ZIMBABWE ECONOMIC POLICY ANALYSIS AND RESEARCH UNIT

LINKING ELECTRICITY SUPPLY TO ECONOMIC GROWTH IN ZIMBABWE

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ABSTRACT

The study investigates the role of electricity supply in enhancing economic growth in Zimbabwe through different sectors of the economy. Literature reveals that all economic processes require energy, so that energy is always an essential factor of production. Electricity (as an especially high grade of energy) facilitates technological advances and in turn stimulates the economy, by providing gains in productivity. Despite the huge potential electricity resource base through generation expansion projects, the country is currently facing enormous shortages of electricity due to generation shortfalls. The power utility, ZESA, is facing enormous challenges in the generation and distribution of electricity. Targeted interviews were conducted with key informants from major players in the electricity, manufacturing, mining and agriculture sectors. Stakeholders in the manufacturing sector revealed that damages caused by power outages to some furnaces which are expected to run without stopping are expensive to repair. In the mining sector, underground mines need a constant uninterrupted supply of electricity to prevent them from being flooded by underground water streams. In the agriculture sector, load shedding results in a decline in yields per hectare due to moisture stress. The paper recommends that since the capacity for the Government to invest in the electricity sector through construction of additional power stations is minimal due to lack of fiscal space, engagement of the private sector participation through public private partnerships is necessary to reduce the deficit. Also the setting of the tariff should enable viability of service providers to enable independent power producers to come on board. The paper also suggests that in future the country should prioritise investment in hydro power plants which are cheaper to run though expensive to set up.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AfDB	African Development Bank
CFLs	Compact Fluorescent Lamps
CFU	Commercial Farmers Union
CZI	Confederation of Zimbabwe Industries
DRC	Democratic Republic of Congo
GDP	Gross Domestic Product
GWh	Giga Watt Hour
IPPs	Independent Power Producers
kWh	kilo watt hour
MW	Mega Watt
PPPs	Public Private Partnerships
REA	Rural Electrification Agency
RERA	Regional Electricity Regulators Association
SADC	Southern African Development Community
SAPP	Southern African Power Pool
UNDP	United Nations Development Programme
UPS	Uninterrupted Power Supplies
USc	United States cents
USD	United States Dollars
ZESCO	Zambia Electricity Supply Corporation
ZETDC	Zimbabwe Electricity and Distribution Company
ZIMSTAT	Zimbabwe National Statistical Agency
ZIZABONA	Zimbabwe-Zambia-Botswana-Namibia

1. INTRODUCTION AND RATIONALE

1.1 Introduction

Electricity, as an especially high grade of energy, is a critical factor of production which facilitates technological advances and in turn stimulates the economy, by providing gains in productivity. Hence, understanding the nexus between electricity supply and economic growth is very vital in the effective design and implementation of energy policy. Currently, the power utility, ZESA, is facing enormous challenges in the generation and distribution of electricity, such as lack of adequate working capital to support the refurbishments of power stations, vandalism of the power network infrastructure, skills shortages due to human capital flight, inability to charge competitive tariffs, and huge and unsustainable debt of over US$400 million, among other factors. This is worsened by diminishing excess capacity in the Southern African Development Community (SADC) regional power utility Southern African Power Pool (SAPP)[1] region. The SAPP promotes trading of electricity and provides power via the day head market competitive rates to all utilities in its member states including ZESA. Intermittent power outages have slowed down the pace for the recovery of the economy.

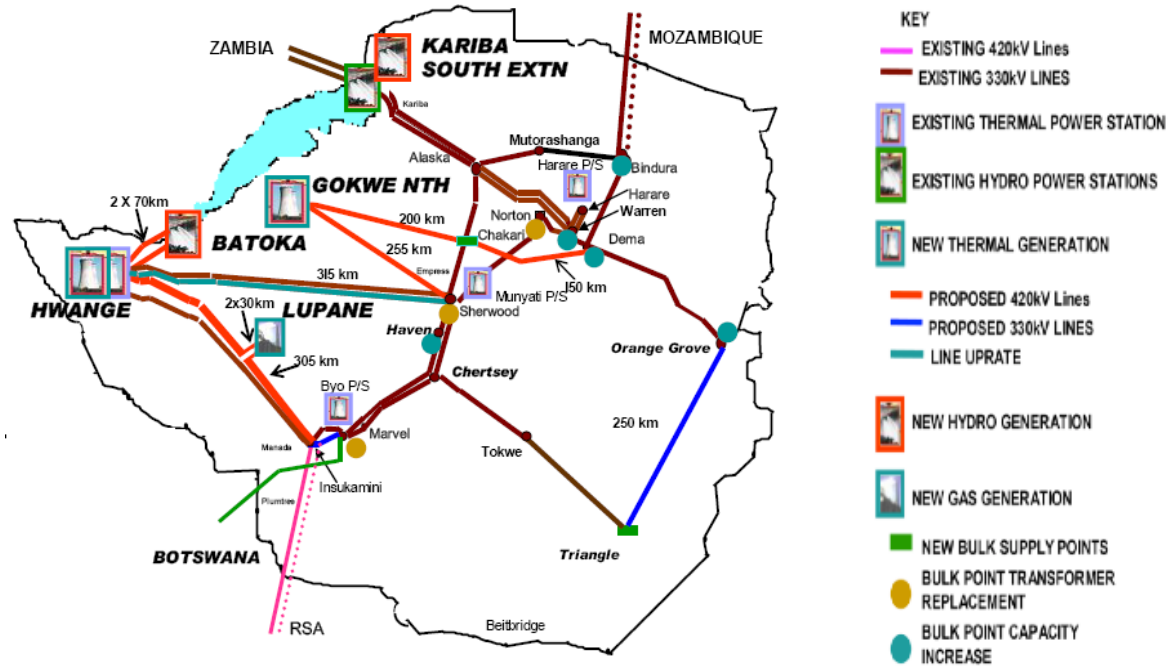
Despite the huge potential electricity resource base through generation expansion projects namely, Hwange 7 and 8 (2x300 megawatts (MW)), Kariba South Extension (2x150MW), Lupane Gas (2x150MW), Gokwe North (4x350 MW), Batoka (1600MW) to be shared between Zimbabwe and Zambia and small hydros, the country is currently facing enormous shortages of electricity due to generation shortfalls. Out of a total installed capacity of 1960MW, about 1400MW is currently available against national demand of 1800MW and a peak demand of 2100MW[2]. The national demand for electricity far outstrips internal generation which is augmented by imports of about 150MW from Cahora Bassa of Mozambique. The lack of meaningful investment in additional generation capacity and charging of a sub-optimal tariff have been compounded by maintenance deficiencies in existing plants, transmission system losses and the rising demand of on average 3% per annum. The gap between supply and demand entails rolling load shedding daily. The availability of adequate and reliable electricity is critical for sustained economic growth, hence the need to undertake the study.

The coverage and quality of basic infrastructure for power in Zimbabwe was once among the best in the region during the early 1990s but now the country lags behind most other regional groupings (African Development Bank, 2011). The location of the existing and planned power generation plants and transmission situation in the country is presented in figure 1.

[1]a grouping of power utilities in Southern African Development Community (SADC) currently with 12 member countries represented by their respective power utilities. The members are Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

[2]ZESA, June 2011

Figure 1: The Existing and Planned Power Generation Plants and Transmission situation in Zimbabwe



Source: Adapted from ZESA, 2010

Due to its geographic location, Zimbabwe's power network provides a strategic hub for the transfer of power within the Southern Africa Power Pool (SAPP). ZESA is also part of the transmission interconnector project called Zimbabwe-Zambia-Botswana -Namibia, code named ZIZABONA which agreed on a project concept of developing a high voltage transmission infrastructure network linking the four countries.

The Medium Term Plan (MTP) recommends that a substantial amount of public resources be committed towards rehabilitation, maintenance and expansion of key infrastructure in the power sector as shown in Table 1 (MTP, 2011). The main objective in the short-to-medium term is to restore and increase power generation capacity to meet national demand. This can be achieved through rehabilitation and expansion of Hwange and Kariba by 2012, resuscitation of small thermals and upgrading of the transmission and distribution power grid. Implementation of demand side management is expected to create 300MW, capacity which is almost equivalent to that of combined small thermals (Table 2). Installation of pre-paid meters and enhancement of billing system is expected to enable ZESA to enhance revenue collection since customers would be compelled to pay for the service upfront.

