

Overview

Natural Gas is a fossil fuel that occurs beneath the earth. Sometimes it is explored alongside crude oil as associated gas (AG) or as non-associated gas (NAG), depending on the Gas to Oil ratio. It is mostly made up of the shortest hydrocarbon (methane) and is colourless and odourless at the same time. It naturally occurs alongside some longer-chain hydrocarbons like propane, butane, NGL, carbon dioxide and water vapour. It is then processed to produce dry gas (or LNG), LPG and some condensates (equivalent to oil, but lower API gravity).

Natural gas is significant economically as it provides about 22% of the world's total energy needs following oil and coal. It provides a cleaner alternative supply to both coal and oil because of the lower carbon chain and is seen as a transitional fuel to a cleaner and more environmentally friendly energy mix.

World Gas Market

The world gas market is very fragmented due to the lack of a transportation network as sophisticated as that of crude. Most gas sales are majorly on long-term contracts (spot market exists) priced based on some energy basket that reflects the energy content of the gas. Sometimes, it can also be as a percentage of oil price as well.

The demand for natural gas is estimated to grow at 5.16% over the next few years according to Statista, which is majorly driven by the need to optimize energy mix. As shown in **Figure 1**, the United States remains the major consumer of natural gas contributing 22% of total global consumption, followed by Russia and China. However, due to the abundance of shale gas and a large number of salt caverns for storage, the United States has maintained a very low gas price (**Figure 2**) compared to other regions and recently turned a net exporter (**Figure 3**) of gas as well. On the demand side, the major net importers are China, Japan, Germany and Italy. On the supply side, the major net exporters are Russia, Qatar, Norway, Canada and the United States, **Figure 4** Illustrates the net trade of these major players.

It is good to point out that demand/supply for gas is affected by seasonality, peaking during the cold winters in Europe (also in some regions, it tends to increase significantly during summer due to the increased activities & use of air conditioners). This demand fluctuation can affect prices, especially in Europe where the storage facility is insufficient to provide a cushion for periods of increased demand.

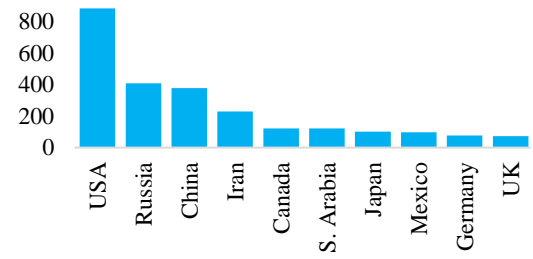
Africa Gas Market

Africa's contribution to the Natural gas market is roughly 7% in terms of production volume. In as much as a significant reserve of natural gas is held in the continent, the lack of development of the gas infrastructure has limited its contribution to the global market. Nigeria and Algeria account for most of the exports from the continent and Europe is the main export destination for gas produced in Africa, through pipeline from Algeria or LNG. This LNG export accounts for roughly 60% of the natural gas export according to Energy Institute 2022 statistical, while the rest is through pipelines (pipeline export is mostly by Algeria

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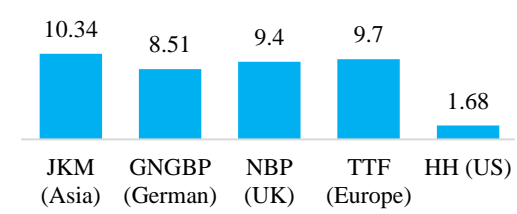
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Figure 1: 2022 Top Natural Gas Consumers



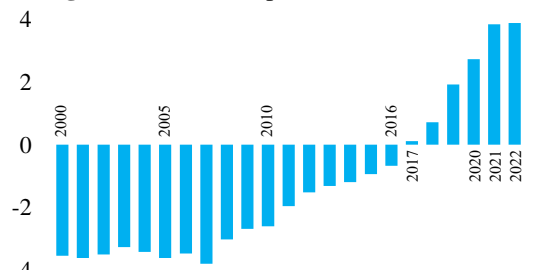
Source: Energy Institute Statistical Review, Zrosk IM

Figure 2: Estimated April 2024 Gas Price (\$/Mmbtu)



Source: Energy Institute Statistical Review, Zrosk IM

Figure 3: US Net Exports (Tcf)



Source: Energy Institute Statistical Review, Zrosk IM

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due to proximity). In Africa, the major use of natural gas is for electricity generation. Nigeria's production is significantly for export.

Algeria, Egypt, Angola and Libya produce for both export and consumption. The Nigerian government is making policies to incentivize production for the local market as we will discuss later in this report. There are countries like Tunisia, Ghana, Morocco and South Africa that also import gas for domestic consumption as well.

