benga coal mines), Zambia (recommissioning of Maamba Coal Mine with the objective to also build a 600 MW coal power plant), Botswana (Lucara and Gem diamond mines), etc.

New mining developments cause step loads that, if not adequately planned, bring constraints to the grid, resulting in the need for significant system upgrades. Despite the supply constraints, investment in new generation and transmission has not matched the growing demand. The regional power shortages have forced utility companies to operate at reduced reserve margins, with the situation expected to continue until 2020 when generation capacity shortfalls should come to an end[6]. The large Medupi (4,800 MW), Kusile (4,800 MW) coal power plants and the Ingula (1,332 MW) pumped storage plant in South Africa and other new generation projects in other countries are expected to be in operation by that time. The projects are explained in section C. below, under "Power projects".

Ageing equipment: Prior to the advent of the crisis in 2008, the last power plant commissioned in the region was the Majuba coal power plant in 2001. Most of the power plants had been mothballed due to excess supply experienced in the 1990s and early 2000. The bulk of the baseload generation fleet across the region is almost 40 years old. Owing to supply constraints, regular maintenance schedules have not been adhered to, resulting in further plant outages. A case in point is the Hwange thermal power station in Zimbabwe, which was commissioned in 1987. Despite extensive refurbishments through a power deal with the Namibia Power Corporation (NamPower), the station continues to be beleaguered with breakdowns. The weakening dam wall integrity from the ageing of the Kariba power station built in 1957 is also worth mentioning, given its significance for Zambia and Zimbabwe, especially, and the neighbouring countries it exports electricity to.

The regional transmission network is equally challenged and urgent investment is required to create new interconnectors and strengthen internal transmission networks. For instance, the central transmission corridor that links the north and south networks of the SAPP grid in Zimbabwe has been a major bottleneck to power trading.

[6] SAPP internal documents.

Box 2: NamPower - ZESA deal

In 2008, NamPower entered into an agreement with ZESA to finance the refurbishment of parts of the latter's Hwange coal-fired power plant at a cost of $40 million in exchange for 150 MW of firm power. The five-year contract was renewed in 2013 for further refurbishments in exchange for 80 MW firm supply. Despite these refurbishment works, Hwange power station is still not performing reliably.

These constraints can be seen on the SAPP day-ahead market. When it was introduced from December 2009 to March 2013, there was a total of 230,131 MWh of matched sale and buy bids, but it only managed to transmit 62,154 MWh (27 per cent) (IRENA, 2014). Most utilities cannot afford to purchase the spare parts needed for repairs and maintenance for the current transmission infrastructure. Concessionary finance to carry out extensive refurbishment is also not available.

3. Technical and management glitches

Major new-build projects such as the 600 MW Morupule B coal-fired power station in Botswana and Medupi and Kusile in South Africa have been beset with problems from the beginning, thus delaying their coming into operation. In 2012, Botswana commissioned the Morupule B power station after several synchronization failures. The plant has since suffered constant technical hitches, and failed to reach 600 MW on the bus bars because of boiler defects. The Government is now considering selling the plant to the Chinese contractors who built the power station, and then entering into a power purchase agreement.

The South Africa Medupi power station has faced delays in synchronizing its first unit. This project has also experienced debilitating labour unrests, poor workmanship, and suboptimal planning and management of contractors. These failures have resulted in substantial cost overruns and delays. The utilities have also lost experienced staff, who have retired or moved abroad to greener pastures.

4. Dearth of planning, operation and management of the sector

The electricity supply industry had, until recently, been characterized by vertically integrated utilities that are responsible for power generation, transmission, distribution and planning. The situation still prevails in most countries in the region where the utility services have their own system master plans, which are then approved and adopted as national plans by the Government. The system master plans are not subjected to public scrutiny. The technical capacity to develop master plans lies within the utilities, with ministries mostly having one or two planners. Even at the utility level, only Eskom, NamPower, the Tanzania Electricity Supply Company Ltd. (TANESCO), the Zimbabwe Electricity Supply Authority (ZESA) and ZESCO, the Zambian electricity supply utility, have units or divisions dedicated to system planning.

Integrated resource planning (IRP) is a new transparent and comprehensive energy planning process that is being widely adopted by the energy sector. In SADC, only Malawi, Namibia and South Africa, have developed their national electricity integrated resource plans. Malawi developed its IRP process in 2011 (with a planning period up

Box 3: Integrated resource planning

IRP is a transparent and participatory planning process that considers a full range of feasible supply-side and demand-side options to provide energy services at minimum cost, including environmental and social costs. The options are assessed against a common set of planning objectives and criteria (Swisher J. N. et al, 1997).

to 2030) under the Millennium Challenge Corporation compact agreement, although the Government did not adopt this plan, as it had felt that the consultations had not been adequate. The South African IRP process, covering 2010-2030, was promulgated in March 2011 and the revised plan of 2013 is yet to be adopted by the Government. The Namibia 2012 plan, coordinated by the regulator, was never adopted by the Government. The plan is now under review. It is a cause for concern that, despite efforts and the resources put into developing IRP processes, governments still fail fully to embrace these processes.

Since 2000, SAPP has introduced two pool plans (2001 and 2009), which, were never formally adopted, owing to differences among members who felt that since the priority projects in the 2001 plan were concentrated and located in a few countries, they could therefore not be accepted as being a priority for the whole region. South Africa displayed the tradition of poor and improper planning when, in the 1990s, the Government turned down Eskom's request for a new-build programme and introduced private players. The country has since learned its lessons and is now at the forefront of integrated strategic planning, as shown by the 2010 IRP, the attraction of private power producers through the Department of Energy's IPP Office and, recently, the renewable energy development zones.

B. Impact of the crisis

1. Load shedding and tariff hikes

The power crisis has adversely affected the economies of the region. Severe load shedding resulted in reduced production in all sectors of the economy requiring electric power. Businesses then resorted to generator sets, which in turn raised the cost of doing business. In South Africa, stage 1 load shedding, i.e. 10 hours of blackouts per day for 20 days a month was estimated to have cost the economy R20 billion per month in 2015[7].

In order to avert the crisis, utilities engaged in expensive generation options, mainly open-cycle gas and diesel. Mothballed plants were brought into operation, while new diesel power plants were built. Eskom brought in a fleet of 14 open-cycle gas plants, totalling 2,072 MW, and another six were procured via the Department of Energy IPP office. NamPower built the 22.1 MW Anixas diesel plants, inaugurated in 2011. With an installed capacity of 283 MW against a demand of 344 MW, Malawi has had to resort to load shedding and power rationing. This led to the World Bank ranking the investment environment of Malawi as not being conducive to doing business because of electricity constraints. The severe drought that afflicted the United Republic of Tanzania between

[7] http://businesstech.co.za/news/general/83429/eskom-blackouts-cost-south-africa-r80-billion-per-month/. Accessed on 22 February 2016. The exchange rate in March 2015 was approximately

2006 and 2011 induced a power crisis that has forced TANESCO to institute rolling blackouts of up to 12 hours, causing about 50 factories to close down and lay off their employees (CDNK, 2012). In 2011, TANESCO was compelled to contract emergency power producers, resulting in increased utility spending, at times, more than two times the company's daily earnings.[8]

Countries that traditionally relied on South Africa for bulk supply: Botswana, Lesotho, Namibia and Swaziland, were severely affected. New supply contracts were adjusted from firm to non-firm agreements meaning that supply interruptions or reductions could happen at short notice. For instance, between April and July 2008, Lesotho Electricity Corporation (LEC) carried out intense load shedding exercises without any notice on the times of supply interruptions and their expected duration, on the basis that imports had been curtailed by Eskom. In Zimbabwe, load shedding has been a permanent feature since 2006.

