The Impact of Electricity Supply in Malawi on Economic Development

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Abstract: The need for electrical infrastructure development in Malawi has to be revisited as the population growth and demand for electricity is increasing. In achieving the outcome of this study time series data from the year 1991-2014 has been used. In application of ARDL approach the results shows that load shading occurs periodically as results of high demand in electricity and low supply. It has been seen that the country has only few power generators which produce electricity in small quantity which does not meet the required demand. It has been seen that there might have been a long-run relationship between power utilization and GDP per capita in the country. The economy is mostly dependent on energy for manufacturing sector and other sectors to function productively and contribute to the economic growth.

Keywords: Economy, Electricity, Growth, Infrastructure, Manufacturing

1. Introduction

Electricity supply commission of Malawi (ESCOM) remains the monopoly in generating, transmitting and distributing electricity in Malawi. That is 95% of the electricity generated by the company is noted to be hydropower. It has been noted that the company is approximately serving 200,000 customers which have been categorized as domestic, general, commercial and industrial. This symbolizes 8% of total population in Malawi. That is 92% of the population does not have access to electricity ESCOM (2015). The country experience high load shading during peak periods due to number of factors which exist in different power generating stations. Sustainable growth is regarded as a key to poverty reduction, improvement in people's living standards and increased employment levels. Due to other circumstances the countries experience various problems such as inadequate energy generation and supply, increased unemployment, and environment degradation due to poor agriculture planning and poor infrastructure in the country. This creates more gaps in the export base and increases in imports thus threating the balance of payments.

The country's climate change as well puts the country low growth margin as the country's country I the past decades has been agro-based. MGSD II plans support that by integrating the economy. An MGDS strategy is to continue implementing the interventions aimed at guaranteeing sustainable economic growth in the country. This improves growth in sectors like agriculture, mining and tourism, thus creating conducive environment for private sector participation in the economy. The sustainable economic growth has been based in basic areas like agriculture; natural resources and environmental management; mining; private sector development, industry and trade; rural development; tourism, wildlife and culture; labour and employment; and land. It has been seen that all these sectors cannot function properly without enough energy generation for them to be productive. This sheds light in that a well-developed and efficient energy system is crucial for industrial growth, mining and tourism development. Thus government has to take its sole responsively in considering energy sector during its budget allocation every fiscal year. According to MGDS II strategy, government will focus on increasing the generation, transmission and distributing of electricity and promote energy sources with the gist of improving service delivery in the economy. To advance mechanical improvement, Government will advance utilization of current innovation in assembling; encourage accreditation of value confirmation establishments; embrace modern changes; advance item and business sector expansion; and advance worth expansion in existing and potential items. Government will likewise execute various procedures to advance mining and tourism parts.

In Malawi the demand for electricity is always high in heavy industries, commercial loads like Illovo Sugar Company, tea and cotton companies and agricultural loads. Furthermore, a coal and uranium

Table 1: Electricity Generating Plants

Generating Plant	Units Generated	Quantity of Power Generated (MW)		Year Installed
Nkula A Nkula B	3 3 1 1	8 20 20 20	24 60 20 20	1966 1980 1986 1992
Tedzani Falls I Tedzani Falls II Tedzani Falls III	2 2 2	10 10 26.35	20 20 52.7	1973 1977 1996
Wovwe Min Hydro	3	1.45	4.41	1995
Kapichira Falls phase I	2	32.4	64.8	2000
Mzuzu Diesel Unit	1	1.1	1.1	
Likoma Islands Diesel Units	3	0.25	0.75	
Chidzumulu Islands Diesel Units	2	0.15	0.3	
TOTAL	**25**	**149.7**	**288.06**	

Source: ESCOM (2015)

mine in the northern region and timber Ripley industrial loads consumes much of the energy produced. Table 1 shows Malawi's generating plants, quantity of power each station produces based on its units per plant and the year each plant was installed.

