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[1,2.]Adekomaya OLUDAISI

SUSTAINING THE NIGERIA POWER PROJECTS IN THE FACE OF DWINDLING GAS INVESTMENT

[1.]Department of Mechanical Engineering, Mechatronics and Industrial Design,
Tshwane University of Technology, Pretoria, SOUTH AFRICA
[2.]Department of Agricultural and Mechanical Engineering, Faculty of Engineering, College of Engineering and Environmental Studies, Olabisi Onabanjo University, Ibogun Campus, Ifo, Ogun State, NIGERIA

Abstract: Natural gas development in Nigeria is currently facing numerous challenges amid growing competition from shale gas, coal bed methane and tight gas in the U.S., Europe and China. This has undoubtedly had some damning economic implications for the Nigerian gas market whose major patronage have traditionally been the US and Europe. According to a recent report published by Nigerian National Petroleum Company (NNPC), the gas market in Nigeria witnessed sharp drop in 2012 when virtually no single export was made to US as a result of shale gas currently being developed in that country. This continuous decline in gas export to US and Europe may further worsen power project development in Nigeria due to other challenging issues like pipeline vandalism, youth restiveness in the Niger-Delta and un-harmonised government policies. Couple with the fact that crude oil production has witnessed significant drop in Nigeria due to low oil price and glut in the global market, it may be of utmost interest to explore viable gas utilization option with a view to promote further investment in gas business. Sustainability of Nigeria power sector depends largely on power plants which are driven by gas and the current power outage in Nigeria may not be unconnected with gas shortage to power these power plants. In this study, the authors x-ray sustainable gas utilization option aimed at promoting gas export, boasting investors' confidence in Nigeria gas market and the authors equally beam searchlight on government's policies that are inimical to the free gas market among other pressing issue. Part of the conclusion drawn from the research reinforces the need to widen gas utilization options most especially in the area of Gas-to-Liquid (GTL) conversion technology in order to sustain electricity generation in Nigeria.
Keywords: Natural gas, electricity generation, crude oil production, sustainable gas utilization, future gas investment

INTRODUCTION

Global energy consumption is expected to witness unprecedented rise by 2035 going by the research published by Nwaoha and Wood (2014) and the percentage increase may surpass 40% in view of emerging power demand in developing countries of the world. Of critical attention is the trend in low investment in gas reserves globally as a result of low crude oil price and global economy slowdown.

Nigeria remains a rallying point for gas reserves globally and their energy deficit equally needs attention which cannot be met alone by crude oil production (Economides and Wood, 2009). Nigeria gas reserves alone as at 2012 stood at180TCF (trillion cubic feet) and this projection is expected to rise considering new discovery in some part of the country (Anejionu et al., 2015, Oyedepo, 2014). This huge abundance of natural gas resources need to be fully explored to meet the growing and increasing demand for electricity both locally and in the neighbouring countries of Africa (Loe and Ladehaug, 2012).

Nigeria gas reserve is illustrated in Figure 1 depicting a potential that has the capacity of sustaining a long term investment in gas market. As reported in the some literatures (Fawole et al., 2016, Soltanieh et al., 2016), Nigeria's population as at 2012 was in the range of 169 million people compared to 45.2 million in 1960 with a projection to exceed 200million population by 2030. This prediction places a huge burden on the existing infrastructure most importantly energy demand as power supply continues to be a major obstacle to industrialization in Nigeria.

The impact of natural gas to bridge the growing energy deficit in Nigeria remain undebatable if proper roadmap are available to provide a sustainable gas development in Nigeria. Shale gas exploration in US may be an initial setback to gas development in Nigeria but this unconventional gas may not after all stay for next decade

as the production may decline in face of growing demand (Zou et al., 2010). Key of the challenges of gas development in Nigeria has to do with transportation and storage as these further compound gas delivery when compared with oil, and this may have contributed to its minimum utilisation for a considerable period most especially in Nigeria (Courson et al., 2000, Akinbami et al., 2001). The global gas market has improved drastically in the last twenty years and the market continues to enlarge in leap and bound when compared with other conventional fuels (Economides and Wood, 2009).