2. Impact of emergency power on selected utilities

In 2015, Eskom submitted an application to the regulator, Nersa, to recover R8 billion in costs associated with the utility's peaking open-cycle gas turbine plants and R2.4 billion for primary energy costs[9] as provided for in the multi-year price determination (MYPD) scheme. The MYPD scheme is designed to strike a balance between the possible short-term negative effects of increasing electricity prices, the sustainability of the industry and the long-term economic and social needs of South Africa. The building blocks to the requirements needs are the sum of its own (i.e. Eskom) needs and the support to independent power producers (IPPs).

For the period 2012/13-2017/18, the application for revenue indicated a "total price increase of 16 per cent (year-over-year)" made up of an "average price increase for Eskom's revenue application (own needs) at 13 per cent" and "support for the entry of IPPs at 3 per cent". The 16 percent year-on-year price increase translates to 67 cents/kWh (or R0.67/kWh) from the current average of 61 cents/kWh in 2012/13 to an estimated average price level of 128 cents/kWh in 2017/18, more than doubling the current price (Eskom, 2012). It must be noted that this increase is a result of massive new generation of 3,725 MW of renewable energy capacity from IPPs, a 1,020 MW gas peaking plant and partly 8,000 MW of coal.

The tariff hikes by South Africa affected other interconnected countries. In Namibia, the Electricity Control Board (ECB), the regulator, granted NamPower a tariff increase of 13.22 per cent for 2014/15, pushing the bulk tariff to N$1.17/kWh,[10] citing the rising costs of operating expensive thermal peaking plants and expensive non-firm imports. The utility had proposed an 18 per cent per year tariff hike over a five-year period. This tariff increase is additional to the N$170 million pumped into NamPower by the Government towards subsidizing the operations of the thermal power plants.

[8] http://www.reuters.com/article/tanzania-energy-idUSL6N0BWE2F20130304. Accessed on 4 March 2016.
[9] http://www.timeslive.co.za/local/2016/01/18/Nersa-starts-tariff-hike-hearings-Eskom-wants-to-recover-R22.8-billion. Accessed on 23 February 2016.
[10] ECB. 2014. 14 May 2014. The Namibian dollar is pegged to the rand, at parity.

The Swaziland Energy Regulatory Authority, (SERA), that country's regulator, recently announced a multi-year electricity price increase of 11.7 per cent. The country already has one of the highest electricity prices in the region. In Lesotho, following a request by LEC for an annual tariff increase of 26.8 per cent, the Lesotho Electricity and Water Authority, the regulator, allowed for a 12 per cent tariff hike to cover the costs of bulk purchases from Eskom, the Mozambican utility EDM and its own Muela hydropower plant. Tariff adjustments in Malawi, which is not connected to the regional grid, are generally driven by currency devaluation and inflation. ZESA, in Zimbabwe, is requesting a 45 per cent tariff increase to cover the cost of newly built diesel-fired plants. It is unfortunate that SADC countries continue to ignore their ubiquitous renewable energy resources, whose costs continue to fall against costly imported diesel-generated power.

Most countries apply the "cost plus rate-of-return methodology" in terms of tariff regulation, hence the costs associated with operations and emergency power plants are always passed on to the consumer.

3. Social and economic impact

The power crisis has had serious implications for the economies of the region, which are rather vulnerable and lack diversity. Figure 1, on GDP at market prices and annual real growth in SADC, shows that the annual growth took a heavy knock in 2009 from around 8 per cent per annum to an average 4 per cent per annum ever since. One of the strategic goals of the SADC industrialization strategy and road map, 2015-2063 is to lift the regional growth rate of real GDP to a minimum of 7 per cent a year. It is important, therefore, to adopt resource efficiency around production processes, among other pillars. The industrialization strategy and road map are hampered by factors such as inadequate and poor infrastructure (including energy).

Randomly looking at the different economies where information is readily available across the region, it is evident that the power crisis has hurt their economic performance. Zambia is among the top 10 global copper producers. There is a linear relationship between copper output and real GDP growth in the country (IMF, 2015). The electricity shortages and recent weaker copper prices have put pressure on the country's mining industry, threatening output, jobs and economic growth. The power problems and copper price slide have driven the kwacha to a record low.[11]

The annual GDP growth rate of South Africa declined from 3.2 per cent in 2011 to 1.5 per cent in 2014, partly owing to the power crises. On 6 November 2014, Moody's investors service downgraded the Government's credit rating to Baa2, partly because of the continuing energy shortages, poor medium-term growth prospects stemming from structural weaknesses and rising interest rates.[12] Prior downgrades had been effected by Standard and Poor's (BBB on 13 June 2014) and by Fitch (BBB on 10 January 2013. The consequence of these downgrades is the lack of attractiveness of a country to investors and a higher cost of capital.

[11] http://www.reuters.com/article/zambia-mining-idUSL5N11D2J320150908. Accessed on 23 February 2016.
[12] http://www.stanlib.com/EconomicFocus/Documents/Domestic/SAcreditrating112014.pdf. Accessed on 23 February 2016.

Box 4: The case of Sable Chemical Industries

Sable Chemical Industries, a fertilizer manufacturing firm in Zimbabwe, drawing 70 MW from the grid for its electrolysis plant, was forced to shut down in 2015, following tariff increases, sending 200 workers into the street. The ripple effect is being felt upstream and downstream in the host town of Kwekwe and beyond.

In Zimbabwe, the state of the manufacturing sector survey conducted by the Confederation of Zimbabwe Industries (CZI, 2015) cites power cuts and shortages as the most problematic infrastructure factors affecting the business environment and ultimately the level of competitiveness.

Load shedding and tariff hikes have, undoubtedly, caused company closures and loss of jobs and incomes. This has adversely affected livelihoods. Load shedding has resulted in increased use of generators, LPG and, for the less affluent, kerosene, firewood and charcoal for thermal needs. The use of fossil fuels as a substitute for electricity has naturally increased the emission of greenhouse gases and pollutants. Although no statistics are currently available, this may very well affect the Millennium Development Goal indicators on health, equality, education and environmental sustainability.

Box 5: SADC industrialization strategy and road map

From 2015 to 2063, SADC economies will seek to progressively move from factor-driven to investment-driven to efficiency-driven and ultimately to the high growth trajectory, driven by knowledge, innovation and business sophistication. The Strategy is anchored on three pillars: industrialization as champion of economic and technological transformation; competitiveness as an active process to move from comparative advantage to competitive advantage; and regional integration and geography as the context for industrial development and economic prosperity.

The strategy is aligned to the African Union Agenda 2063.

Indeed, the power crisis is a threat to the SADC Common Agenda, which guides the regional integration agenda. The crisis also threatens to derail the objectives of the SADC industrialization strategy and road map (2015-2063), which seeks to enhance the productive capacity, productivity and competitiveness of SADC economies. The energy deficit being experienced by the region will widen with the implementation of the strategy, unless the supply of electricity is substantially increased.

C. Dealing with the energy crisis

1. Policy interventions

The power crisis prompted several reactions from different parties, which had a stake in the sector. The reactions ranged from the axing of directors and senior staff of the utilities to the procurement of emergency power; and in some countries, serious consideration and adoption of strategic planning. In South Africa, the Government

established what it termed a "war room", headed by the Deputy President, to tackle the energy crisis.

At the regional level, the Regional Infrastructure Development Master Plan was signed at the SADC Summit in August 2012. The Master Plan and its energy sector plan guides the developments in key infrastructure such as energy, road, rail and ports and also acts as a framework for planning and cooperation with development partners and the private sector.