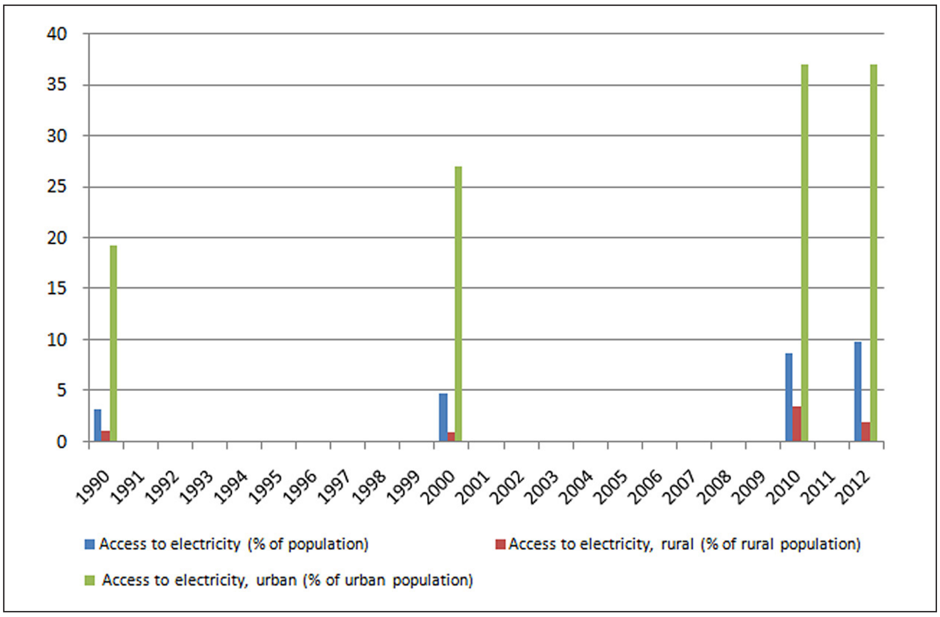
Table 1 also shows that Nkula and Tedzani remain the main power generating stations in Malawi. There are various stations which have been elected but these stations produce small quantities of electricity to meet the actual demand of customers in the country. The country had 15 million people by 2011. Thus the population counts rose to 16.36 Million by 2013. This population is expected to rise to 17.6 Million in 2015. Due to rise in population demand for better life also increases. Due to this the demand for electricity in the country rises every year. As of 2013 the demand for electricity was 360 MW and this amount was projected to 400 MW at the end of the year. This amount is quite small compared to the actual supply in the country. As seen in Table 1 above the overall generation stations can only produce and supply 288.06MW of power in the country. This creates more gaps for increased load shading in the country thus reducing productivity in manufacturing industries, firms and other sectors which are dependent on energy for it functioning.

Electricity generation in Malawi is constrained with various challenges. This hinders the company to manage supply enough energy to its customers. Mostly due to high resistance affect the system experience high transmission loss which is mostly caused by long transmission distances at low voltages. Mostly the cables carry 66kv and 33kv of energy. Due to increased load shading most investors run away from business environment that is tarnished with continuous power cut. Due to this economic growth retards. One of the most worrying issues is that most of the energy produced in the country is hydro-based and this puts pressure on in the long-run in the sense that the generation is dependent on the amount of rainfall. Thus if drought occurs shire river would stop flowing and this would result into power crisis in the country. As a purpose of compiling this study unbundling of the utility and issuing of licenses to independent power producers would be the best solution to the problem. This would increase competition hence low prices charges. Figure 1 on the following page shows that urban people use much of electricity compared to rural areas people.

Most of the people in the country use mixed source of energy. Thus most of the people use charcoal and firewood for cooking and uses electricity only for lights and some household machines. Figure 2 on the next page shows the aggregate mixed source of energy most of the people use as an alternative to electricity.