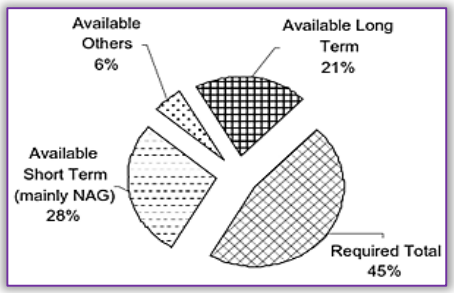

Figure 1: Potential gas reserves and demand balance. Adapted from Odumugbo (2010)

Currently, natural gas remains the third largest energy source globally and it is predicted to overtake crude oil if sustainable roadmap is developed in the management of gas and this may bring the gas demand and consumption to increase substantially in coming years (Hekkert et al., 2005). The current stop-gap in gas investment may be a temporary setback as literatures (Makogon et al., 2007, Makogon, 2010) continue to project gas as sustainable energy for the future. Part of the added advantages of gas energy is its availability, versatility and also reported (Leather et al., 2013) to be cleaner when compared with coal and crude oil.

In line with further submission reported by Economides and Wood (2009), these authors also aligned with other authors (Thomas and Dawe, 2003, Akansu et al., 2004) on the attractive property of natural gas being cleanest in terms of combustion among other convectional fuel and has a tendency to produce high grade energy conversion efficiency when adapted for energy generation in combined cycle power turbines.

One of the paramount concern militating against the exploitation of gas reserves is the delivery mechanism which remain an issue that have not been completely resolved. Natural gas must be conveyed from its production source to market base where demand exists and of great concern to this delivery system is that the infrastructures are completely expensive and available methods are generally cumbersome. According to Odumugbo (2010), virtually 40 to 60% of the world gas reserves are stranded in the sense that their locations are remote and the available methods to convey them to the market base are prohibitive. These delivery infrastructures may hinder huge proportion Nigeria gas reserve from getting to the market for further application based on the survey conducted by (Gudmundsson and Graff, 2003) and this may also affect over 80% of new gas discoveries in Nigeria as large deposit of these reserves are located offshore. This barrier may have necessitated large volume of gas flared from 1999 to 2009 as illustrated in Figure 2 with the proportion of gas flared to gas conveyed to the market shown in Figure 3.

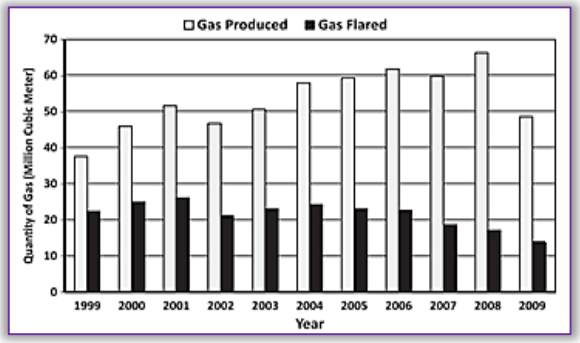

Figure 2: Proportion of gas produced and gas flared in Nigeria from 1999 to 2009. Adapted from Anomohanran (2012)

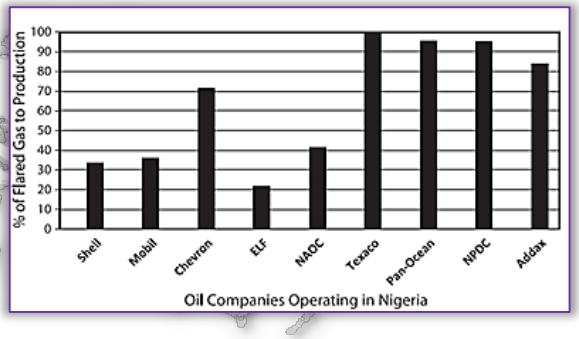

Figure 3: Proportion of gas flared to gas delivered for power generation by oil producing companies. Adapted from Anomohanran (2012)

