

Is Natural Gas a Viable Option to Promote Electrification in Nigeria?

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Executive summary

1. Motivations underlying the research

Nigeria is Africa's largest economy and its most populous country, but, as of 2014, only 57.7% of Nigerians had access to electricity. Nigeria's total primary energy supply (TPES), 20% that of the African continent, is dominated by biomass fuel consumption in the residential sector. As its population continues to grow steadily, one of the greatest challenges for Nigeria is to develop the infrastructure that is needed to provide modern energy services to its citizens.

The Nigerian government is driven to leverage its domestic resources to advance electricity access. Interest in natural gas-based power generation is buoyed by the country's abundant endowment of oil and gas – 2.6% of world proven gas reserve and 2.2% of world proven oil reserve – and by gas-fired technology's modular size and lower emission intensity relative to coal-firing plants.

The development of gas-to-power supply chains in Nigeria has the potential of contributing to energy access and decarbonisation simultaneously. However, natural gas extraction and delivery requires a set of gas sector infrastructure that feeds into downstream power sector infrastructure. This makes the challenge of infrastructure development much more complex than dealing with the development of the power or gas sector independently. This paper seeks to answer whether natural gas can be used to promote electrification in Nigeria, once the complex interdependence between gas and power infrastructure is taken into account.

2. A short account of the research performed

This research first provides context to recent Nigerian power sector developments from four perspectives: the ongoing reform to privatise and liberalise the power sector, initiated in 2005, and its impact on infrastructure ownership and commercial arrangements; Nigeria's track record to develop power generation infrastructure by attracting private capital; current policy addressing electrification; and the use of multi-year tariffs to recover gas and power sector costs. These issues are found to be particularly salient for interested researchers and policy makers to develop a grounded understanding of Nigeria's institutional framework and challenges.

Following these introductory notes, we perform a segment-by-segment review of Nigeria's gas-to-power supply chain, from gas production and processing to power consumption. This allows us to assess whether natural gas is a viable option to achieve full electrification in Nigeria.

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3. Main conclusions and policy implications of the work

Many constraints exist across the gas to power supply chain in Nigeria, making the use of gas for electrification challenging. First, the development of the gas sector's regulatory regime has not been separated from that of oil which has been highly tumultuous given contention over resource and revenue control. Second, the gas network in Nigeria is very inadequate. It is only the Southern coastal states that benefit from access to gas. In sharp contrast, the NLNG facility enjoys access to six supply pipelines, financed by the IOCs that run the plant, which guarantees a reliable supply of gas for export. This is demonstrative of the perceived economic attractiveness of exports compared to expanding domestic gas consumption, although delivery of gas to West African neighbours of Nigeria through WAGP has been less reliable. Since 2016, a new wave of militant attack on critical oil and gas transportation infrastructure has severely disrupted the gas-to-power supply chain, exacerbating the pre-existing gas shortage, undermining progress made in generation capacity revitalisation since privatisation.

Third, the availability of generation capacity is a key constraint. Nigeria has opened up the power generation segment to private investment, but efforts to channel private investment into functioning generation capacity have experienced difficulties. The participation of private capital in financing new generation capacity is low.

Forth, the state-owned power transmission network is the weakest link in the power supply chain of Nigeria. The topography of the network and the low reserve capacity available are such that the power grid is easily destabilised by fluctuations in generation and demand. The country faces frequent major power blackouts following disturbance in supply and demand.

Fifth, the liquidity crisis that has emerged in the Nigerian power sector is of a scale that required state intervention. The revenues remitted by DISCOs to GENCOs through NBET is far from enough to cover their own costs, not to mention supporting the restoration of out-of-service generation units and investment in additional generation. The non-payment of electricity bills then trickles upward the supply chain and is replicated between GENCOs and their gas suppliers.

Finally, DISCOs are ill-equipped to monitor and reduce the aggregate technical, commercial, and collection losses, given the fundamental absence of measurements (customer enumeration and metering). Under current circumstances, retail tariff adjustment by itself cannot be used to fill the revenue gap that is experienced by the sector in general. This is because increasing the tariff without reducing the aggregate losses will result in an increase in electricity bills that are growing non-proportionally with the billed customer's actual consumption. This has the potential to further alienate electricity customers and lead to further voluntary disconnection and collection losses.

In the interdependent supply chain for the gas-to-power strategy, delivery of gas-generated power to customers requires the adequate operations of downstream links. Therefore, if the constraints related to downstream of generation are not addressed, then upstream performance improvement, such as increased availability and reliability of gas supply due to improvement in gas sector regulation and infrastructure development, still has limited potential for advancing electrification. Therefore, policy actions addressing the constraints outlined in this paper needs to be coordinated, so that gains achieved in one area is not eroded by lack of improvement in another.