Table 1: Policy Objectives and Targets of the MTP for the Power Sector

Policy Objective	Policy Targets	Programme/ Project	Activities
To restore and increase power generation capacity to meet national demand for the attainment of economic recovery and growth.	Restoration of generation capacity at Hwange to installed capacity by 2012.	Rehabilitation of Hwange and Kariba to full capacity Expansion of Kariba and Hwange power stations.	Rehabilitation and expansion
	Lease of small thermals to increase electricity supply by 290MW by 2011.	Rehabilitation of thermals.	
	Installation of prepaid meters by 2012.	Enhancement of the billing and collection system. Local manufacture of transformers, prepaid meters and other spares.	Installation of meters
	Institute demand side management to energy savings of up to 300MW by 2013.	Demand side management Installation of energy saver Bulbs.	Saving measures
	Electrify rural areas and reduce fuel wood consumption.	Rural Electrification Programme	

Source: Adapted from Zimbabwe MTP 2011-2015, Page 260

With the little available resources, the Government of Zimbabwe committed US$25 million in 2010 and US$60 million in 2011 for the rehabilitation of Hwange. This resulted in all the six units of the power station operating at full capacity in June 2011.

In the long term the Government aims to invest in Greenfield projects such as coal bed methane and renewable energy technologies (i.e Batoka and mini-hydro power generation) through public private partnerships (PPPs). This means that the government of Zimbabwe must lure potential investors into the country to invest in the power sector. However, the cost of doing business is also perceived to be very high in Zimbabwe. According to the Doing Business 2011 report, Zimbabwe is ranked 157th out of 183 economies (Doing Business, 2011). Property rights (ranked 120th) are perceived not to be well protected. This could be worsened by the Indigenisation and Economic Empowerment Act which requires foreign owned companies with an asset value of at least US$500,000 to dispose 51% of their shareholding to indigenous Zimbabweans. Clarity on the Indigenisation and Economic Empowerment programme is also crucial to be able to lure investors.

1.2 Key Players in the Electricity Sector

The Ministry of Energy and Power Development has oversight responsibility for the energy sector with a mandate for policy formulation, performance monitoring, regulation, development and promotion of renewable energy. The Ministry also supervises and oversees ZESA. The then Zimbabwe Electrical Supply Authority (ZESA) was introduced by the Electricity Act of 1985, which gave it monopoly

in generation, distribution and sales of electricity. In 1996, the Act was amended to allow for the formation of the Zambezi River Authority, which allowed Zimbabwe and Zambia to share responsibilities for the running and maintenance of the Kariba Dam hydroelectric station.

Before the Act was amended in 2003 to allow for partial liberalisation of the sector, there were two failed attempts at partial privatisation, which include the attempted privatisation and expansion of ZESA's Hwange coal-fired power station and the setting up of a new coal-fired power station at Gokwe North. The former was intended as a joint venture between the YTL Corporation of Malaysia (51%) and ZESA (49%), while the latter involved the UK-based multinational Rio Tinto Corporation (Bhagavan, M.R, 2003). The privatisation negotiations were abandoned in 2000 after going on for over three years, since the independent power producers (IPPs) had proposed a tariff of US6c/kWh against the prevailing tariff of US3.5c/kWh (Bhagavan, M. R, 2003). At that time the proposed tariff was unsustainable.

Reforms were embarked upon in the sector, with a new Electricity Act (Chapter 13:19) being enacted in 2002. This brought about the restructuring and unbundling of the then Zimbabwe Electricity Supply Authority into separate successor companies focusing on Generation, Transmission & Distribution and Service companies. The new Act also provided the framework for the setting up of an independent regulatory body, which saw the Zimbabwe Electricity Regulatory Commission (ZERC) being established in accordance with section 5 of the Act in 2005.

The unbundling process saw the creation of the Zimbabwe Power Company (ZPC) and the opening up of the generation sector to allow IPP to produce power for sale. The Zimbabwe Electricity Transmission Company (ZETCO) was established on the transmission side as the single buyer, being mandated to plan, construct and operate the Transmission Grid. ZETCO was also given the responsibility of buying power from local and external generation entities and performing the system operations functions. The distribution and retail business was given to the Zimbabwe Electricity Distribution Company (ZEDC). In 2011, Zimbabwean Government has set up the Zimbabwe Energy Regulatory Authority (ZERA) as part of the process to harmonise regulation of the energy sector. The new regulatory authority succeeds the ZERC, which ceased operations in September 2011. ZERA is an autonomous body which also determines the electricity tariff to ensure viability and rational price levels.

A number of IPPs are currently active in power generation in Zimbabwe. Examples of such IPPs are the two sugar milling companies generating electricity from bagasse[3] in Chiredzi, namely, Hippo Valley Estates and Triangle Sugar Ltd. These two companies are regarded as bulk consumers of electricity. Triangle Limited and Hippo Valley Estates are producing over 70MW of electricity. Triangle sugar mill produces up to 32.5MW and Hippo Valley has an installed capacity of 44MW of which 10 MW is sold to

[3]Organic residue from sugar processing frequently used as a fuel for power generation

the national grid during the milling season. ZESA had an electricity power purchase agreement with Hippo Valley Estates but it expired in 2002. During milling season Hippo Valley Estates exported excess power to the national grid and would be given back the electricity off-milling season. Hippo Valley Estates is renewing the operating agreements with ZETDC and the process is expected to be finalised in December 2011. As for Triangle Ltd, an interview with ZETDC official revealed that it does not have adequate facilities for protection if they have to connect to the national grid. However, it was noted that Triangle Ltd can export 10MW to the grid.

Another IPP which operated in Zimbabwe is Rusitu Power Corporation. A 750kW micro-hydro power plant was installed at Rusitu in the eastern highlands. ZESA had a power purchase agreement with Rusitu which exported electricity to the national grid at an equivalent of US4.1c/kWh. This price was sub-optimal and could not sustain the refurbishment of the power plant resulting in the running down of the power station. Currently the power plant is not operational due to viability problems. At Nyamingura there is a 1.1MW hydroelectric plant currently trading with Boarder Timbers. Gwayi which has a power plant which produces 120MW applied for connection to the grid. Lusulu, Chisumbanje and Charter produce 600MW, 100kW and 500kW respectively. There are also some new planets at Mutirikwi. An interview with ZETDC revealed that the grid impact for the majority of IPPs were done by ZESA except for Gokwe North.

In 2010 Rio Zim Ltd, a mining company which is also a bulk user of electricity was given a generation license. In addition to electricity generation, the licence also allows transmission and distribution, which makes it easier to engage other investors as partners. RioZim intends to build a thermal power station, taking advantage of its ownership of the vast coal fields near the proposed power station site, owned by Sengwa Colliery, which is its subsidiary company. The RioZim project it is expected to produce about 2400MW, and would be developed in phases, the first one being expected to end in 2014, and the last in 2020. However, the feasibility study for this project indicates that the coal field can produce only 1400MW. It was also mentioned that the 2400MW to be produced by Rio Zim outstrips the national demand hence part of the electricity produced will not be absorbed into the national grid. Chances of exporting excess capacity to the SAPP are fading since potential electricity importers (Botswana and South Africa) are constructing their own power stations. Another potential electricity importer, NamPower, a power utility in Namibia only imports not more than 200MW. Currently most IPPs are negotiating new power purchase agreements with ZETDC and are pegging their electricity prices between US16c/kWh and US21c/kWh, which is almost twice the US9.98c/kWh tariff being charged by ZESA (Table 3).

A separate Rural Electrification Fund, a Board and Agency have been set up under the Rural Electrification Fund Act, passed in January 2002. The Agency is administering a special fund formed under this Act to finance rural electrification projects. The Board is accountable to the Minister of Energy and Power Development.