ELECTRICITY GENERATION FROM GAS FIRED POWER PLANTS

Power generation in Nigeria have relied solely on gas fired power plants and the dwindling gas investment coupled with the youth restiveness in the Niger Delta of Nigeria have worsen the flow of interest in this sector. Nigeria's electricity generation and distribution ranges between about2500 MW and 3000 MW, despite the liberalization policy of government and these output alone cannot cater for huge demand from industries (Olugbenga, 2009). According to other authors(Ubi et al., 2012),the estimated power demand in Nigeria may be in the range of 10,000 MW and that only insignificant proportion of the population (about 30%) has access to epileptic power supply. Gas development has been identified as only measure to promote private sector participation in energy growth in Nigeria. According to the survey conducted by Energy Sector National Technical Working Group (2009), suggested among

other issues, that the power supply need to be overhauled considering the projection of attaining 25000-40000MW by 2020 in view of growing population. The new gas transmission model is shown in Figure 4 and in line with the agenda of government in ensuring transparency in the distribution plan, many authors (Adekomaya et al., 2016) have raised a lot of concerns considering the bottleneck this model is likely to create as most transmission companies have not been able to convey power to end-users as a result of vandalism and gas shortage from Nigerian Liquefied Natural Gas (NLNG). The evolution of National Integrated Power project (NIPP) has largely contributed to the success of increased access to transmission and distribution networks at various level of energy development but the growth of this project is currently being hindered by emerging global player in oil and gas.

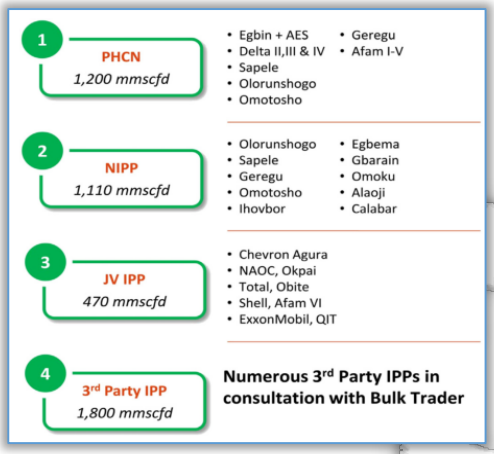

Figure 4: Gas supply chain process in Nigeria. Sourced from Nigerian National Petroleum Company

Gas development remain a Herculean task in Nigeria and once these gasses are not conveyed to demanding power plants, this may result to flaring and resultant environmental degradation (Hassan and Kouhy, 2013). According to a projection cited by Nwaoha and Wood (2014) as shown in Figure 5, the forecast for gas demand by various existing power plants may likely be in excess of over 3.5 bcf/d of gas demand by over 30 existing and proposed power plants. Although, these stranded gasses are abundant at various offshore production facilities, the appropriate distribution channels may likely hinder these estimated volume of gas from being assessed (Soltanieh et al., 2016). Gas delivery and transportation provides a large network for gas market and these opportunities can only be exploited if the infrastructure to transport and store these gasses is available at every offshore production platform in Nigeria. The dwindling fortunes of gas market may also be attributed to low crude oil price and gas being a product of crude oil production has also experienced huge decline in price. This low gas price sometimes deters investors as returns from investments may not likely justify various commitments earlier made (Chidebell-Emordi, 2015). Development of gas transportation networks involves large capital expenditure, as it is currently being experienced in the U.S.A and other developed countries (Andre et al., 2009), the prospect of this network in Nigeria has been a subject of debate in many studies (Andre et al., 2009, Woldeyohannes and Majid, 2011) as factors like pipeline vandalism, resource control by Niger-Delta agitators among other pressing issue remain a stumbling block.