RERA was tasked with harmonizing the region's regulatory policies and facilitating cross-border trading. SAPP was tasked to seek a response strategy, which included revisiting the regional priority projects. SAPP also looked at three options: building new power stations; reducing demand growth; and managing the existing load by demand side management (SAPP, 2009).

2. Power projects

As things stand, the power projects that were embarked on to address the crisis include generation, transmission, demand-side management and the soft issues (regulations, project facilitation and financing).

(a) Generation projects

In order to address the crisis, the multi-pronged approach adopted for generation entailed de-mothballing, rehabilitation and then new-build projects. In 2008 and 2009, a total of 1,442 and 2,266 MW were brought into the SAPP grid, respectively. A further 1,100 MW became available in 2012 and 1,361 MW in 2013. The IPPs were expected to contribute, with another 6,026 MW to be added in 2014. The cycle was expected to continue until a target reserve margin of at least 15 per cent was reached by 2017 bringing a new total addition to the SAPP grid of 21,000 MW. It is now apparent that 2017 is too close for all the planned projects to have come on line, because of delays being experienced in their execution. A number of large generation projects in South Africa include the Medupi and Kusile coal power plants with a combined capacity of 9,600 MW as well as Ingula pumped storage of 1,332MW and 3,725 MW of renewables from IPPs. South Africa alone is targeting 49,000 MW of new generation by 2030. Table 3 illustrates selected generation projects greater than 100 MW in different countries that are likely to come on line by 2019, even though the majority of them are still at the feasibility stage.

In 2011, the SAPP Executive Committee used the various country master plans to develop a 2011 regional list of priority projects for implementation. Table 4 shows some of the priority generation projects, which exceed 1,000 MW. These projects are far from being developed. Construction had been slated for 2013/14 for some of them, yet all of them are still on the negotiating table. Because of the size of these projects, their financing is complex and they require a strong transmission backbone.

With the committed generation, new installed capacity is expected to reach 24,062 MW by 2019.

Table 3: SAPP Generation projects > 100 MW

Country	Project name	Capacity (MW)	Fuel type	Status
Angola	Soyo	700	Gas	Financial close
	Lauca	2 067	Hydro	Construction
	Cambabe extension	700	Hydro	Construction
DRC	Inga 3	4 800	Hydro	Financial close
Mozambique	Moatize	300	Coal	Prefeasibility
	Benga	600	Coal	Prefeasibility
Namibia	Kudu	800	Gas	Feasibility
	Baynes	360	Hydro	Feasibility
Swaziland	Lower Ngwempisi	120	Hydro	Feasibility
UR Tanzania	Rusumo	900	Hydro	Feasibility
	Singida	100	Wind	Construction
	Mtwara	600	Gas	Prefeasibility
	Stiegler	2 000	Hydro	Feasibility
Zambia	Itezhi-Tezhi	120	Hydro	Commissioned in 2016
	Kariba North Bank extension	360	Hydro	Commissioned in 2014
	Kafue Gorge Lower	750	Hydro	Feasibility
	Maamba	300	Coal	Under construction
	Lunsemfwa Lower	255	Hydro	Feasibility
Malawi	Pamodzi	120	Coal	Feasibility
Zimbabwe	Kariba South extension	300	Hydro	Under construction
	Hwange expansion	600	Coal	Financial close
TOTAL		16 732		

Source: Author's compilation.

Table 4: SAPP 2012 high priority generation projects >1,000 MW

Rank	Country	Project name	MW	Type	USD million	USD million/kW	Date
1	Mozambique	HCB North Bank	1 245	Hydro	771	619	2015
2	Mozambique	MphandaNkuwa	1 500	Hydro	2 000	1 333	2017
3	Zambia/Zimbabwe	Batoka	1 600	Hydro	4 400	2 750	2022
4	DRC	Inga 3	4 320	Hydro	4 000	926	2018
5	Zimbabwe	Gokwe North	1 400	Thermal	2 240	1 600	2017
6	South Africa	New Clean Coal	6 250	Thermal	13 750	2 200	2026
7	South Africa	Nuclear	9 600	Thermal	24 000	2 500	2023
Total			**25 915**		**51 161**	**1 974**	

Source: IRENA (2014).

One of the biggest generation projects that have been on the cards for a long time is the gigantic 40,000 MW Grand Inga along the Congo River in the Democratic Republic of the Congo. Touted as the largest hydropower site in the world, the Grand Inga will be one of the continent's most cost-effective power sources, with a generation cost estimated at $0.03/kWh (World Bank, 2014). In 2014, the World Bank provided a technical assistance facility of $73.1 million for Inga 3 Basse Chute, which is the third phase of the

development of the Inga hydropower projects. Large projects such as the Grand Inga are synonymous with high capital costs and critical socioeconomic and environmental impact concerns. Political uncertainty in the Democratic Republic of the Congo also contributes to long development timeframes of the Grand Inga. The Inga site is, therefore, likely to be developed in stages as a way to mitigate the associated risks.

(b) Transmission projects

Several transmission projects, mainly aimed at refurbishing and reinforcing the grid, have been embarked on in the countries. These include:

- South Africa Mpumalanga to Western Cape lines
- Namibia HVDC Caprivi Link (although it is a new line) with funding from the European Investment Bank
- Upgrading and rehabilitation of network infrastructure in Zimbabwe, with funding from the African Development Bank through the Zimbabwe Multi-Donor Trust Fund
- Upgrade of the Zambia Kafue Town-Muzuma-Livingstone high voltage transmission line and rehabilitation of the Lusaka transmission and distribution network, both funded by the World Bank, and construction of the transmission line from Itezhi Tezhi to Lusaka West funded by the Europea Investment Bank (EIB), the African Development Bank (AfDB), and the Agence Française de Développement
- The Tanzania Iringa, Dodoma, Singida and Shinyanga 667 km 400 kV AC double circuit transmission line to the southern parts of the country with funding from EIB, World Bank, AfDB/ Japan International Cooperation Agency (JICA) and the Korea Economic Development Cooperation Fund

(c) Priority transmission projects

The priority transmission projects of SAPP are grouped, with their carrying capacity, as follows:

(a) Interconnecting non-operating members of the SAPP; 300 MW, Mozambique-Malawi; 400 MW, Namibia-Angola; 600 MW, Democratic Republic of the Congo-Angola; and 400 MW, Zambia-United Republic of Tanzania-Kenya;

(b) Relieving congestion on the SAPP grid; 600 MW, Zimbabwe-Zambia-Botswana-Namibia (ZIZABONA); 300 MW, Central Transmission Corridor in Zimbabwe; 600 MW, Kafue-Livingstone upgrade in Zambia; 600 MW, North-West upgrade in Botswana;

(c) Evacuating power from generating stations to the load centres; 3,000 MW, Mozambique backbone phase I and phase II; 500 MW, second Mozambique –Zimbabwe (part of Mozambique-Zimbabwe-South Africa (MoZiSA) interconnector); 650 MW, second Zimbabwe-South Africa (part of MoZiSA); and 600 MW, Democratic Republic of the Congo-Zambia.

3. Project preparation

Preparation of bankable projects has always been the Achilles heel of SAPP, as most of the project ideas have failed to reach financial closure. SAPP sought support from its traditional funders to adequately prepare the projects, and two project preparation facilities are now in place:

a) Project Preparation and Development Fund hosted by the Development Bank of Southern Africa. The fund finances feasibility studies for regional infrastructure projects. It has so far received R64 million from Germany for the MoZiSA Regional Interconnector Project;

b) The SAPP Project Advisory Unit has just been established with the support of the World Bank, to accelerate the implementation of the SAPP priority projects. The Project Advisory Unit will: conduct regional analytical work; screen, select, prepare and monitor the implementation of regional priority projects; and play an advisory role to SADC governments.