Zimbabwe is also a member of SAPP is a grouping of power utilities from 12 Southern African Development Community (SADC) member countries, who would

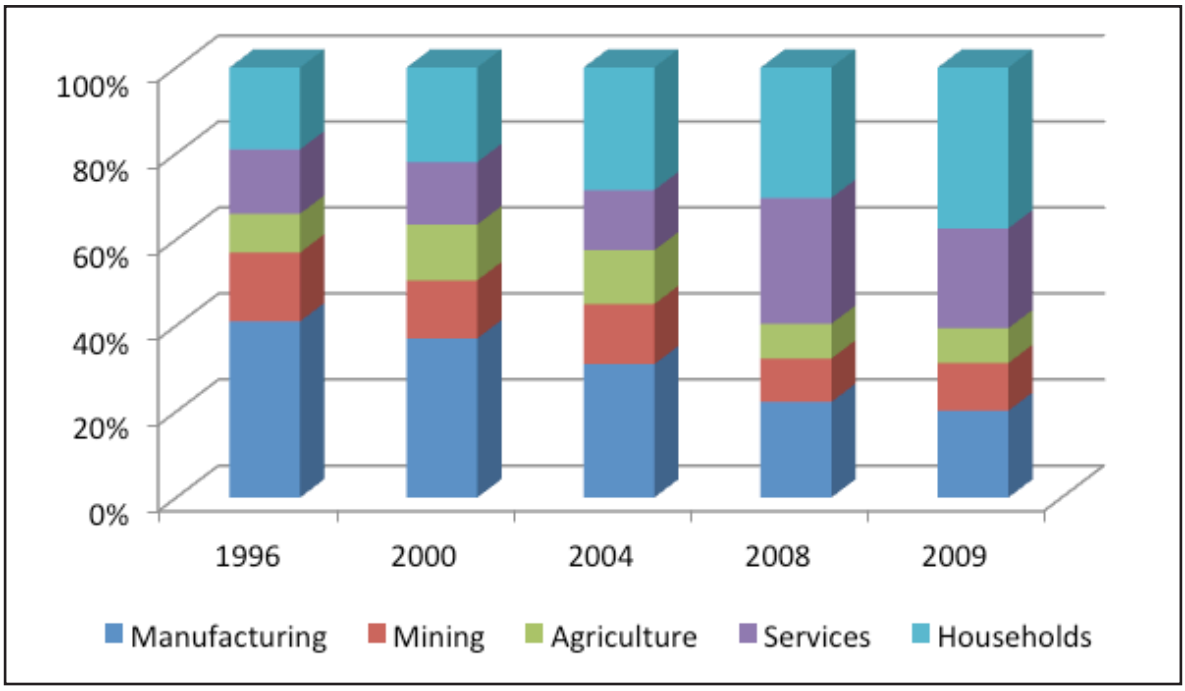
be represented by their respective electric power utilities. The members of SAPP are Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. SAPP is a coordination centre, which coordinates activities such as regional planning on demand and supply balance issues as well as operations, which covers transmission issues, power exchanges among members, trading and environmental aspects among member utilities. Its role is to promote electricity trade in the region by promoting the development of generation and transmission projects, particularly regional projects. It offers power via the day head market competitive rates to all utilities including ZESA.

For a power utility to be a member of SAPP, it has to get approval from its government and the regulatory authority. In addition, the player should be licensed by SAPP to do cross border trading of electricity. SAPP is governed by the inter government memorandum of understanding which is signed by all participating governments which was revised in 2006 to allow operations of private players as IPPs.

1.3 Electricity Consumption Patterns

Electricity consumption in Zimbabwe is generally categorized for consumption in manufacturing, mining, agriculture, services and households. Overall electricity consumption is 12.4% of final energy consumption (Dube, 2007). Figure 2 shows the breakdown of electricity consumption by sector.

Figure 2: Electricity Consumption by Sector (%), 1996 - 2009



Source: Constructed using figures adapted from MTP 2011-2015

In 1996 the bulk of electricity was consumed by industry (40%) followed by households (19%), mining (16%), services (15%) and agriculture (9%). The trend was reversed over time when households (37%) became the bulk electricity consumers at the expense of the manufacturing sector which shrunk substantially to (20%) in 2009. The decline in the share manufacturing sector can be attributed to the sharp decline in capacity utilisation from 76% in 1996, to 56% in 2000, 18.9% in 2008 and 32% in 2009 43% 57%. Capacity utilisation, however, recover in 2009, 2010 and 2012 to 32%, 43% and 57% respectively[4].

Mining sector also shrunk from 16% in 1996 to 10% and 11% in 2008 and 2009 respectively. The consumption by the agriculture sector fell from 13% in 2000 to 8% in 2009. The share of electricity consumption by the services sector almost doubled from 15% in 1996 to 29% in 2008, registering a decline to 23% in 2009. This is because most companies in the services sector are located in areas such as the central business district which are exempt from load shedding. The decline in the share of electricity in key sectors of the economy, especially manufacturing is worrying since these sectors are expected to resuscitate the recovery of the economy from the effects of a decade long of economic crisis.

1.4 Sources of Electricity in Zimbabwe

The country's electricity is generated internally from hydro power plant at Kariba and thermal power plants from Hwange, Bulawayo, Munyati and Harare. The internal sources are augmented by imports from Mozambique, South Africa, Zambia and Democratic Republic of Congo (DRC). Out of a total installed capacity of 1960MW, about 1400MW was available from internal sources against national demand of 1800MW and a peak demand of 2100MW (Table 2). However, part of the capacity is used internally for powering power plant auxiliaries. The national demand for electricity far outstrips internal generation which is augmented by imports of up to 500MW.

Hwange Power Station has for the first time, since a decade ago, started operating all the six units at full capacity, attaining the highest peak of 727MW in June 2011 (ZESA, 2011). Small thermals (Harare, Bulawayo and Munyati) were producing an average of only 100MW out of the possible 290MW during the same period. Small thermals are normally operated in winter when the cost of imported power is high compared to the production costs of the plants and also subject to coal availability. In June 2011, ZESA was importing 150MW from Cahora Bassa of Mozambique. The gap between supply and demand for electricity entails rolling load shedding daily. If no investments are undertaken, the electricity supply gap will continue to widen against the backdrop of diminishing excess capacity in the SAPP region.

[4]CZI website and CZI 2011Manufacturing sector survey

Table 2: Installed versus Available Electricity Capacity, 2000-2011

Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
Installed capacity (MW)												
Hwange	920	920	920	920	920	920	920	920	920	920	920	920
Kariba	694	722	736	750	750	750	750	750	750	750	750	750
Small Thermals	290	290	290	290	290	290	290	290	290	290	290	290
Total	1904	1932	1946	1960	1960	1960	1960	1960	1960	1960	1960	1960
Available Capacity												
Hwange	496	716	659	498	583	579	435	421	388	287	500	727
Kariba	511	531	588	701	723	725	711	727	747	746	750	573
Small Thermals	133	105	101	43	110	42	26	26	34	13	60	100
Total	1140	1352	1348	1242	1416	1346	1172	1174	1169	1046	1310	1400
% of installed capacity	59.9	70	69.3	63.4	72.2	68.7	59.8	59.9	59.6	53.4	66.8	71.4
Peak demand	1986	2013	2028	2007	2069	2066	1904	1758	1429	1403	2100	2100
Supply Deficit	(846)	(661)	(680)	(765)	(653)	(720)	(732)	(584)	(260)	(357)	(790)	(700)

**up to June 2011*

Source: African Development Bank, 2011 and ZESA, 2011

There has been no significant heavy investment in internal electricity generation in Zimbabwe since 1984, at a time when the demand for electricity has been increasing, estimated to be at an average annual rate of 3% (Dube et. al., 2007). As a result, Zimbabwe is struggling to meet its electricity requirements, at a time when industrial demand for electricity for the resuscitation of the economy has increased. Aging infrastructure, lack of spares, limited generation and sub-optimal tariff have been given as the reasons for the intermittent power outages.

To augment grid electricity, the Rural Electrification Agency (REA) has embarked on research and development of renewable energy and other cost effective technologies for use in rural areas. REA has adapted a solar mini grid system that generates conventional electricity big enough to power a school, clinic, or small to medium irrigation scheme[5]. REA also provides services for the design and installation of standby generators and Uninterrupted Power Supplies (UPS). Private investors are also called upon to participate in the industry by generating electricity and

[5]www.rea.co.zw, accessed 15 July 2011

selling it to the ZETDC, transmission network. Currently only those bulk consumers of electricity have shown interest in the generation of electricity.

In the SAPP region, load shedding programmes of varying magnitude were implemented by power utilities due to inadequate power supply and other constraints, especially during peak periods. As at April 2011, SAPP's installed capacity was 56321MW against available capacity of 50262MW, leaving a deficit of 6059MW as shown in Table 3. The region's demand and supply balance indicate that SAPP will have adequate generation reserve after the year 2014 (SAPP Annual Report, 2010). The rural electrification programme also increases the demand for electricity. Hence there is an urgent need for power generation expansion in Zimbabwe to curb the load shedding.