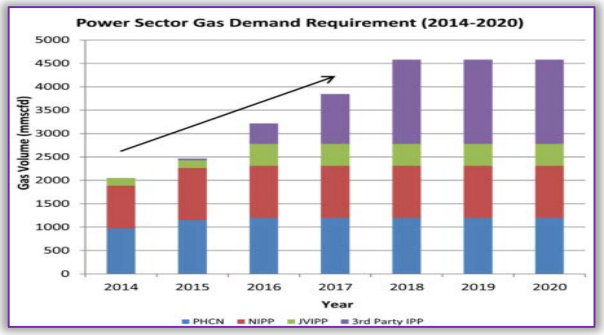

Figure 5: Power sector gas demand in the future. Adapted from NNPC

SUSTAINABLE GAS UTILIZATION OPTION

In order to boast activities in the gas industry, it is equally important to explore other sustainable gas utilization option so that gas flaring will be reduced and equally promote gas viability which will in turn sustain power sector in Nigeria. Onwukwe Stanley (2009) also reiterated the need to develop Gas-to-Liquid (GTL) technology in Nigeria which will on the long run foster cordial gas distribution share in the oil industry. GTL technology has been in existence for many years in US and other developed countries of the world. This technology tends to converts natural gas into clean diesel, naphtha, kerosene and other fuels in order to promote diversification in the oil and gas sector. Part of the concept of this technology is that huge volume of gas flared will definitely be channelled to this technology thereby reducing greenhouse emission and global warming.

Table 1: Quality performance index of refinery diesel and GTL diesel. Adapted from Elisabetta and Roberto, 2009

Diesel fuel characteristics	Standard diesel	GTL diesel
Boiling range (°C)	180-360	150-360
Density(Kg/m³) 15°C	840	780
Sulphur(ppm vol)	50	<0.5
Aromatic(% vol)	23.4	<0.1
Cetane number(CN)	51	81
Cloud point(°C)	0	-15

Nigerian gas reserve is acclaimed to be clean, versatile with abundant reserve, and for these reasons, it is projected to be a good substitute for oil whose environmental impact is far-reaching. Table 1 gives a detailed assessment of diesel fuel and GTL diesel as investigated by Elisabetta and Roberto, 2009. The

results of their experimental study clearly show that the GTL products meet the stipulated conditions provided by all product requirements. GTL technology is appropriate for offshore gas production where gas delivery methods are not economically viable through pipeline and also in order to reduce the incidence of gas flaring associated with this production pattern. GTL, according to some literatures (Chedid et al., 2007, Bao et al., 2010) has the prospects of converting a huge percentage of flared gas to several hundred billion barrels of liquid fuels, which is environmentally friendly and low greenhouse gas impact. Conversion technology of these gases as shown in Figure 6 provides some leverage to host communities in terms of direct job engagement and other means of transportation.

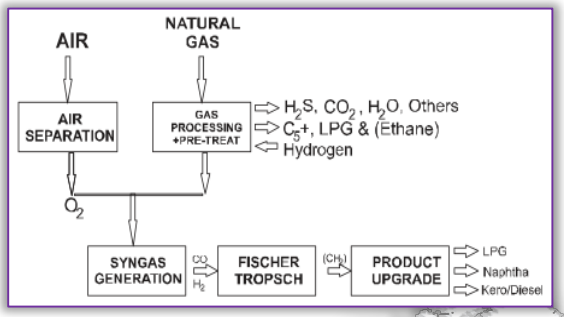

Figure 6: Gas-to-Liquid Technology.
Adapted from Onwukwe Stanley (2009)

Part of the added advantage of this method is that the steam generated through the conversion process could be used for electricity generation necessary for plant usage, while the excesses could still be exported to oil producing communities in order to improve living conditions and thereby douse self-determination struggle in the Niger-Delta.

CONCLUSIONS

Declining crude oil investment occasioned by low oil price possess a challenge to power growth in Nigeria. Nigeria crude oil exports has declined considerable due to youth unrest and pipeline vandalism and this threat remain a stumbling block for Nigeria to realise its full potential in global oil market. Sustaining the existing power project in the face of low gas production must be addressed considering sustainable gas utilisation option as discussed in this study. Nigeria currently ranked 9th in global natural gas reserves and in order to effectively channelled this huge gas reserves appropriately and to further reduce the menace of gas flaring, it may be of high interest to engage different stakeholders in oil and gas industry in order to chart a sustainable roadmap for power development in Nigeria.

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