4. Energy efficiency and demand-side management

In order to mitigate the effects of the power crisis, governments came up with different energy efficiency measures and ordered utilities to formulate demand-side management measures. Demand-side management is the modification of the level and pattern of energy usage with the objective of the utilities stabilising their grid and delaying building further capacity. SAPP embarked on six demand-side management projects with different capacity reduction targets, including: compact fluorescent lamp distribution (1,500 MW); solar water heater project (500 MW); hot water load control (electricity geysers-ripple control) (400 MW); commercial lighting; prepaid meter installation; and time-of-use tariffs.

Compact fluorescent lamp and ripple control measures achieved quite significant savings in SADC, cumulatively reaching 2,045 MW and 171 MW, respectively.[13] Questions still linger as to whether SAPP and the utilities are the best entities to work on energy efficiency in the long run, since under normal stable power supply conditions, with the appropriate tariffs in place, utilities will always want to sell more electric units rather than curtail energy consumption.

Most demand-side management measures are implemented in all SADC countries except for demand market participation, which is implemented in Namibia and South Africa only (table 5).

[13] SAPP internal documents.

Box 6: Demand market participation

With demand market participation, customers voluntarily agree to reduce their demand and loads to assist the system operator with the balance of electricity supply and demand. Customers are remunerated for their efforts by the system operator.

Table 5: Energy efficiency support measures in SADC member States

	Compact fluorescent lamp distribution	Energy efficiency awareness	Demand market participation	Time of use tariff	Ripple control	Solar water heating	Energy efficiency audits and in buildings	Prepaid meters	Power factor correction	Energy efficiency in transmission and distribution networks	Standards and appliance labelling
Angola	X	X									
Botswana	X	X		X	X	X	X	X	X		
Democratic Republic of the Congo	X							X			
Lesotho	X	X		X		X		X			
Malawi	X	X		X				X		X	
Mozambique	X	X		X		X		X	X		
Namibia	X	X	X	X	X	X	X	X	X	X	
South Africa	X	X	X	X	X	X	X	X	X	X	X
Swaziland	X	X		X				X	X	X	
United Republic of Tanzania	X	X		X			X	X	X	X	
Zambia	X	X		X				X	X		
Zimbabwe	X	X		X	X	X		X	X		

Source: Adapted from REN21.

Energy efficiency is essential for competitiveness, in terms of reduction in production cost. It is also important for minimizing greenhouse gas emissions. In the long term, energy efficiency measures are better coordinated by agencies, other than power suppliers (utilities) that are not negatively affected by the impact of a successful energy efficiency programme. Ideal agencies include the ministry responsible for energy, the energy regulator or better still, a dedicated energy efficiency entity. An enabling policy and financing framework should support the institutional arrangement for energy efficiency.

5. Challenges and constraints

The generation, transmission and energy efficiency and demand-side management projects came with their own challenges. For several reasons, all projects saw their lead times extended beyond expectation. A typical example is the Medupi coal power plant, where construction began in 2007. While it had been scheduled to come on line in 2012, the plant is still nowhere near completion, with a cost escalation of double the original budget, mainly for the reasons stated in section A. above, under “Shortages

Table 6: Energy sector challenges and constraints in SADC

Challenge	Potential remedy
Skills shortages	Training and capacity-building programmes initiated with the support of development partners
Labour unrests	Build and enhance communication channels; invest in skills development to enable workers to respond to challenges
Policy and regulatory flaws	Review and enact enabling policies and regulations
Bankability of PPAs	Standardized PPAs and implementation agreements
Policy and regulatory inconsistency hampering the concluding of agreements, such as wheeling or power purchase agreements	Political intervention sought at Heads of State level; RERA tasked with harmonizing regulations and standardized PPAs developed
Long approval process including environmental impact assessments, registration process	One-stop shop in the form of an IPP Office, and put in place standardized PPAs
Lack of capital by governments and State-owned utilities	Introduction of IPPs and provision of government guarantees, e.g. South Africa.
Poor preparation and packaging of projects, leading to delays in reaching financial closure	Project preparation and development fund; and Project Advisory Unit established by SAPP
Low tariffs	Review tariffs towards cost reflectivity
Non-payment of energy bills by government entities	Moving all customers to pre-payment metering

PPA – power purchase agreement

of bulk power, water and coal". A number of projects are taking too long to reach financial closure, owing to cross-border issues, failure to secure off-taker agreements, inadequacies in the project documentation and other factors. Table 6 summarizes some of the challenges and potential remedies.

D. Private sector participation (entry of independent power producers)

The energy industry is a heavily regulated sector, and for a long time, was not open to the private sector. Faced with the energy crisis, governments were forced to explore quicker and more efficient alternatives. IPPs offered a helping hand but required an enabling environment to be set up for their participation. The enabling environment includes favourable tariffs, access to the grid, and fiscal support incentives. Renewable energy technologies such as biomass, solar, small hydro and wind were viewed as less risky, especially in terms of lead times for the IPPs. Besides, financing was readily available from the development partners.

The first and most successful IPP programme was set up by South Africa, in the form of the Renewable Energy Independent Power Producer Procurement Programme. With a target of 10,000 GWh of renewable energy in the IRP process, a capacity of 3,725 MW was allocated to different IPPs. After the staggered introduction of the feed-in tariff approach, competitive bidding was then adopted by the Government as a procurement framework for renewable energies in the country. After four rounds of bidding, a total of 5,237 MW capacity was allocated to different IPPs (table 7).

One important outcome of the bidding process was a drastic price reduction in all renewable energy technologies across the bid windows. For example, using April

Table 7: Analysis of bid windows MW allocation and remaining capacity

Technology	MW capacity allocated in First Bid Window	MW capacity allocated in Second Bid Window	MW capacity allocated in Third Bid Window	MW capacity allocated in Fourth Bid Window	MW capacity remaining
Solar Photovoltaic	632 MW	417 MW	435 MW	415 MW	626 MW
Onshore Wind	634 MW	563 MW	787 MW	676 MW	660 MW
Concentrated Solar Power	150 MW	50 MW	200 MW	N/A	-*
Small Hydro (≤ 40 MW)	-	14 MW	-	5 MW	116 MW
Landfill Gas	-	-	18 MW	-	7 MW
Biomass	-	-	16 MW	25 MW	19 MW
Biogas	-	-	-	N/A	60 MW
TOTAL	**1 416 MW**	**1 044 MW**	**1 456 MW**	**1 121 MW**	**1 488 MW**

** 200 MW was allocated in the March 2014 CSP Bid Window*

Source: Department of Energy (2015).

2014 as the base year, the fully indexed average price of photovoltaic dropped from 3,288 R/MWh in bid window 1 to 786 R/MWh in bid window 4. Other benefits of the process were the economic activities brought to impoverished provinces such as the Northern Cape. The bid evaluation was split 70/30, as price and non-price (economic development requirements). The economic development requirements were "designed to incentivize bidders to promote job growth, domestic industrialization, community development, and black economic empowerment" (Eberhard and others, 2014).

Other Southern African countries have IPPs operating, although there is no formalized framework of engaging with them outside negotiated power purchase agreements. Such a process is cumbersome and involves long-drawn-out negotiations. The IPPs currently operating are mainly in the agroforestry business, where power generation is not the core activity and also in the small hydropower sector, which is considered too small for the involvement of State-owned utilities. Countries with such IPPs include Swaziland, Zambia and Zimbabwe. Zambia also has managed to attract an IPP for coal works at the Maamba Colliery.