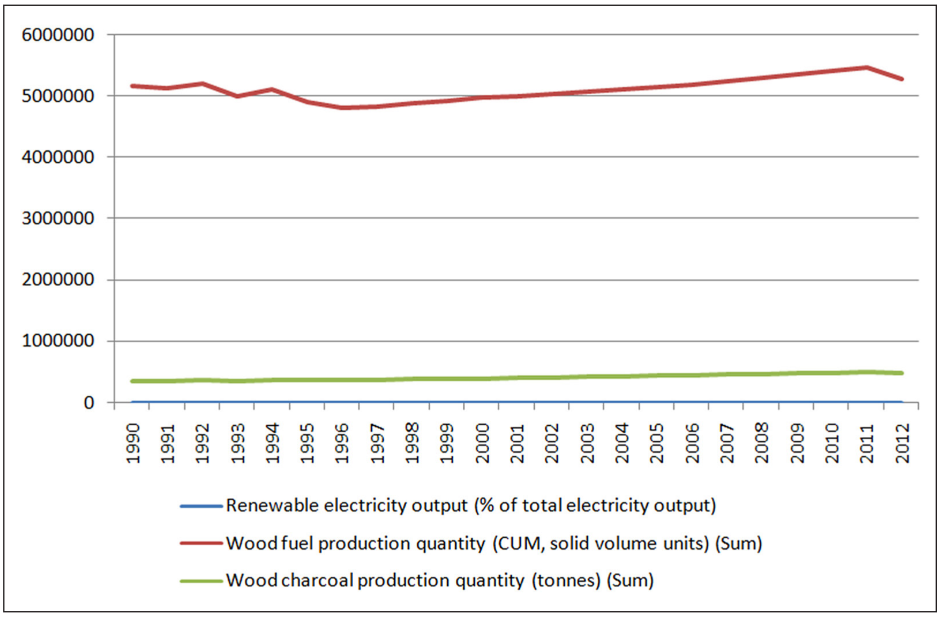
In the report which was presented at JICA international centre in Tokyo Japan from 2-22 June 2013 under the status of energy in Malawi in the republic of Malawi shows that 9.8% of the population had

Figure 1: Weighted Average of Population Access to Electricity



Source: Quantec 2015

Figure 2: Mixed Source of Energy



Source: Quantec 2015

access to electricity overall country. Thus only <1% represents rural area access to electricity.

Mostly people switch to mixed type of energy due to lack of competition in the generation sector hence high bills of electricity. Thus 87% of energy is from biomass and this usually results into grim deforestation and environmental degradation in the country. In the year 2015, ESCOM reported to be producing 351 MW of energy and this will be boosted by an independent power producer company known as Atlas Energies which is going to install solar panels of about 160 thousand on an area of approximately 60 hectares. This is going to add 40 MW to the super grid (ZBS News, 2015).

2. Literature Review

There are various literatures which put much emphasis on the impact of electrical infrastructure towards economic growth. Wolf-Rufael (2005) investigates the long-run relationship between energy use per capita and per capita real gross domestic product (GDP) for 19 African countries. Time series data from the period 1971-2001 was used and cointegration test was applied. The results approved the existence of long-run relationship only eight countries and causality only in 10 countries. Yoo (2006) investigated the causal relationship between electricity consumption and economic growth among the Association of South East Asian Nations (ASEAN) members. Time series data from the year 1971-2002 was used. Engel-granger cointegration approach was used. The finding of the study shows that an increase in electricity consumption directly affects economic growth and that economic growth also stimulates further electricity consumption. However, uni-directional causality runs from economic growth to electricity consumption

Wolde-Rufael (2006) examined the long-run and causal relationship between electricity consumption per capita and real gross domestic (GDP) per capita for 17 African countries. Time series data from the year 1971-2001 was used. A cointegration test result shows that there might have been a long-run relationship between power utilization and GDP per capita .Furthermore, Granger causality was noticed for only 12 countries.

Wolf-Rufael (2009) re-examined the causal relationship between energy consumption and economic growth for seventeen African countries in a multivariate framework. Time series data from the year 1971-2004 and VAR model was used. The results shows that energy is no more than a contributing factor to output growth and not an important one when compared to capital and labor. Labor and capital are the most important factors in output growth in fifteen out of the seventeen countries. Menyah (2010) explored the long-run relationship between economic growth, pollutant emissions and energy consumption for South Africa. The study applied cointegration approach and used time series data from the year 1965-2006, labour and capital has been included as an additional variables. The study findings show that South Africa has to sacrifice economic growth or reduce its energy consumption per unit of output or both in order to reduce pollutant emissions.

Odhiambo (2010) examined the causal relationship between energy consumption and economic growth in three sub-Saharan African countries, South Africa, Kenya and DRC. ARDL-bounds testing procedure was used on time series data from the year which covers the period 1972-2006. The results show that South Africa and Kenya there is a unidirectional causal flow from energy consumption to economic growth. The implementation of energy conservation policies may not significantly affect economic growth because the country's economy is not entirely energy dependent. However, for South Africa and Kenya there is a need for more energy supply augmentations in order to cope with the long-run energy demand. Yoo and Lee (2010) articulate that electricity is the foundation of economic growth and constitute one of the important infra-structural inputs in socio-economic development. The study shows that demand for electricity is dependent on population growth, extensive urbanization, industrialization and strive for better living standard. The study used time series data from the year 1975-2004 and cointegration approach was used in the study.