Table 3: Installed Capacity vs Peak Demand 2009/2010

Country	Utility	Installed Capacity (MW) as at April 2011	Available Capacity (MW) as at April 2011	Installed minus Available Capacity (MW)	2010 Peak Demand (MW)	Peak Demand Growth (%)	Number of Customers	Net Imports (GWh)	Net Exports (GWh)	Transmission System Losses (%)	Rate of Return (%)	Net Income (USD million)
Angola	ENE	1399	1202	197	1100	8	194296	27	0	10	n/a	n/a
Botswana	BPC	202	190	12	553	10	221536	2945	0	3.6	-9.7	-69
DRC1[6]	SNEL	2442	1330	1112	1081	-5	426232	38	871	9.3	n/a	n/a
Lesotho	LEC	72	72	-	121	12	58900	49	7.4	11	5.2	5.1
Malawi	ESCOM	300	300	-	300	7.4	176654	-	0	7.7	3	2.5
Mozambique	EDM HBC	233 2075	174 2075	59 -	560	14.4	614510	2326	309	7	n/a	n/a
Namibia	NamPower	393	360	33	564	-1.3	3449	2462	294	3.2	6	53
South Africa	Eskom	44170	41074	3096	36705	-0.3	4463301	10047	13754	3.3	2.2	500
Swaziland	SEC	70	70	-	204	0.24	97000	909.4	0	6	7	9.7
Tanzania	TANESCO	1108	880	228	833	6.3	67110	52	0	4.5	4.86	-19.1
Zambia	ZESCO	1812	1215	597	1640	2.2	356605	-	65.6	4.4	8	7.9
Zimbabwe	ZESA	2045	1320	725	**2100**	12.7	**579006**	**710**	**0**	**4**	**-34**	-120
TOTAL SAPP		**56321**	**50262**	**6059**	**45761**							

Source: SAPP Annual Report, 2010

[6]Democratic Republic of Congo

Comparing the available capacity and peak demand in the SAPP region, it is noted that most countries are net importers of electricity. In 2010, the transmission system loss for Zimbabwe was 4%, which is in line with most Southern African Development Community (SADC) countries which ranged from 3.2% to 4.5% during the same period. Other countries which experienced relatively high transmission losses compared to Zimbabwe are Swaziland (6%), Mozambique (7%), Malawi (7.7%), DRC (9.3%), Angola (10%) and Lesotho (11%). The system transmission losses of Zimbabwe are expected to decline in the near future since the African Development Bank (AfDB) intent to reinforce the transmission and distribution systems to improve the reliability of the power grid and to reduce the portion technical losses (AfDB, 2011). This will ensure constant and uninterrupted supply of electricity to vital sectors of the economy.

Table 3 also shows that the rate of return for ZESA in 2010 was -34%, meaning that ZESA is making sub-optimal profit. This has some implications to the fiscus since it would require a subsidy through the national budget, crowding out other equally important projects. This implies that there is need to consider engaging the private sector to fund the refurbishment of existing power stations and also for the construction of additional power plants through PPPs. The issue of electricity tariff must be revisited to make sure that it covers costs that are incurred to incentivise potential investors in the electricity sector and IPPs with excess power to export to the national grid.

The SAPP annual maximum demand forecast for the respective power utilities for the period 2012 to 2025 reveals that the demand for electricity is expected to rise (Table 4). The Maximum demand forecast for Zimbabwe is expected to almost double from the current 2100MW[8] to 3674MW in 2025. If no investments are undertaken, the gap between available and maximum demand will widen. Given that electricity is an important factor of production, the deficit will have an impact on the performance of companies in different sectors of the economy. This will happen at a time when other countries with inadequate power supply are busy constructing their power stations to cover the deficit and for future demand. A meeting with ZESA official revealed that South Africa and Botswana are constructing their own power stations.

[7]Namibia (3.2%), South Africa (3.3%), Botswana (3.6%), Zambia (4.4%) and Tanzania (4.5%)
[8]ZESA, June 2010

Table 4: Annual Maximum Demand Forecast (MW), 2012 - 2025

	Utility	2012	2013	2014	2015	2020	2025
Angola	ENE	1320	1426	1540	1657	2226	2871
Botswana	BPC	817	864	904	928	1183	1272
DRC	SNEL	1655	1723	1795	1865	2229	2723
Lesotho	LEC	152	156	160	165	188	214
Malawi	ESCOM	394	412	430	448	541	629
Mozambique	EDM	690	722	757	793	974	1208
Namibia	NamPower	576	599	623	651	779	933
South Africa	Eskom	42923	44005	44998	45952	50316	53878
Swaziland	SEC	245	255	264	271	304	323
Tanzania	TANESCO	916	955	995	1037	1275	1566
Zambia	ZESCO	1894	1919	1944	1970	2171	2407
Zimbabwe	ZESA	2414	2484	2558	2643	3115	3674
Total Interconnected		51366	52727	54003	55238	61259	66632
Total SAPP		53966	55520	56969	58380	65301	71698

Source: SAPP Annual Report (2010)

1.5 Challenges Faced by ZESA

There are a number of challenges being faced by the power utility ZESA in the generation and distribution of electricity. Aged and obsolete equipment and poor state of infrastructure as well as vandalism of the power network infrastructure hamper the efficient generation and distribution of electricity. The power utility is also not spared by skills shortages especially in professional and technical grades due to human capital flight in search of greener pastures. There is also lack of adequate working capital to support Hwange Power Station refurbishments and small thermals to unlock their full generation potential. Small thermals are expensive to run at an average cost of US13c/kWh, compared to about US5.6c/kWh for Hwange Power Station.

The country also face challenges to finance the construction of new power stations since ZESA has no financial capacity to fund these huge capital projects on their own. A meeting with ZESA official revealed that viable projects have been identified and feasibility studies carried out on some of the projects and they are only awaiting funding. To address some of these challenges the Government of Zimbabwe opened up participation of private players to engage in power generation as IPPs, or as PPPs. However, the tariff must be charged in line with the costs incurred since it has a direct impact on the companies' total cost of production.

Mumvuma (2010) indicates that between 2006 and 2008 electricity was sold to

customers at US1c/kWh. The price did not cover the cost of generation and transmission of electricity which led to the dilapidation of electricity infrastructure. The tariff rose to US7.53c/kWh in 2009 after the adoption of the multi-currency system. The massive increase in electricity prices of over 700% in 2009 made electricity unaffordable to the majority of consumers. Most consumers have defaulted leading to ZESA accumulating a debt of more the US$400 million, making it extremely difficult to refurbish its power plants and to venture into new projects. Defaulting customers and vandalism of transformers made it extremely difficult for ZESA to offer a reliable and efficient service. About US$300 million was spent in 2010 to repair vandalized transformers[9]. Despite the problems faced by ZESA, it is still one of the cheapest utility in the region after Botswana. The utility currently charges US9.98c/kWh after the 31% tariff increase effective 1st September 2011 as opposed to the regional average of US12.6c/kWh. Comparative regional electricity tariffs are shown in Table 5. Countries which charged higher tariffs compared to Zimbabwe are highlighted in purple whereas the tariff for Zimbabwe are highlighted in green.

Table 5: Comparative Regional Electricity Tariffs (cents/KWh), 2005 - 2010

Country	Utility	2005	2006	2007	2008	2009	2010	2011
Angola	ENE	2.88	4.77	10.72	9.19	-	10.06	-
Botswana	BPC	5.55	4.71	5.22	4.24	-	5.45	-
DRC	SNEL	3.20	3.20	-	3.20	-	-	-
Lesotho	LEC	6.17	7.23	6.59	8.14	-	6.45	-
Malawi	ESCOM	0.55	0.55	3.91	5.15	-	4.34	-
Mozambique	EDM	7.07	8.48	9.13	9.13	-	10.70	-
Namibia	NamPower	5.69	5.68	4.70	6.03	-	8.50	-
South Africa	ESKOM	2.43	2.59	2.61	2.84	-	4.57	-
Swaziland	SEB	7.00	6.99	6.49	6.49	-	11.23	-
Tanzania	TANESCO	7.38	7.38	11.78	7.38	-	8.17	-
Zambia	ZESCO	1.88	2.57	3.13	2.55	-	2.45	-
Zimbabwe	ZESA	1.98	2.81	1.26	0.78	7.53	6.23	9.98
Regional Average		4.32	4.75	5.96	5.47		7.11	12.6

Green shading– tariff for Zimbabwe
Purple shading –higher tariff compared to Zimbabwe
Source: ZETDC, 2011 and ZESA Website, 2011

[9]1st United Nations Development Programme (UNDP) - ZEPARU Poverty Reduction Seminar Series workshop report, held on 22 November 2010: Rainbow Towers Hotel

In 2005, Zimbabwe's electricity tariff of US1.98c/kWh was lower than most power utilities in the SADC region except for ESCOM and ZESCO which were charging US0.55c/kWh and US1.88c/kWh respectively. The tariff for ZESA was far below the regional average of US4.32c/kWh and the same scenario happened in 2006. In 2007 and 2008, ZESA was charging the lowest tariff at US1.26c/kWh and US0.78c/kWh against a regional average tariff of US5.96c/kWh and US5.47c/kWh respectively. In 2010 and 2011, ZESA tariff was still below the regional tariff.