A conducive environment is key to attracting more private players to the power sector and introducing them in countries without any. Some of the essential conditions for IPPs in the energy sector are:

- Policy and regulatory framework conducive to IPPs
- IPP policy framework that defines the rules of engagement, among other things
- An IPP procurement framework, such as competitive bidding/tendering, quota, transparent and fair feed-in tariff
- Favourable tariffs, if the feed-in tariff is the preferred option

- Clarity in the role of different stakeholders (government ministries and agencies, energy regulator, utility and/or off-taker, etc.) in the engagement of the IPPs

E. Cost reflective tariffs and their impact

It is hard to attract IPPs to the energy sector in SADC because of the low prevailing tariffs. Figure 7 shows the average electricity tariffs in 2014/15. Countries such as the Democratic Republic of the Congo, Lesotho and Zambia, with a significant share of hydropower in their energy mix, have much lower tariffs than the others.

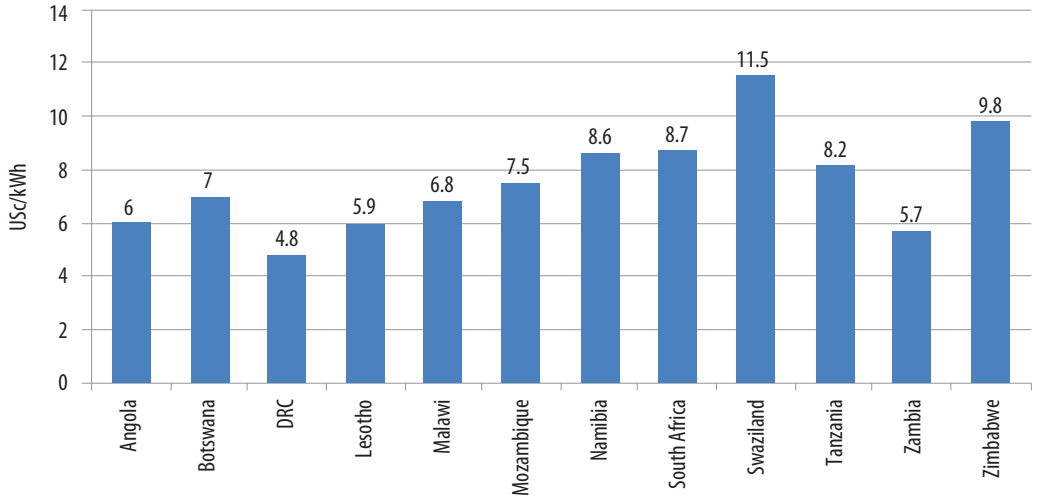
Swaziland has one of the highest tariffs in the region, followed by Zimbabwe, with averages of 11.5 US cents/kWh and 9.8 US cents/kWh, respectively. Swaziland imports almost 80 per cent of its electricity requirements, mainly from South Africa and Mozambique.

In as much as low tariffs are considered a barrier to IPPs, high tariffs do not necessarily translate into private sector participation. Indeed, countries such as Namibia, Swaziland and Zimbabwe, which have some of the highest tariffs in the region, have very few IPPs, and only in cogeneration and other small-scale renewable energy undertakings. It would, indeed, be difficult to attract IPPs in countries such as the Democratic Republic of the Congo, which have low tariffs, unless the country is in a power crisis or the IPP is offered a more attractive tariff. Despite its low tariffs, Zambia has four IPPs in hydro, diesel and coal generation, which have negotiated and secured cost-reflective tariffs from ZESCO that, incidentally, are higher than the rates paid by the end consumer.

According to RERA (2015), there is general agreement that cost-reflective tariffs will:

- Ensure the long term viability of the sector
- Attract private sector investment
- Increase regional cross-border electricity trade

Figure 7: Average electricity tariff (2014/15)



Source: SAPP 2015 Annual Report.

- Encourage the appropriate and efficient use of scarce resources
- Facilitate a self-funding sector that allows States to fund other services

SADC ministers responsible for energy decided as early as 2004, at a meeting in Namibia, to adopt the principles of cost-reflective tariffs in the region. The SADC Council of Ministers, which resolved that member States should endeavour to reach cost-reflective tariffs within a period of five years, i.e. by 2013, reiterated this decision in 2008.

All countries may not reach cost reflectivity soon, since this has social and economic ramifications. For instance, the doubling of tariffs in Zambia will just complicate the viability of the struggling mining industry. The same implications can be felt across the region. For SADC to reach its industrialization goal, it is important to ensure the affordability of energy services for industrial competitiveness. RERA (2015) argues that, while cost-reflective tariffs are important, a utility's ability to collect payment for the electricity it delivers is also a vital component of a healthy power system.

III. Planning for the future

A. Policies, governance frameworks and regional integration

The SADC region faces challenges in energy development and usage, including low energy access; power shortages; constrained and ageing infrastructure; lack of funding for infrastructure; low tariffs; poor project preparation; weak regulatory instruments; overreliance on coal, which runs contrary to global efforts to curb greenhouse gas emissions; reliance on hydropower, which is highly susceptible to climate change; and policy and regulatory issues that impede the development of renewable energy.

Policies, regulations and strategies will have to be designed and developed to address the current and future energy challenges facing the region and most importantly, issues that hamper the implementation of the policies.

As outlined in section I. B, under "Institutional architecture", the Regional Indicative Strategic Development Plan and the Strategic Indicative Plan for the organ on defence, politics and security remain the guiding frameworks for SADC regional integration, providing SADC member States, the SADC secretariat and other SADC institutions with consistent and comprehensive programmes of long-term economic and social policies. The 2012 Regional Infrastructure Development Master Plan and its Energy Sector Plan are the guiding strategic documents for the energy sector in SADC. The strategies are implemented by member States and their national agencies, with coordination support from the SADC Infrastructure and Services Directorate, SAPP Coordination Centre and RERA. SADC operates on consensus basis, and most of its resolutions, plans and programmes are implemented voluntarily without consequences for failure to comply. RERA is still an association of regulators compared to its counterparts, such as the Economic Community of West African States (ECOWAS) Regional Electricity Regulatory Authority (ERERA), which is the regulator (authority) for regional electricity cross-border trade in West Africa. SAPP is owned by the utilities that set the rules of play without any entity regulating it. This is probably one of the reasons why pool plans at the regional level fail to be adopted by the countries.

At the national level, all countries have national energy policies that show good intent to develop the sector further, by unbundling the loss-making national utility into economically functioning business units and opening up the sector for private players. Some of them have policies and regulations that favour energy efficiency, and renewable energy development such as feed-in tariffs, tendering and net-metering. However, only South Africa and Tanzania have promulgated the regulations, on tendering and feed-in tariffs, respectively. Clearly, while SADC does show the intent, it lacks the action.

The formation of energy regulators in all countries, except Botswana and the Democratic Republic of the Congo, has brought greater regulatory oversight to planning, tariff determination processes and control over large capital expenditure programmes by State-owned utilities. A number of regulators are linking tariff adjustments to key performance indicators. For example, the following areas are assessed by the Zambia

Energy Regulation Board in the tariff determination process: customer metering; cash management; staff productivity; quality of service supply; and system losses.

Energy access is the biggest challenge for most of the countries in the region. Policies and strategies to address the access gap focus on grid extension. Mozambique, United Republic of Tanzania, Zambia and Zimbabwe have put in place specialized agencies to implement rural electrification policies. In countries, such as Malawi and Swaziland, development partners, with government support, fund rural electrification. Electrification policies focus on electrifying public institutions, leaving out the majority of households simply because they may not be able to afford connection charges or pay usage bills. It is therefore important to develop strategies and business models and identify technologies and approaches that bring energy to rural households.

