ERSA Research Brief
September 2018

Electricity crisis and the effect of CO2 emissions on infrastructure-growth nexus in Sub Saharan Africa

By Chengete Chakamera and Paul Alagidede

Introduction

Sub Saharan Africa (SSA) is a region of over 950 million people but also with greatest proportion of population without access to electricity. The World Development Indicators reveal that electricity-related CO2 emissions (CO2EM), and the ratio of electricity transmission and distribution losses (RETDL) have been rising in SSA over the past decades, implying deterioration in efficiency of the power sector. Given the recent rising focus on the Sustainable Development Goals (SDGs), studies on the impact of electricity consumption and CO2 emissions on economic growth remain vital to inspire energy policy and academic research. Several studies have examined environmental Kuznets curve (EKC) that hypothesizes environmental quality and economic growth nexus. Closely related to this study, plenty of literature is done on the cointegration between electricity, CO2 emissions and growth. Despite the fact, firstly, accounting for electricity quality is still lacking and remains a serious gap. Secondly, measuring both the nature and size of the influence of electricity-related CO2 emissions on the growth contribution of electricity stock (quantity) and quality is another angle that has not been properly interrogated in the literature. Therefore, we investigate the economic growth effects of both electricity stock and quality before and after accounting for electricity-related CO2 emissions.

Key findings and implications

First, electricity consumption shows a positive impact on growth in SSA and this impact declines when the effects of CO2 emissions are accounted for. Second, electricity quality developments suggest negative growth effects. The negative growth effects from poor quality in the distribution of electricity are intensified once the CO2 emissions are taken into consideration. Consequently, CO2 emissions from electricity and heat production reduce the growth effects from electricity stock and quality.

Our findings provide important policy implications. First, positive growth effects of electricity consumption warrants the importance of electricity in economic activity. However, we believe that the electricity sector may attain its economic growth potential when the critical power shortages are reduced. Appropriate planning and substantial investment is highly required to promote economic development. Moreover, the greater proportion of people without access to electricity may represent an opportunity to be exploited when these people become future consumers of energy, especially in productive activities such as agriculture. Given a higher proportion of rural population without access to electricity, SSA may increase small-scale off-grid systems in a decentralised manner. Electricity consumption can also be improved by lowering electricity rates in SSA, which are currently among the highest in the world. Second, the negative growth effects of electricity quality suggest the extent in which electricity distribution losses are counter-productive in SSA. Both technical (e.g. faults) and non-technical losses (e.g. pilferage) lessen the quantity of electricity consumed by the intended end-users and also raise

the cost of production and distribution. To enhance efficiency, large power plants are believed to be cost-effective unlike the small-scale power systems that dominate Africa. Moreover, proper planning and implementation, skilled personnel, proper maintenance of aged power plants are among the key factors. Third, the adverse effect of CO2EM on electricity growth contribution calls for appropriate measures that are designed to lessen these emissions. We realised that coal has been the key source of electricity in SSA while also the major emitter of CO2EM. Thus, it seems vital to increase power production from renewable resources such as solar, hydro and wind resources while reducing reliance on coal. The reported downside effects of CO2EM may also suggest the importance considering the CO2 emissions' influence on electricity growth effects in the calculations of carbon taxes (carbon pricing). Some countries might be in a phase where rising emissions from electricity entail minimal negative effects on the electricity growth contribution, in the opinion of EKC hypothesis. Therefore, where carbon pricing is applicable, considering both the sizes of CO2 emissions and their influence on electricity-growth contribution ensures a carbon pricing approach that is designed to minimise emissions without excessively discouraging the benefits from electricity sector. Additionally, resources that are equivalent to the potential growth loss implied by increased emissions can be used in efforts that are meant to create a friendly environment. Most importantly, policy makers should seek to improve the efficiency of most aged and inefficient coal plants as well as considering CO2 capture and storage technologies that handle CO2 emissions from the entire power sector.

Conclusion

This paper examines the relationship between electricity stock (electricity consumption) and quality (RETDL) in 18 SSA countries over the period 1990-2013. Our results suggest that electricity consumption has a positive impact on economic growth whereas the RETDL exerts a negative pressure on growth. Thus, deterioration in electricity quality reduces economic growth. High levels of CO2EM lower the growth contributions of electricity consumption and exacerbate the negative growth impact of electricity quality.