1.6 Study Rationale

When investigating the electricity-economic growth nexus, it is important to identify the linkages between the sector and macro economy. Being part of the basic economic infrastructure, the electricity sector provides an essential input to all other economic sectors. It is apparent from the above that the country faces a number of challenges in ensuring the consumers with adequate and reliable electricity supplies. This is occurring at a time when the economy is recovering from a decade long economic turmoil that bedevilled the economy. Also the economy cannot satisfy the peak national demand at a time when the regional power utility SAPP is facing diminishing excess capacity in the SADC region.

Imports are also not enough to cover the generation deficit, implying that there is still need for expansion or entry by other players. In 2010 for example, imports were estimated to be a maximum of 500 MW, at a time when the generation shortfall was over 700MW. This resulted in a deficit of about 200 MW leading to rolling load shedding. This impacted on performance of companies which required an uninterrupted power supply to meet their production targets at minimum costs. Some companies used alternative energy sources, such as generators which proved to be unsustainable.

Given that electricity is a key factor of production, availability of reliable electricity is deemed very important. The economy also has abundant potential projects where feasibility studies have been done. Potential projects such as the undertaking of Hwange 7 and 8, Kariba South Extension, Lupane gas and Batoka are awaiting investments as shown in Table 6. The 1600MW for Batoka Gorge is to be shared between Zimbabwe and Zambia. Interviews with key informants revealed that the expansion of Kariba can be considered in 2015. If all the projects are implemented, they will dwarf the electricity generation capacity.

Table 6: Generation Expansion Projects

Name of Plant	Number of Units	Construction Lead Times (Years)	Estimated Power Plant Construction costs US$ million	Related Transmission Costs US$ million	Grand Total US$ million
Hwange 7 and 8	2x300 MW	3	420	80	500
Kariba South Extension	2x150 MW	4	200	0	200
Lupane Gas	1x150 MW 1x150 MW	4	250	16	266
Batoka	1600 MW	6	1117	92	1209
Total Projects Costs			3123	262	**3385**

Source: Dube et. al., (2007, p.g 38)

There is also a lot of potential for mini-hydros as sources for electricity generation, given that they can take place at irrigation dams and from fast flowing rivers. It has been generally observed that in Zimbabwe, this potential is confined largely to the Eastern Highlands where the rivers flow throughout the year. The mountainous terrain also favours mini-hydro electricity generation. Feasibility studies for these small hydro plants have already been completed, and those sites identified include those shown in Table 7.

Table 7: Small Hydro potential in Zimbabwe

District	Site	Capacity (MW)	Annual Energy Production (GWh)
Mwenezi	Manyuchi	1.4	5.5
Masvingo	Mutirikwi	5	40
Mutasa	Osborne	3	23.6
Bikita	Siya	0.9	5.6
Mutasa	Duru	2.3	6.0
Nyanga	Gairezi	30	70
Nyanga	Tsanga	3.3	8.8

Source: Ministry of Energy and Power Development website, accessed 26/11/2011

Small hydro power stations which have the capacity to produce 120MW are expected to boost the country's internal generation capacity. By their geographical locations mostly in the eastern and southern districts, located far away from the major generation centres at Hwange and Kariba, the mini hydros will have an effect of reducing transmission costs currently being incurred. The prioritised mini hydro projects for implementation are Gairezi in Nyanga (at an estimated cost of US$50million), Mutirikwi in Masvingo (US$10million) and Manyuchi in Mwenezi (at US$3million)[10].

The other problem that is currently affecting the undertaking of potential projects is the mixed reactions on the implementation modalities of the indigenization and economic empowerment laws which requires foreign companies to dispose 51% of their shares to indigenous Zimbabweans. The issue of lower tariff which is regarded as below optimal level by both ZESA and IPPs can also be a deterrent to new investors.

The broad objective of this study is to investigate the role of electricity supply in enhancing economic growth in Zimbabwe. Specific issues to be covered by this paper are as follows:

- Reviewing literature on the electricity - economic growth nexus;
- Linkages of electricity to selected sectors of the economy;
- Determining the role of electricity supply to selected sectors and economic growth in Zimbabwe through targeted interviews;
- Recommending a strategy to achieve reliable electricity supply to attain economic growth.

2. LINKAGES BETWEEN ELECTRICITY SUPPLY AND ECONOMIC GROWTH

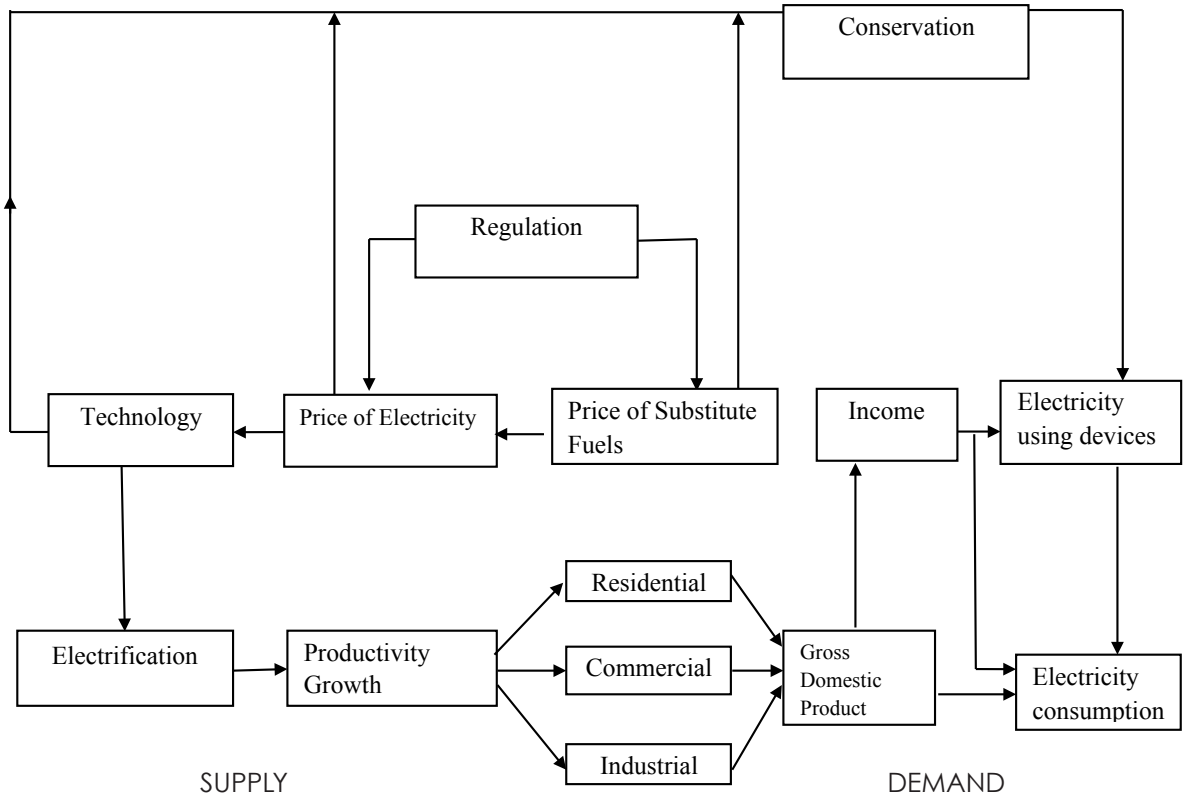
Understanding the nexus between electricity supply and economic growth is very vital in the effective design and implementation of energy policy. Natural scientists and some ecological economists place a very heavy emphasis on the role of energy and its availability in the economic production and growth processes (e.g. Hall et. al., 2001, 2003 as cited in Stern et al., 2004). Hence gaining an understanding of the role of energy in economic growth cannot be achieved without first understanding the role of energy in production.