The ageing infrastructure needs urgent attention; and as new technologies come in, it is therefore important for the energy industry to adopt smart grid technology as it strives to modernize its infrastructure. Such a process and technology will help improve system losses, especially at the distribution level, where there is hardly any remote monitoring of the network.

Box 7: Smart grid technology

The smart grid technology is the automation of electric systems from generation to end-user. According to OECD/IEA (2011), smart grids enable increased demand response and electric energy, integration of variable renewable energy resources and electric vehicle recharging services, while reducing peak demand and stabilizing the electricity system.

Planning for both on- and off-grid energy supply is still weak within government and public institutions. At the moment, only Malawi, Namibia and South Africa have adopted the holistic integrated resource planning approach. In South Africa, the IRP process has helped the country understand the role that each technological system can play in the future energy mix and has thus set targets for the development of each of these resources.

At the regional level, the two SAPP pool plans that were developed were never adopted despite the immense benefits of economies of scale and avoidance of duplication that would result from coordinated planning, partly because of the approach used in selecting, adopting and implementing projects. The planning process should be well coordinated to consider both national and regional priorities. Planning should be the responsibility of the governments, and not the utility whose role is to implement the plans. The competitive market operated by SAPP provides very useful signals on the state of the power sector, including indicative unit costs. The intra-day market will also be useful in providing a balancing market for intermittent resources such as solar and wind.

SADC countries must continue working with NEPAD on PIDA and ensure that projects being presented as the next continental priority projects for investment are well-packaged and also include new and renewable energy technologies. Regional and

continental cooperation is essential for the exchange of lower-cost regional supplies, such as hydropower from the Grand Inga, rather than focus on national self-sufficiency.

B. New and sustainable technologies

1. Renewable energy

While SADC is endowed with renewable energy resources such as hydro, biomass, solar and wind power, they are yet to be developed fully. Recent work by IRENA (2015) indicates that the region has a combined potential of 370,570 MW of wind at 300 W/m^2 resource quality, large-scale photovoltaic power of 605,840 MW at 270 W/m^2 and concentrated solar power of 1,257,770 MW at 300 W/m^2. These resource qualities are top notch and the best in the world. Renewable energy development continues to face numerous barriers, such as lack of knowledge of the resource base; lack of enabling frameworks (policies and regulations) to support their development; lack of capital since they are still more capital-intensive than gas and diesel plants of equivalent nameplate capacity; limited skills base to plan, develop, operate and govern projects and grids with higher shares of renewables; poor institutional set-up to coordinate and promote renewables; and lack of awareness.

The Renewable Energy Independent Power Producer Procurement Programme adopted by South Africa in 2011 has succeeded in bringing the private sector into the renewable energy sector. The programme design and contractual arrangement is a power purchase agreement (PPA) between Eskom and the IPP, an implementation agreement is between the Government and the IPP, while the government support framework is between the Government and Eskom. The contractual arrangement has provided the needed assurances to trigger a renewable energy boom in the country, where most of the projects have been underwritten by local banks. South Africa is moving forward with a strategic approach to the development of renewables, by streamlining regulatory processes, while directing transmission infrastructure investment through the renewable energy development zones.

The lessons from South Africa are that, with sound strategic planning, government commitment, and enabling frameworks, investment will come into the sector. The economy of South Africa, however, is much more advanced than all the other SADC countries and beyond, hence factors such as scale, a robust financial sector and technical capacity cannot be used as those that other countries could emulate. Countries will need to strategically plan and develop long-term approaches to managing and developing their renewable energy sector. Government commitment and leadership are fundamental requirements.

2. Energy efficiency

Energy efficiency, which can be defined as using less energy for the provision of the same service, is a much cheaper option if considered strategically and implemented in such a way that the full effects on the energy system are accounted for. The long-term objective of energy efficiency is to defer the urgency of building more expensive generation and capacity while in the process, easing the pressure on the tariffs, and reducing greenhouse gas emissions. The demand-side management initiative by SAPP in the wake of the power crisis indicated that substantial energy savings could be achieved through conservation.

Implementation is always a challenge with energy efficiency, as champions are hard to come by. Utilities cannot be implementers of energy efficiency programmes since it will erode their revenues. Utilities will implement demand-side management and energy conservation, i.e. reducing or going without a service to save energy, for as long as they are facing system constraints. An effective energy efficiency programme is holistic, covering all sectors, including agriculture, transport, energy (all forms, including fuel) supply and demand, buildings, manufacturing and the domestic sectors. Its implementation should also involve all players, including the utilities. Measures should be put in place to incentivize and reward energy efficiency achievements, but also to discourage and punish wastage. The biggest challenge with energy efficiency is to measure and quantify the savings. It is therefore, prudent to back up an energy efficiency programme with a measurement and verification protocol, which, if put in place, can provide the confidence needed in securing funding for the projects.

3. Energy access, distributed generation and storage

Low access to clean and affordable energy sources is a blight on the economic development of SADC. The challenge with the current common model for addressing energy access is with grid extension. It is assumed that the grid will reach everyone and those connected to the grid will be able to utilize and pay for the service. The reality is that universal access to energy, through this model, is very expensive, while the financial returns are negative. Power consumption in rural households is very low, and in most cases, those connected to the grid often meet their thermal needs for cooking and heating with firewood, leaving electricity for lighting and powering appliances. Besides, rural households in SADC are spatially displaced, making grid extension very expensive. It is important for countries to avoid donor-driven business models and rather focus on those anchored on local sustainable financing that utilize local business mechanisms.

Distributed generation, storage and appropriate business models may go a long way in addressing energy access and the adoption of renewable energy. Distributed generation is referred to as generation of energy on site or close to a place of production. Besides avoiding the need for long grid extension lines, it also encourages efficiency. Small-scale generation technologies such as rooftop photovoltaic, bio-plants and fuel cells are ideal for distributed generation. The advantage of distributed generation is its ability to shift control to the consumer, who can then be able to implement load management techniques.

Storage is often considered the weakest link in distributed generation from intermittent resources like solar and wind. Current storage devices such as batteries and flywheels are cumbersome, weak and expensive. However, there is global attention to addressing storage problems by traditional storage companies as well as new technology companies such as Google and Tesla. SADC must actively engage with storage development companies to benefit from advances in this technology.

Combining renewable energy, storage and information, communication and technology is a new model of energy supply that involves and enhances communication between the supplier and consumer. The consumers also become producers (prosumers), enabling them to better manage their production and consumption of energy through a smarter grid. It is important to introduce, from the outset, appropriate regulations

and policies that support the technology and address security issues to keep pace with evolving technology.