Nigeria Gas Market

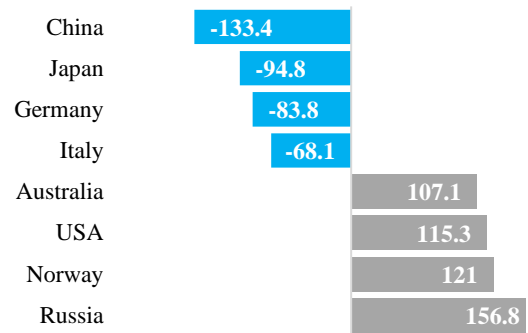
Nigeria is in the world's top 10 Natural gas reserve holders (**Figure 5**). It is blessed with about 209Tcf of gas reserve which about 106.67Tcf is non-associated gas which is higher than the associated gas. In terms of production, Nigeria produced a total of 2.503Tcf of gas in 2023 (6.9bcf/d). However, much of the production is from the associated gas, driven by IOC operations offshore. Non-associated gas production, stood at 2.64bcf/d representing 39% of total gas production.

A large proportion of the gas is flared, 182Bcf of gas produced was flared in Nigeria in 2023, which represents 7% of the produced volume. **Figure 6**, from NLNG 2022 Facts and Figures illustrates the historical improvement in the reduction of flared gas. With more and more incentives for businesses to invest in that area, we have seen a reduction in the percentage of flared gases & increased volume in export and domestic consumption. Nigeria has many gas-producing fields, some produce wet gas, and others produce significantly dry gas. The major deepwater gas fields include Agbami, Bonga, Akpo, Egina, Abo, Erha and Usan. Akpor field (OML130) by TUPNL and Agbami field by Chevron are the most productive deepwater fields by 2023 volume, contributing around 12% of the country's production. There are also a lot of Onshore gas producing fields which include Obiafu, Ughelli, Sapele field, Utorogu field, Oben and many others.

It is good to cite that a good amount of gas produced in Nigeria is converted to LNG by NLNG's 6 train processing plants that consumes around 3.5 Bcf/d (roughly 1.3 Tcf per annum). The locally consumed gas is less than exported gas (**Figure 7**) and most of the local consumption is for electricity generation, while a good amount to LPG is used for cooking. Nigeria also imports butane LPG to support the local market due to the unsuitability of propane LPG for Nigeria's cooking market. Demand for gas also comes from fertilizer production, metal refining and energy for cement production.

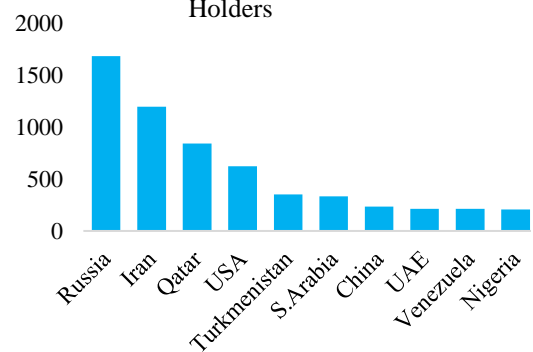
We analysed 2023 gas production data to show a picture of the industry players. The major gas producer in Nigeria is SPDC, producing about 349 Bcf in 2023. The other big producing assets are owned by Chevron, Exxon, Agip, Mobil and Total Nigeria. **Figure 8** shows the 2023 production data of the top ten highest producers in Nigeria, which we tagged "top 10" for this report. SEPLAT and NNPC are the only two names on the list that are indigenous, and their production comes mainly from non-associated fields.

Figure 4: Net Trade for 2022 (Bcm)



Source: Energy Institute Statistical Review, Zrosk IM

Figure 5: Top Natural Gas Reserve Holders



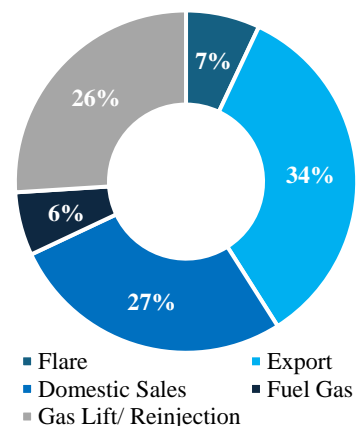
Source: Africa Oil and Gas, Zrosk IM

Figure 6:



Source: 2022 NLNG Facts, Zrosk IM

Figure 7: 2023 Produced Gas By Use



Source: NUPRC 2023 Annual Report, Zrosk IM

As shown in **Figure 9**, out of the 47 companies that produced gas in 2023, the “top 10” contributed 89% of the country's total production. They also contributed most of the AG and NAG for the year as shown, this further illustrates the power of the IOCs in the gas space. The local producers are still in their nascent stage and with the divestment of IOCs from some assets, these local producers are expected to increase production in the future. **Figure 10** shows the output of the top local producers in Nigeria currently. SEPLAT dwarfs the rest and 83% of SEPLAT production is from their NAG gas fields in OML4.