The second law of thermodynamics (the efficiency law) implies that a minimum quantity of energy is required to carry out the transformation of matter. Therefore there must be limits to the substitution of other factors of production for energy. All economic processes must, therefore, require energy, so that energy is always an essential factor of production (Stern, 1997a). But these are not given an explicit role in the standard macroeconomic growth theories that focus on labour and capital. Therefore, understanding the role of energy in the mainstream theory of growth is not so straightforward and the role of energy as a driver of economic growth and production is downplayed.

Electricity (as an especially high grade of energy) may facilitate technological advances and in turn stimulate the economy, by providing gains in productivity

(Stern, 2004). Stern (2004) also suggests that electricity supply – Gross Domestic Product (GDP) relationship is affected by a host of factors. Among those believed important are prices of electricity and competing energy forms; composition of national output; regional economic activity; technical change; conservation practices; and government policies (Figure 3).

Figure 3: Relationships affecting Electricity and Economic Growth



Source: Committee on Electricity and Economic Growth Energy Engineering Board, (1986)

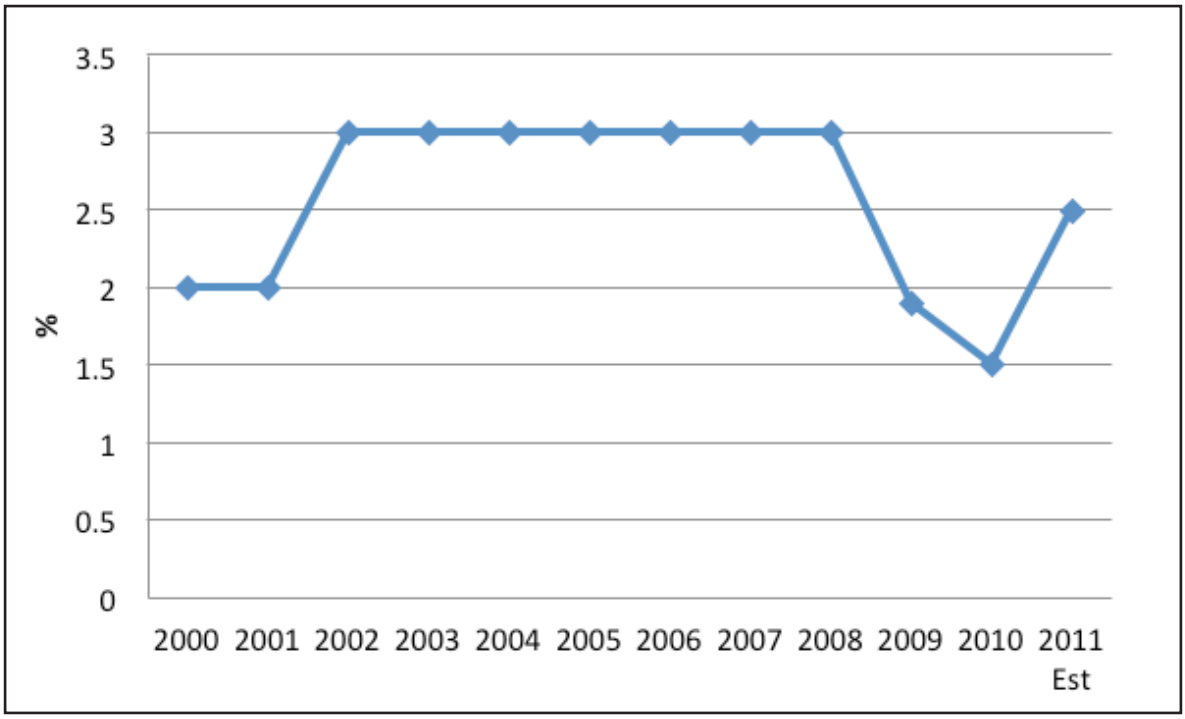
Only when there are major disturbances in the trends (not simply movements about the trend lines) of these underlying variables would be changes in the basic electricity use – GDP relationships be expected. Two forces believed capable of altering the trends of future electricity use and economic activity relationships are electrification and conservation. Furthermore, there is an implicit dependence of electricity consumption on energy prices through the dependence of GDP in part on productivity growth, which in turn shown to depend on energy prices. Productivity growth may be ascribed partly to technical change in many industries. Technical change also tends to increase the relative share of electricity in the value of output. Hence electricity supply is a prerequisite for economic growth given that electricity is a direct input in the production process which complements labour and capital inputs (Toman and Jemelkova, 2003).

The linkage of electricity to other sectors in Zimbabwe became very evident during the periods of economic collapse. The falling capacity utilisation levels and the sluggish response to the improvements in the economy have been attributed to erratic power supplies. According to the Confederation of Zimbabwe Industries (CZI)'s 2010 Manufacturing Sector Survey Report, industry needs a minimum of 18 hours of uninterrupted power supplies to enhance capacity within operations, which explains why manufacturing companies are failing to perform well as this is something not achievable given ZESA's capacity. Interviews with key informants revealed that the mining industry's biggest challenge is the unavailability of electricity. The mining industry is a major consumer of electricity, such that the unavailability of electricity had resulted in some companies importing electricity directly from Carhora Basa.

The importance of the electricity sector to the mining industry is also revealed in Kaseke (2010), who estimated the costs faced by the mining sector in Zimbabwe due to power outages in 2008. The study uses two methods to estimate the costs; the direct assessment method and the captive generation method. The direct cost method encompassed costs in form of the value of output lost, labour cost, material destruction cost, running very expensive backup power generating equipment, for example generators and other cost such as restart cost and damage to equipment cost. It revealed that the total outage costs of the surveyed mines were US$18876586 and the total cost for the sector was US$251007576.

The contribution of electricity together with water to GDP in Zimbabwe hovered around 2% between 2000 and 2002 (Figure, 4). The contribution of electricity was lumped together with water because the Zimbabwe National Statistics Agency (ZIMSTAT) does not disaggregate the two when reporting its statistics. From 2002 to 2003 there was a slight increase in the contribution of the sector to GDP to around 3%. It remained stagnant until 2008 when it declined to about 2% and 1.5% in 2009 and 2010 respectively. In 2011, it is estimated that the contribution of electricity and water is expected to recover to 2.5% presumably because of the refurbishments of Hwange and Kariba power stations during the year. This is despite the fact that electricity supply is still inadequate for its customers.

Figure 4: Electricity and Water contribution as a Percentage of GDP, 2000 – 2012



Source: ZIMSTAT, 2010 and Ministry of Finance 2011

The electricity sector contributed only 0.74% to total employment in 2009 (ZimStat, 2010). This is due to the fact that the sector is capital intensive.

3. METHODOLOGY AND KEY FINDINGS

3.1 Methodology

The study involved a desk research, which benefited from published information on the Zimbabwe electricity sector. In addition, interviews with key informants from major players in the electricity, manufacturing, mining and agriculture sectors were conducted. Results from the interviews were used to form the basis for analysis and policy recommendations.

3.2 Emerging Issues from the Interviews

Issues raised during interviews with companies in the manufacturing sector were that per unit costs of electricity in Zimbabwe are higher than those being faced by their competitors, hence giving their competitors some competitive advantage in terms of pricing. This is also compounded by load shedding, where generators would be used as substitute, which also increase the cost of production. In addition, some furnaces are expected to run without stopping, resulting in power outages causing damages which are expensive to repair. Some manufacturing companies lamented that they pay huge electricity bill of about $20,000 every month, which is deemed to be unsustainable.