C. Cross-cutting issues

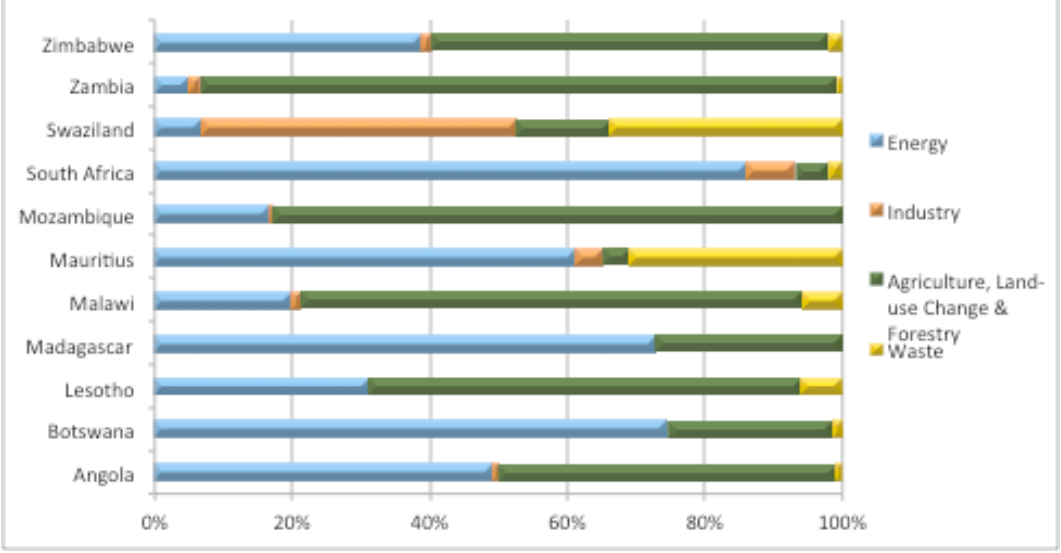
1. *Climate change*

SADC relies on two technologies associated with climate change. Coal and distillates contribute 61.6 per cent and 4.3 per cent respectively to the electricity mix of the region, whilst hydropower contributes 20.9 per cent to the mix. Figure 8 shows sectoral contributions to greenhouse gas emissions in selected countries in 2000. The energy sector is the biggest contributor to greenhouse gas emissions in a number of countries, followed by agriculture. The main fuel for energy generation for several mainland countries is coal, while heavy fuel oil is the main source in island countries.

Fossil fuel-based power generation emits significant greenhouse gases that contribute to global warming and climate change.

Climate change causes rises in ambient temperatures and rainfall variability, both of which have an impact on rainfall and water security. Member States such as Angola, Malawi, Swaziland, Zambia and Zimbabwe, which rely on hydropower, have been forced to scale down generation due to fast dwindling water in the reservoirs. Media reports[14] indicate that drought in the region could force a shutdown of the Kariba power station, which supplies power to Zambia and Zimbabwe, by August 2016 if inflows do not improve. The region experienced unusually dry seasons in1992/1993 and 2003/04, with a significant impact on the power sector. It is, therefore, important for SADC member States to invest in early warning systems and act on indications/ signals so as to adapt to hydrological cycles from the changing climate.

Figure 8: Sectoral contribution to 2000 CO2eq emissions in selected countries



Source: Compiled from national communications to the United Nations Framework Convention on Climate Change.

[14] http://www.reuters.com/article/us-zimbabwe-drought-powerstation-idUSKCN0VS1GM. Accessed on 26 February 2016.

As signatories to international treaties on climate change, SADC member States are expected to rein in their greenhouse gas emissions and pursue low-carbon development pathways.

2. Gender and energy

SADC has adopted a two-pronged approach to achieving gender equality: creating equal opportunities for women and men, and focusing specifically on women's empowerment (SADC, 2008). Gender inequality is widespread in the region, especially in the energy sector. The goal of the energy sector in SADC is to ensure the availability of sufficient, reliable, least-cost energy services that will assist in the attainment of economic efficiency and the eradication of poverty, while ensuring the environmentally sustainable use of energy resources. Owing to low energy access, women and the girl child spend a significant amount of their time looking for firewood and other fuel sources to prepare food. This exacerbates their burden and leaves them with very little time to engage in empowerment activities such as studying.

It is important for SADC member States to mainstream gender equality in all policies and structures, including science-based education, to allow the girl child to have meaningful employment positions in the energy sector. Programmes such as "women in energy" and "women in engineering" must be strongly supported.

Utilities are encouraged to provide gender statistics when reporting on the number of employees in their annual reports.

D. International cooperation and technology transfer

All SADC member States are members of the United Nations family, and as such, participate in and collaborate with United Nations-affiliated agencies and initiatives. A notable example is the United Nations Sustainable Energy for All (SE4ALL) initiative that seeks to achieve sustainable energy for all by the year 2030. The initiative has: ensured universal access to modern energy services; doubled the rate of improvements in energy efficiency; and doubled the share of renewable energy in the global energy mix. The SE4ALL goal is now part of the 2030 agenda for sustainable development adopted by world leaders in 2015. SADC member States are working with development partners to tackle the Sustainable Development Goals.

The energy sector is working with IRENA on a number of initiatives, including the Africa Clean Energy Corridor that seeks to accelerate the expansion of renewable electricity production in a power corridor from Egypt to Cape Town. Its projects and activities include renewable energy zoning, regulatory empowerment, planning and statistics. SAPP has had successful collaborative activities with the Nordic countries, especially in the establishment of the spot market, modelled along the lines of the original NordPool. SAPP has benefited immensely from capacity-building programmes. Other development partners that have worked with the SADC Secretariat, SAPP and RERA and member States include the United States Agency for International Development (USAID), the World Bank, the Danish International Development Agency (DANIDA), Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) and the European Union.

The Energy and Environment Partnership in Southern and East Africa programme, jointly funded by the Ministry of Foreign Affairs of Finland, the Austrian Development Agency and the Department for International Development of the United Kingdom and Northern Ireland, since March 2010, has been funding energy efficiency, renewable energy and clean cooking technology projects from prefeasibility studies to project construction, including hardware, across the entire region. Coordination of renewable energy and energy efficiency projects at the regional level has always been a challenge. It is hoped that the planned Southern African Centre for Renewable Energy and Energy Efficiency will act as that coordinating hub.

The Power Africa initiative of the Government of United States of America, launched in June 2013 by President Barack Obama, seeks to double access to electricity in sub-Saharan Africa, with targets of 30,000 MW of installed power capacity and 60 million new connections by 2030. Power Africa has created momentum through partnerships with the Governments of Norway and the United Kingdom, NEPAD, SE4All and IRENA.

It is therefore important for SADC to strategically position itself to tap into these international initiatives by formulating and packaging projects and programmes to present to these partners for financial and technical support. It must further ensure that the projects implemented in partnership with development partners have a strong bias towards capacity-building and technology transfer.

E. Financing energy infrastructure

Energy infrastructure has traditionally been developed and financed by utilities through their balance sheets or by governments through the public treasury or with development finance, backed by government guarantees. Traditional sources of development finance include the Paris Club, multilateral creditors, such as the AfDB, the World Bank, the European Investment Bank and bilateral creditors such as the Agence Française de Développement and KfW. The funding has often been structured to include both grants and loans. Brazil, China and India have recently been active in infrastructure projects in SADC.

Hamstrung by infrastructure funding challenges, SADC has now established the Regional Development Fund - a financial mechanism intended to mobilize resources from member States, the private sector and development partners, to finance programmes and projects to deepen regional integration. The Fund is expected to provide alternative financing modalities for Southern Africa, to support its integration agenda. This follows the realization that the balance sheets of most State-owned utilities are very weak, making it very difficult for them to borrow on concessionary terms. The demand for energy sector infrastructure is rising rapidly, and the traditional models of financing energy projects can therefore not cope with the demand. New models include capital markets; public private partnerships with increasing participation by the development finance institutions, and private sector financing. Public-private partnerships (PPPs) are not yet entrenched in the sector but taking root, just as much as private players.

1. Capital market financing

Domestic and international capital markets have always been a source of funding for the private sector, through listing on the stock exchange. Governments have often raised capital through the issuance of bonds. The energy sector is viewed as a stable investment; hence there is a need for governments to focus on this model to finance power infrastructure projects.

In 2012, Zambia raised $750 million to finance energy and other infrastructure projects through a 10-year Eurobond at 5.6 per cent, although the country had planned to raise only $500 million. The bond issue was oversubscribed to $11.9 billion.[15] In July 2013, NamPower issued a notice to raise N$5billion by selling a bond in Namibia and South Africa to fund the development of the proposed 800 MW Kudu gas power plant.

Countries or utilities must have fairly good credit ratings to be able to issue international bonds.