Yuan *et al*. (2007) emphasize that real GDP and electricity consumption for china are cointegrated and there is only unidirectional granger causality running from electricity consumption to real GDP and not vice-versa. The study was achieved by examining the results by applying cointegration approach using data from 1978-2004. Chen *et al*. (2007) conducted a study on estimating the relationship between GDP and electricity consumption in 10 newly industrializing and developing Asian countries using panel data from the year 1971-2001. Thus ECM and panel cointegration were used in the study. The results shows that electricity conservation policies through both rationalizing the electricity supply efficiency improvement to avoid the wastage of electricity and managing demand side to reduce the electricity consumption without affecting the end-user benefits could be initiated without adverse effect on economic growth. The findings on the long-run relationship indicate that a sufficiently large supply of electricity can ensure that a higher level of economic growth in the economy at large.

Khalid *et al*. (2012) re-investigated the multivariate electricity consumption function for Pakistan between 1975 and 2010. Thus the main focus was based on economic growth, foreign direct investment and population growth. Cointegration approach was used in the study and the results shows that determinants of electricity consumption function are cointegrated and influx of foreign direct investment, income and population growth is positively related to electricity consumption in the country. Faisal and Eatzaz (2010) recommend that growth in output in commercial, manufacturing and agricultural sector tends to increase electricity consumption while residential sector, growth in private expenditure is the cause of rising in electricity consumption. The study concludes that electricity production and management needs to be better integrated with overall economic planning exercises. This is essential to avoid electricity shortfalls and unplanned load shedding. The findings were achieved by applying annual time series data from period 1960-2008 and cointegration approach was used.

3. Research Methods

This study has been compiled with the aim of evaluating the impact of electrical infrastructure development in Malawi in economic growth. Annual time series data from the year 1991-2014 has been used. ARDL model has been used in this study in order to check the long-run relationship of the variables. Technology used in this study has been derived by using Cobb-Douglas production function on GDP, capital accumulation and labour. In this study the model used has been specified as follows:

$GDP=\beta+POP+KGDP+EMPLY+TECH+\mu$

Thus:

GDP: Real GDP at constant 2005 national prices (in mil. 2005US$)

POP: Population (in millions)

KGDP: Gross domestic product per capita, constant prices: National currency

EMPLY: Number of persons engaged in employment (in millions)

TECH: technology computed from capital accumulation and labour in the economy.

Table 2: Augmented Dickey Fuller Test

Variable	T-Statistics	P-Value	Order of Integration	Conclusion
GDP	-5.915137	0.0001	I(1)	Stationary
POP	-3.951618	0.0070	I(1)	Stationary
KGDP	-6.840848	0.0000	I(0)	Stationary
EMPLY	-2.577094	0.0126	I(1)	Stationary
TECH	-6.523642	0.0000	I(1)	Stationary

