EmPower Nigeria

Improving Nigeria's electricity supply industry through public education

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Nextier Power is a consulting firm that provides policy advisory, investment advisory, and support services to the electricity supply industry. The firm aims to use this weekly publication to educate Nigerians on the intricacies of the Nigeria electricity supply industry on the assumption that a more informed public would advocate for the right policies and programmes which, in turn, would lead to a robust market that delivers the electricity needs of Nigerians. This column will cover everything from the basics of the industry to the more intricate, sometimes, complex policies and programmes.

Cost of Generating Power

Introduction

Electricity can be generated using different technologies and different primary energy sources. Approximately 85% of the power generated in Nigeria comes from natural gas stations and the remainder comes from three large hydropower plants. Yet much of the electricity that Nigerian homes and businesses use is actually produced by diesel and petrol generators. The number of generator sets in the country is estimated to be 60 million.

Nigeria needs a dramatic increase in electricity generation capacity to meet its challenges. Various important targets have been put forward and many parties are vigorously working on improving the regulatory framework and triggering the necessary investments. But what mix of gas, coal, hydro, and renewables-based generation will give Nigerians the best value for the money they are investing into power generation?

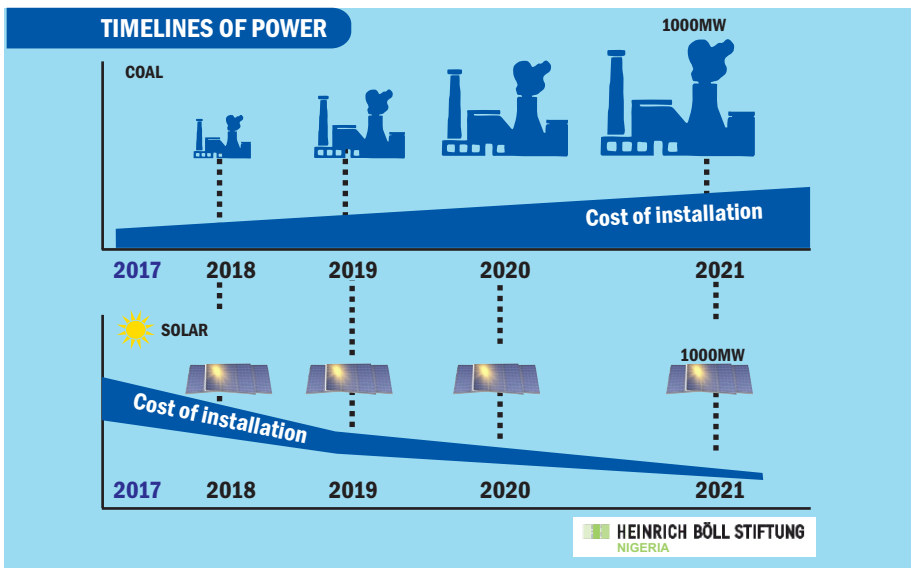
Costs to the investor versus costs to society

There are various ways of calculating the cost of generating power. One widely used metric is the Levelised Cost of Electricity (LCOE). LCOE reflects the cost to the investor of producing one kilowatt hour of power over the lifetime of his/her investment, and is therefore widely used to compare different electricity generating sources on an equal footing. LCOE includes the upfront cost of the plant, cost of purchasing fuel, cost of operating and maintaining, and cost of financing or the cost of capital.

Traditionally, LCOE does not incorporate costs of transmission and distribution, nor the costs associated with matching production to demand in the market place. Moreover, it does not recognise external costs such as those coming from air pollution, climate change, geopolitical risks, etc. If these costs are added, we can arrive at the Society's Costs of Electricity (SCOE). In contrast to LCOE, SCOE is not a well-defined metric, and different practitioners may define it in rather different ways.

The Time Factor

The cost of generating one kilowatt hour of electricity from gas, hydro, solar, wind, coal, etc., in 2017, will not be the same as the cost in 2020 or 2027. Assessing the costs of different pathways towards increased power generation should reflect the past and projected cost trajectories of different technologies. For example, the average cost of producing one megawatt hour of utility-scale solar Photovoltaic (PV) solar fell by around 60% between 2010 and 2015, and the International Renewable Energy Agency (IRENA) projects that it will drop further by 5.9% by 2025. On the other hand, the costs of mature technologies such as natural gas, coal or nuclear generation plants have either increased or at best remained constant.



Calculating the best deal for Nigeria

A recent study by the Nigerian Economic Summit Group and the Heinrich Böll Foundation has brought together the costs to investors (LCOE), the cost to society (SCOE) and future cost projections to illuminate the debate on what the best deal for Nigeria in terms of power generation investments. One of the key strengths of this comparison is its reliance on Nigerian-based data wherever possible and the validation by various stakeholders. Much of the Nigerian data is publically available as they form the basis for the calculations of electricity tariffs, by the Nigerian Electricity Regulatory Commission (NERC).