Interviews with key informants in the in the mining sector revealed that most mining companies are among the bulk consumers of electricity. Some of these companies are ZIMPLATS, MIMOSA, Unki, Rio Zim, Bindura Nickel BNC, Hwange Colliery, Chiadzwa, and Renco Mine. Mining companies were given priority by ZESA to have a constant supply of electricity from small thermals at a relatively higher cost of US$12.77c/kWh against a general tariff of US9.98c/kWh. Most of these companies subscribed to a higher tariff. Although the higher tariff imply a general increase in production costs, mining companies which are generally bulk electricity consumers find it cost effective to subscribe to the tariff since the majority of the mine equipment runs on electricity. Key stakeholders from the mining sector suggested that on average, mining sector companies require at least 16 hours of uninterrupted power supply per day in order to maintain production levels. However, underground mines need a constant un-interrupted supply of electricity to prevent them from being flooded by underground water streams. Some companies have invested in alternative sources of energy such as industrial generators to supply the mines with constant supply of power, which have proved to be more expensive and costly to run and maintain since they run on diesel energy. When minor power cuts do occur, they damage machinery which must be run without stopping. Repairs of damaged machinery are very expensive. The higher tariff is comparable to the SAPP regional average tariff of US12.6c/kWh for 2011.

An interview with Hwange colliery revealed that the company has an understanding with the HPC where they are guaranteed of a constant supply of electricity, since they supply coal used to fire the power stations. The company produces an average of 2000 tonnes of coal per day, with two shift, hence they need 16 hours of uninterrupted power supply per day in order to maintain production levels. The underground mines also require a constant supply of electricity to prevent them from being flooded by underground water streams. Electricity constitutes less than 10% of the unit cost of production with mine being charged US9c/kWh. In the medium to long term, the firm aims to be an IPP and is in the process of carrying out feasibility analysis for setting up a power plant if a technical partner is found.

Players in the agriculture sector revealed that power supply is essential to power irrigation schemes especially in winter when 100% irrigation is required. In summer, supplementary irrigation is also required to achieve higher yield. The wheat, horticulture and dairy sub-sectors require uninterrupted power supply to achieve maximum yield per hactare. Tobacco and cotton mostly rely on rainfall. For maize, the majority of the hecterage is planted on dry land. Wheat is the largest consumer of electricity and it requires 100% irrigation. The wheat sub-sector has some preferential treatment to encourage farmers to grow it since Zimbabwe is a net importer of wheat. An interview with Commercial Farmers Union (CFU) revealed that about 410,000 metric tonnes of wheat are required to meet local demand as opposed to only 10,000 metric tonnes which were produced last season against a peak of 310,000 metric tonnes produced in 2001. Interruptions in power supply were attributed as one of the factors that led to the lower yields.

The CFU representative argued that the negative impact of power cuts was felt, for instance on 15 May 2011 when Kariba power station was down when they wanted to geminate wheat. This resulted in a decline in yields due to moisture stress. It was mentioned that wheat requires moisture to be one metre deep for the first six weeks to enable the maximum yield to be achievable. It was mentioned that sometimes farmers produce less than 5 metric tonnes per hectare (mt/ha) compared to the optimum yield of 16 mt/ha. To address the problem of unreliable power supply, the Zimbabwean government urged farmers to form wheat farming clusters which constitute medium and large scale farmers. The clusters get 3 blocks of 12 hours per week of uninterrupted power supply, which is a substantial improvement and CFU applauded the government for that. The cost of electricity to production is about US$194/ha as opposed to fertiliser and seed, and harvesting and transport which require US750/ha and US$330/ha respectively. It was mentioned that farmers use generators only at critical times because it is not cost effective.

CFU complained that when power is restored, restarting the motors will require three times the normal amount of power. Hence, big motors that pump big volumes of water would push the farmer into maximum demand and is charged more. The use of estimates by ZESA was also considered to be causing distortions. It was also mentioned that crops/hactarage are irrigated in cycles and interruptions in power supply will result in direct impact on yield.

A meeting with ZESA official revealed that ZESA had to go for a tender, looking for companies that were prepared to access electricity produced by small thermals without any interruptions at a rate of US13c/kWh, and about 100 companies responded positively. This shows that some companies are prepared to access electricity even at a much higher price if they are guaranteed that they will not be affected by load shedding.

Interviews with key informants also revealed that for IPPs to export excess power to the national grid there is need the following in place:

- Energy policy;
- Investment policy;
- Investment protection bill enacted; and
- Energy regulators law enacted.

Currently there are drafts of the above mentioned policy but these policies need to be finalised with urgency. It was also noted that although there are a number of generation expansion projects, these projects take time to be completed. For the power plants to start its operations there are quite a number of issues to be ironed out such as, the need for feasibility studies to be undertaken, negotiations on special purpose vehicles (shareholding), financial closures and tendering for the constructor. The probable operational dates for Kariba South Extension, Hwange 7 and 8 and Gokwe North were pegged at 2017, 2018 and 2019 respectively, if the whole process is started with immediate effect. It was also mentioned that there is also a general lack of understanding on the role of the proposed Kariba South extension, as this is intended only to help during periods of peak demand like in winter, as the power station would not able to run 365 days a year.

Concerning the issues of vandalism, interviews with key informants revealed that the Zimbabwean government should impose stiffer penalties for those caught vandalising ZESA's transformers. While stiffer penalties for those caught will result in a deterrent effect, the current laws allowing the export of scrap metal are incentives for vandalism. Scrap metal is a good business with little value to the economy, and vandalised equipment end up finding its way into the export market as scrap. Hence export of scrap metal should be abolished.

The SAPP revealed that electricity projects are capital intensive projects and long-term, requiring huge capital investment as well as long term commitment. Security of investment under such a scenario is therefore a critical issue. The coming in of indigenous players can only be possible if they have the requisite funding and the expertise to run the power stations. Another critical issue for the electricity sector is that Zimbabwe is currently in a deficit and only investment in expansion projects could address the situation. The sector is also a growth driver for other sectors of the economy due to its linkages with all sectors, which also needs to be borne in mind during the indigenisation debate. Investors also want to participate in bankable projects with credible off-takers and high return on investment. The financial position of the power utility as reflected on the balance sheet has to be healthy, indicating the ability to repay debts.

Financing for the electricity sector is also a challenge due to the long term nature of the projects, e.g a project could be generating returns after 5 years. However, there is scope to make profit in the electricity sector provided that players charge an optimal tariff which caters for the generation, transmission and a fair profit. In Zambia for example, there are many independent players in addition to ZESCO, the Zambian national power utility. Zimbabwe is also making strides towards establishing IPPs to ease the electricity shortage in the economy by exporting excess power to the national grid.

The REA is expanding the grid to the rural areas implying that the demand for electricity would increase. Electricity in rural areas should be seen beyond lighting households; grinding mills and business centres can benefit a lot, through facilitation of creation of cottage industries. Schools and clinics also benefit from access to electricity. It was noted that although it may seem to be cost ineffective to extend the grid to rural areas instead of pursuing wind and solar energy, the issue of sustainability has to be considered. Solar and wind energy cannot adequately sustain cottage industries and cannot be used for cooking. Thus these should complement, rather than replace the rural electrification programme.

A possible solution which was highlighted during the interviews is engaging demand side management and load management strategies. Demand side management programs involve measures that specifically seek a deliberate reduction in the use of electricity below some levels that would otherwise prevail, for example in South Africa there are arrangements where some companies allow the utility to cut off supply when they do not have need for it. Several benefits can be accrued, if demand side management options are vigorously

pursued. Some of the benefits are that demand side management reduces the need for commissioning new power plants and construction of new transmission and distribution lines thereby reducing capital investment costs and improving power reliability and quality of supply. Interviews with key informants revealed that there is also need to package generation expansion projects such as Gokwe North and Batoka projects as regional projects rather than as national projects, as the projects are too big for the generated electricity to be absorbed in the country without any export to benefit the region. Classifying the project as a regional project could enhance chances for getting funding.

In an effort to use electricity more efficiently, the SAPP has introduced the use of compact fluorescent lamps (CFLs) in a bid to replace the inefficient incandescent bulbs. A number of utilities rolled out the CFL programs using different modes of delivery. The implementation of CFL program is part of a wider strategy to supplement the supply side strategies by creating a virtual power station of 4500MW in the SAPP region. It is estimated that in the SAPP region CFL program achieved savings amounting to approximately 750MW in 2010.

ZESA is also advocating for the use of energy savers, in line with SAPP's CFL program. ZESA was planning to distribute about 5,5 million energy-saver bulbs countrywide before the end of 2011. The use of energy saver bulbs will result in the power utility saving about 200MW, doubling the current available capacity of the combined small thermals. An interview with ZESA official indicates that CFLs last longer with at least 8 000 hours compared incandescent bulbs which lasts for about 1000 hours. The presence of mercury, a heavy toxic metal in the CFLs has raised concern since the disposal of CFLs after use might cause an environmental hazard. Thus 'SAPP Guidelines on the Use and Disposal of CFLs' have been developed to assist utilities and waste handling agencies in various SAPP countries to manage the CFLs in an environmentally sound manner. The used CFLs should be treated as hazardous waste and as such should be disposed at hazardous waste landfills.