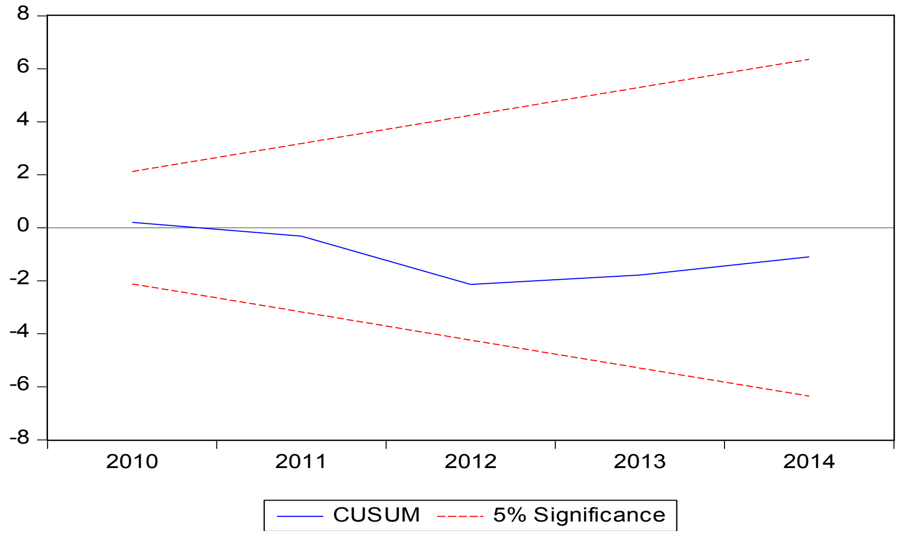
Source: Author

Table 3: ARDL Results

Variables	Coefficient	P-Value
D(LNGDP(-1))	0.096999	0.8916
D(LNGDP(-2))	-1.604002	0.2139
D(LNEMPLY(-1))	-2.299773	0.2436
D(LNEMPLY(-2))	-0.312725	0.9071
D(KGDP(-1))	-0.027809	0.0611
D(KGDP(-2))	-0.007922	0.0852
D(POP(-1))	0.357606	0.3663
D(POP(-2))	-0.468136	0.3208
D(LNTECH(-1))	-1.252671	0.2968
D(LNTECH(-2))	0.946627	0.5216
LNGDP(-1)	-0.440157	0.2828
LNEMPLY(-1)	0.056292	0.9835
KGDP(-1)	0.044744	0.0486
POP(-1)	0.248339	0.2504
LNTECH(-1)	-0.385619	0.7456
1. Model criteria / Goodness of fit: R-square = 0.914, Adjusted R-square = 0.654, 2. DIAGNOSTIC CHECKING: LM= 9.069429(0.0535), WALD TEST=F-statistics = 3.742888, P-value = 0.0869, Chi-square=18.71. (LM= serial correlation LM test, T-statistics and P-value)		

Source: Authors

Figure 3: Stability Test



Source: Authors

4. Findings and Discussion

The finding in this study has been analyzed by using autoregressive distributed lag approach. The approach only allows variables integrated at I (0) and I (1). Therefore Augmented Dickey-Fuller test has used to find that significance. Table 2 on the previous page shows the results.

The results in these tables show that the variables used in this study follows integration of order I (0) I (1). Therefore the variables follow ARDL requirements.

The results in Table 2 on the previous page shows that GDP (gross domestic product), EMPLY (Employment), KGDP (gross domestic product per capita), POP (population growth) and TECH (technology growth) has long run relationship. Thus only technology shows to have negative relations towards the dependent variable GDP. This shows that the model and the variables have long-run association. The model's diagnostic tests are shown to be significant thus both presence of serial correlation and Wald test.

The line along the trend in Figure 3 lies between 5% significance level thus giving surety the existence of stability in the model. The diagnostic test provided in this shows the robustness of the model given in this study. Thus, the absence of serial correlation, stability and strong relationship of the variables in the study. The long-run relationship of the variables shows that a percentage change in technology change in the country will increase by GDP by 1.0.7% and providing speed of adjustments of 0.044% in all sectors. The study found similar results found by Wolde-Rufael (2006) which shows that there might have been a long-run relationship between power utilization and GDP per capita.

5. Conclusion and Recommendations

The study has been compiled with the aim of assessing the impact of electrical infrastructure development in Malawi in economic growth. The result shows that load shading occurs periodically as a result of high demand in electricity and low supply from the period 1991-2014. This has been noted that the power stations generate inefficient electricity to meet its required demand. It has been seen that the country has only few power generators which produce electricity for small quantity which doesn't meet the required demand. Thus rapid population growth contributes to the problem. The economy is mostly dependent on energy for manufacturing sector and other sectors to function productively and contribute to the economic growth. Thus the government has to issue more certificates to IPP in order to increase the completion level and supply of more energy in the country. This will benefit customers by buying electricity at lower price and hence enhancing economic growth. Lastly, electricity conservation policies through both rationalizing the electricity supply efficiency to avoid the wastage of electricity, and managing the demand to reduce the electricity consumption without affecting the end-user benefits could be initiated without adverse affect on economic growth. The findings on the long-run relationship indicate that a sufficiently large supply of electricity can ensure that a higher level of economic growth in the economy at large.

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