With an average LCOE of 5 to 7 USD cents per kWh, combined cycle **natural gas** turbines provide the best value for money in Nigeria at the moment, that is, if the fuel is available. Generating companies report that more than 2 GW of daily capacity shortfall are due to a lack of gas. Combined cycle gas turbines are gradually taking over inefficient single cycle turbines, and it is expected that this will be a major source of Nigeria's future electricity mix. Investments into natural gas generation have a comparatively low share of capital costs, but on the other hand are vulnerable to changing or volatile natural gas prices, as the cost of fuel represents around 60% of the cost of running the plant over its lifetime. The success of current policy drives and investment incentives for the gas distribution infrastructure will determine the future role of gas in the power mix

The costs of generation from large scale **hydropower** falls within the same range as those of gas, according to the available data. In practice hydropower projects in Nigeria generally lead to higher costs than expected.

The next most competitive generation technology, costing an average of 9 cents per kWh, is onshore **wind** energy. There is no high potential in the country for this generation technology but, given the high prospects of further cost reductions, this option probably warrants further attention.

Based on data from Nigeria and other African countries, it costs an average of 10 cents per kWh to generate electricity with **coal**, before social costs are considered. Coal availability is a further challenge in Nigeria, with estimates indicating that reserves could be depleted in four decades.

Data from NERC and other international data sources show that power generation from **biomass** offers a good prospect in Nigeria. However, the market in Nigeria is particularly immature and would require a more detailed analysis. Related options such as waste-to-energy remain understudied.

The renewable energy resource is currently generating interest in Nigeria for utility-scale electricity generation is solar PV. Nigeria's potential for electricity production from **solar PV** technology is in the range of 207,000 GWh per year if only 1% of the land area is covered with PV modules. Solar PV can compete at the lower cost range with coal generation at 10-11 cents per kWh in Nigeria. Globally, the most competitive PV utility-scale projects in 2015 delivered electricity for 8 cents per kWh, and electricity auctions in 2017 have seen winning bids at around 3 cents. Solar PV is competing without financial support even in regions across the globe with abundant fossil fuels and in high-cost regions with comparatively poor solar radiation conditions such as Germany.

Cost structure matters too

Calculating the cost of generation gives us useful insights into the different cost structures and their effect on viability. Cost structure in fact drives the catch-22 of Nigeria's expensive and polluting fleet of diesel and petrol generators. Solar PV systems for self-generation are already cost competitive in Nigeria on a lifetime basis, costing an average of 20 cents per kWh as opposed to diesel generators (30 cents per kWh) and gasoline generators (over 60 cents per kWh). However, the cost of generating power with a diesel or petrol generator is dominated by the cost of fuel. A solar PV system is more affordable in the long run because the fuel source is free, buts requires the consumer to pay more upfront. Global innovations in financing and business models that overcome this barrier are currently taking off in Nigeria.

Looking ahead

At present, SCOE, or the costs to society as a whole (encompassing the health-related costs of air pollution and damages brought about by climate change) drive up the costs of generating electricity with fossil fuels in Nigeria. Making reasonable assumptions on the cost of air pollution and carbon dioxide emissions to Nigerian society, solar PV is fully competitive with coal and even natural gas. In this context, it is important to recall that Nigeria is one of the ten most climate-vulnerable countries, and Lagos is the tenth most vulnerable city in the world.

The Federal Ministry of Environment estimated that Nigeria stood to face GDP losses from climate change of between 2% and 11% by 2020. This figure is brought into focus by ongoing processes such as the shrinking of Lake Chad or crises such as the 2012 and 2017 floods. If society's costs are projected ten years into the future, based on widely agreed cost reduction assumptions, solar PV and wind power will undercut the costs of even the cheapest fossil-fuel based generation. Even when considering LCOE alone, and forecasting costs up to 2025, on-grid solar PV becomes fully competitive with coal generation in Nigeria in the next five years.

The Overall Picture

Investments in new power generation are important long-term decisions, locking public spending and environmental impacts for decades. The comparison of costs to investors and to society across power generation options provides one important building block in the design of robust strategies and cost recovery arrangements for the energy sector.

In Nigeria, renewables are still perceived as a high-risk investment despite recent technological and policy innovations. Cost data counter this prevailing view by providing evidence that renewables are, together with efficient gas generation, one of the strongest options for Nigeria to deliver the needed power in the most cost competitive way today and in the mid-term, and more so when the costs to society are considered.

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