It was also mentioned that the body which regulates ZESA (ZERA) should be an independent body from the government for it to be effective. This is despite the fact that some employees from ZESA were subcontracted by the then ZERC. Also ZERC used to get its funding from ZESA and they reported to the government of Zimbabwe. Another important player is the Regional Electricity Regulators Association (RERA), which is working flat out to harmonise regulation and tariffs in the region, which will also affect Zimbabwe.

It was also mentioned that indigenous investors must be given priority to participate in the construction of small hydro power stations which requires less funding. To construct a power station which produces only 1MW requires US$1.5 to US$2 million capital injection hence it might not be possible for indigenous players to eye huge investments like Gokwe North with the capacity of producing 1400 MW which require billions of dollars. Interviews with key informants revealed that ZESA can also reintroduce the electricity prepayment system which could not be sustained during

the hyperinflationary period. The system was no longer compatible with the rapid increase in the number of digits.

It was also noted that the indigenisation debate should take into account that indigenisation is complementary to huge capital requirement and the requisite expertise for it to be successful in the power sectors. There are also areas where indigenous people can benefit in the electricity sector rather than focusing on generation, and these include billing and support services for ZESA, especially under the re-introduction of the prepayment system.

4. CONCLUSION AND POLICY RECOMMENDATIONS

4.1 Conclusion

There has been sustained deterioration of power infrastructure due to ageing plant and equipment and lack of regular maintenance due to unavailability of funds. Small thermals are said to have gone past their lifespan. This is happening at a time when industrial demand for electricity for the resuscitation of the economy is expected to increase. Prospects of importing electricity in the region are very low due to diminishing excess capacity in the SAPP region. The capacity for the Government to invest in the electricity sector through construction of additional power stations, which requires high investment costs is minimal due to lack of fiscal space hence the need for private sector participation through PPPs and IPPs. Entry into the sector by IPPs is not guaranteed since the tariff is deemed to be unsustainable. Given that the prices for the electricity substitutes are higher than that of electricity, switching to other alternatives are also unsustainable. The agriculture, mining, manufacturing and household sectors have been affected by unreliable and inadequate supply of electricity. Interruptions, in power supply including shortages have repercussions on any efforts to sustainably grow the economy.

4.2 Policy Recommendations

- The capital-intensive nature of the electricity industry acts as a prohibitive factor for construction of additional power stations by the government of Zimbabwe, the traditional investor in the electricity power sector due to lack of fiscal space. What ought to be done is to engage the private sector through PPPs to construct power plants. The rate of generation expansion must be guided by the forecast maximum demand of the economy done by ZESA and SAPP.
- There is need for an energy policy, an investment policy, an investment protection bill enacted and energy regulators law enacted to smoothen the participation of IPPs.
- The setting of the tariff should enable viability of service providers to enable IPPs and PPPs to come on board. The tariff must cover the costs of generation, transmission with a fair profit. The tariff should be reviewed to enable the power utility to recover operational costs and to achieve financial sustainability. The new tariff of US9.98c/kWh, which is far below the regional average, is deemed unviable

by ZESA and IPPs. Currently IPPs are negotiating new power purchase agreements pegging their electricity prices between US16c/kWh and US21c/kWh, which is almost double the price being charged by ZESA.

- There is need for a transparent and predictable tariff setting methodology. In 2009, the tariff charged by ZESA was classified according to the location of the customer's residential area for households instead of the actual electricity consumed.
- Vandalism of electricity equipment should be included as legislation in Zimbabwe just like what Zambia has done. Maximum penalties should apply for theft and vandalism of power equipment and that the laws in the region should be harmonised to discourage export of vandalised electricity equipment.
- Need to do away with the culture of non-payment of electricity bills.
- Indigenous players can participate in small hydros which require less funding.
- Demand side management initiatives must be intensified to send right signal to consumers to limit consumption of electricity. The use of incandescent bulbs can be prohibited in favour of energy savers.
- The Government of Zimbabwe and ZESA must comply with the target of full rehabilitation of powers system by 2013 as stated in the MTP.
- Due to its geographical location, Zimbabwe is at the centre of the regional grid and therefore well positioned to get maximum benefit from bilateral and multilateral power generation and transmission projects with its neighbours. Cooperation with Zambia and Mozambique in the development of the Zambezi hydropower resources can provide more competitively priced power for the country and for SAPP in the medium to long term. Specifically the country needs to define the acceptable balance between local and imported or exported electricity and to commit resources for joint project development for generation and transmission interconnections.
- Since thermal power plants are cheaper to invest but expensive to run, the country should prioritise investment in hydro power plants which are expensive to set up but cheaper to run.
- In view of the empowerment drive of the Indigenization and Economic Empowerment, the need to strike a neat balance with the meaningful attraction of foreign direct investment to support sustainable economic growth cannot be over-emphasized hence the need for clarity on the Act is critical.

5. REFERENCES

African Development Bank (2011), Emergency Power Infrastructure Rehabilitation Project: Zimbabwe, Project Appraisal Report, 15 February 2011

Altinay, G. and Karagol E (2005), Electricity consumption and economic growth: Evidence from Turkey, Energy Economics 27 (2005) 849–856, Elsevier

Bhagavan, M. R (2003), Some Public Benefit Policy Aspects in Reforming the Power Sectors in East and Southern Africa, Paper presented at the International Workshop on Public Benefits and Power Sector Reform, 12–13 May 2003, Stockholm, Stockholm Environment Institute

Confederation of Zimbabwe Industries (CZI) 2011Manufacturing sector survey

Confederation of Zimbabwe Industries (CZI) website, www.czi.co.zw

Dube I, Chiguvare Z and Chipumho E (2007), Zimbabwe Integrated Energy Study, ZEPARU Working Paper Series

Ist United Nations Development Programme – Zimbabwe Economic Policy Analysis and Research Unit Poverty Reduction Seminar Series workshop report, held on 22 November 2010, Rainbow Towers Hotel

Kahsai, M. S; Nondo, C; Schaeffer P. V;Gebremedhin, T. G (2010), Does Level of Income Matter in the Energy Consumption and GDP Nexus: Evidence from Sub-Saharan African Countries Research Paper 2010-7

Kaseke, N (2010), The Cost of Power Outages in Zimbabwe's Mining Sector, The African Executive, Issues 277 August 11-17, 2010

Ministry of Energy and Power Development, Zimbabwe, website www.energy.gov.zw

Mumvuma, T (2010), A Review of Utility Pricing in Zimbabwe: The Case of Electricity, Paper presented at the Ist United Nations Development Programme (UNDP) - ZEPARU Poverty Reduction Seminar Series, held on 22 November 2010, Rainbow Towers Hotel

Nyatanga, 0 (undated), Presentation on Power Generation Options, ZESA Holdings Pvt Ltd

Rafemoyo, B (2010), Investments and Outlook for Zimbabwe's Power Sector in: Generation, Transmission and Distribution, Presentation at Zimbabwe Mining Indaba 15 to 17th September 2010

Short Term Emergency Recovery Programme (STERP), Ministry of Finance, Zimbabwe 2009

Stern, D. I (2004), Economic Growth and Energy, Encyclopedia of Energy, Volume 2, Elsevier

Stern, D. I and Clevelend, C. J (2004), Energy and Economic Growth, Rensselaer Working Papers in Economics, Rensselaer Polytechnic Institute, Department of Economics

Toman, M. T. and Jemelkova, B (2003), Energy and Economic Development: An Assessment of the State of Knowledge, The Energy Journal, International Association for

Energy Economics, vol. 24(4), pages 93-112

ZESA (2010), Investments and Outlook for Zimbabwe's Power Sector in: Generation, Transmission and Distribution. A presentation by Eng Ben Rafemoyo, during a Zimbabwe Mining Indaba 15 to 17th Sept 2010

ZESA website www.zesa.co.zw, accessed June 2011

Zimbabwe Draft Energy Policy (2009), Ministry of Energy and Power Development

Zimbabwe Medium Term Plan 2011-2015 (2011), Ministry of Economic Planning and Investment Promotion, Republic of Zimbabwe

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