SADC member States should also consider issuing domestic local currency denominated bonds to help reduce client foreign exchange risk and promote local-currency long-term funding and capital market development, especially for rural energization projects/programmes, where projects are small and not too well managed, making them less attractive to international investors.

2. Public-private partnership financing

Public-private partnership models are very common in financing road and water infrastructure. The SADC Regional Development Fund is modelled as a PPP. Successful PPP models in the energy sector include the Itezhi Tezhi hydro project, Kariba North Bank extension project and the 250 MW Bujagali hydropower plant project in Uganda. Kenya is developing its geothermal projects through a PPP framework with the State-owned Geothermal Development Corporation doing the exploratory work and the private sector developing the power plants.

The transmission project linking Zimbabwe, Zambia, Botswana and Namibia, known as the ZiZaBoNa project, is likely to be developed under a PPP framework. A special purpose vehicle company owned by the utilities of the four countries involved is registered in Namibia and the private sector will be invited to procure shareholding in the vehicle.

For PPPs to work, the following fundamental principles should be in place:

- Sound and trusted political landscape
- Appropriate risk sharing
- Effective project execution by implementing agencies
- Healthy economic principles in place

[15] http://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/attractiveness-of-african-sovereign-bonds-10251/. Accessed on 26 February 2016.

3. Private sector financing

The private sector has the ability and dynamism to raise capital from different sources, but in order for them to take that risk, their lenders need assurance that their capital is safe. An enabling framework is one of the first conditions assessed by creditors. The South Africa Renewable Energy Independent Power Producer Procurement Programme has proven that with the right business fundamentals, it is possible to attract private capital. Private capital has been brought into the Zambia power market through IPPs and Copperbelt Energy Corporation, the independent transmission system operator. In Namibia, a 5MW PV producer secured a regional electricity distributor as an off-taker of its power. SADC countries need to create enabling frameworks to allow IPPs to bring in their capital. IPPs should be allowed to secure cross-border off-takers without necessarily selling to the State-owned utility, which has been the biggest barrier to private players.

IV. Conclusion and recommendations

A. Conclusions

Through its secretariat and implementing entities such as RERA and SAPP, SADC has been working to address the energy crisis affecting the region since 2008. The crisis emanates from power shortages, constrained and ageing infrastructure, lack of funding for infrastructure, low tariffs, poor project preparation, weak regulatory instruments and overreliance on coal which all run contrary to global efforts to curb greenhouse gas emissions. Other factors include reliance on hydropower, which is highly susceptible to climate change, policy and regulatory inadequacies that impede the development of renewable energy and low energy access.

The crisis has resulted in huge economic losses from the closure of companies, job losses, lack of investment due to insecurity of supply, and delays in addressing energy access and credit rating downgrades. A multi-pronged approach was adopted in dealing with the crisis at the regional and national levels. These include: policy (including the regional infrastructure development master plan and country IRP processes); power projects in generation and transmission, including priority projects; project preparation facilities to enhance the bankability of the projects; and energy efficiency and demand-side management. Although a number of generation projects are lined up to reduce the deficit and reserve margin by 2019, the majority of them are at the feasibility stage, and will therefore be unable to beat that deadline.

Despite the abundance of renewable resources such as biomass, solar and wind, outside hydro, their contribution to the energy mix is almost negligible. Countries continue to consider diesel power plants despite the fact that renewable energy technologies are now cost competitive. There are still some barriers to the development of renewable energy and the involvement of IPPs in the energy sector. The successful Renewable Energy Independent Power Producer programme adopted by South Africa has shown that, with the right policy framework and strong government commitment, it is possible to bring in private capital and IPPs into the energy sector at competitive prices. SADC member States must continue to work to bring their electricity tariffs to cost reflectivity. Models to finance energy access are needed.

B. Recommendations

The recommendations provided below are based on the fact that urbanization will continue to grow and require infrastructure investments; the demand for clean and affordable energy will continue to increase; the renewable energy potential is huge and costs are coming down; the global focus is on Africa; energy access is a challenge and climate change is a big threat to the sector.

The following recommendations are made to the member States, SADC and COMESA secretariats, SAPP and RERA.

1. Recommendations to member States

(a) Policy and regulatory issues

Member States should:

- Adopt a harmonized and competitive policy, and legal and regulatory frameworks that will attract private investors to the power sector, including new and renewable energy technologies
- Continue reforming the utilities sector to increase efficiency, which, in some cases, may involve unbundling, to make it attractive to investors and to level the playing field for IPPs and PPPs
- Enhance the capacity of ministries responsible for energy to develop or update energy master plans and integrated resource plans
- Expedite the creation of independent regulators where they do not exist
- Clarify and define government, private sector and regulator roles and responsibilities for long-term plans, implementation, financing and supervision
- Introduce cost-reflective tariffs and develop mechanisms to cushion the disadvantaged from the high tariffs
- Conduct due diligence before entering into a contract with multinational corporations
- Develop bankable energy project proposals
- Formulate evidence-based plans on energy demand and supply, backed by reliable and timely data to facilitate decision-making by relevant stakeholders
- Adapt best practices from other countries in order to shape responses to similar energy crises
- Encourage the media to be proactive in projecting opportunities available in the energy sector
- Use fiscal and other incentives to attract IPPs into the energy sector
- Develop one-stop-shop service mechanisms to facilitate agreements, land acquisition, permits, licences, water access and other services
- Strengthen capacity for negotiating energy contracts and transactions
- Support research and development, and academic and training institutions to contribute in the design and implementation of workable energy policies and regulations

- Incorporate regional energy development plans into their domestic frameworks
- Develop policies, plans and road maps on energy, including rural electrification
- Establish observatories (websites) with validated data (on energy) to provide up-to-date information

(b) Energy generation, transmission and distribution

Member States should:

- Invest in quantifying and delineating renewable energy resources within their national boundaries
- Encourage utilities to invest in new technologies to reduce generation, transmission and distribution losses
- Facilitate regional transfer of technology
- Address the challenge of the non-payment of electricity bills, particularly by public sector institutions, as this adversely affects the performance of utilities
- Develop new regional transmission infrastructure to facilitate connection of new industrial loads
- Diversify energy sources to address both short- and long-term energy requirements
- Promote mini-grids and virtual power in rural and isolated areas

(c) Demand management

Member States should:

- • Develop and implement energy efficiency policies
- • Invest in advocacy on energy efficiency and conduct energy audits
- • Develop institutional support frameworks for energy efficiency
- • Implement participatory energy efficiency action plans and define the targets, indicators and key actors
- • Accelerate rural electrification programmes through subsidies to households to achieve universal access
- • Raise awareness on renewable energy sources and set renewable energy access targets

2. Recommendations to SADC and COMESA

The SADC and COMESA secretariats should:

- Empower RERA to become an authority, enabling it to effectively tackle the cross-border regulatory challenges
- Make use of the SAPP project preparation facility to prepare and package renewable energy projects for incorporation into the PIDA priority projects list for possible financing
- Develop regional integrated resource plans for the regional power market
- Leverage regional energy cooperation to generate an optimal energy mix
- Ensure that Angola, Malawi and the United Republic of Tanzania are connected to the SAPP grid
- Formulate the SADC regional energy and renewable energy policy
- Enhance regional institutions and structures such as the parliamentary forum, to monitor adherence of national plans to the regional plans
- Collaborate more on energy issues and share experiences on policies and the development of energy projects
- Monitor the operations of IPPs or contactors in the energy sector

3. Recommendations to SAPP and RERA

SAPP and RERA should:

- Encourage member States to make use of the project preparation facility to package projects for submission to potential investors
- Enhance the efficiency of the energy market through an aggregate generation regional strategy, using an average regional price

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