Gas Value Chain in Nigeria

The Nigerian natural gas industry value chain starts from the upstream production by the E&P companies. After Production, some of the produced gas is reinjected into the well to enhance oil production, in the case of associated gas and some are flared as well. The recovered gas from the well can be wet, meaning that it contains some longer-chain hydrocarbons known as Natural Gas Liquids (NGL). They are all pumped and carried to a nearby processing facility, this processing facility can be a dry gas processing facility or LNG processing facility, depending on how the produced gas will be transported.

For **Dry Gas**, the processing facility separates the dry gas from the liquids and the NGLs are further processed into Liquefied Petroleum Gas (LPG) and Condensates. LPG is just propane and butane that is liquefied at -38C, which is mostly used in Nigeria for cooking gas. The condensate is liquid which is just equivalent to crude but of lower quality. The dry gas is mostly transported through pipelines to the demand area. For Nigeria, the major use of dry gas is power generation, the gas supplied is used for power generation. Both the on-grid and reasonable off-grid power generated in Nigeria is through this source.

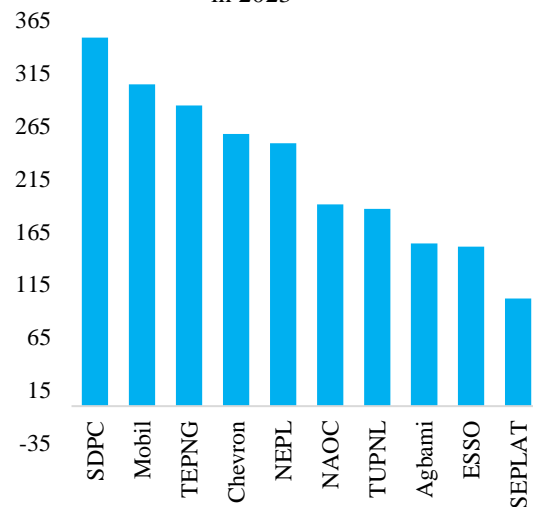
For **LNG**, the processing facility is even more capital-intensive and is only a better option when pipelines cannot work, for instance exporting the natural gas to very far distances. LNG processing involves cooling natural gas to a temperature of as low as -162C at atmospheric pressure, making it condense to liquid which will occupy far less space. The LNG is then shipped abroad using LNG vessels, for Nigeria it is mostly in Europe, where it is converted back to dry gas using a re-gas facility. There are also NGLs associated with LNG processing which are also processed to produce LPG and some condensates just as in the case of dry gas. Apart from power generation and cooking gas (butane in Nigeria mostly), there are other uses of natural gas at the last mile like the CNG powered transport, heating for industrial and raw materials for methanol, fertilizers, petrochemicals etc.

Structure of Nigeria's Gas Industry

Nigeria's gas infrastructure is structured in a way that it is largely dependent on the demand areas. Is divided into the Western system, Eastern domestic system and Export system.

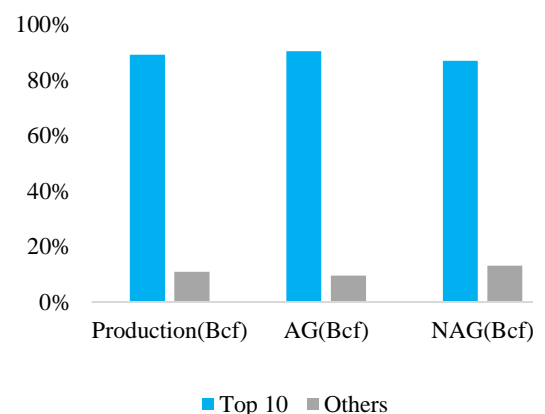
The **Western system** supplies gas to the western region and the north as well. A major part of the western system is the 700km Escravos Lagos pipeline System (ELPS), which currently has a 2.2 bcf capacity after the looping. It supplies major areas of demand in Lagos.

Figure 8: Top 10 Producers by Volume in 2023



Source: NUPRC 2023 Annual Report, Zrosk IM

Figure 9: Contribution of (Top 10) to others



Source: NUPRC 2023 Annual Report, Zrosk IM

Figure 10: Top Indigenous Producers (BCF)



Source: NUPRC 2023 Annual Report, Zrosk IM

The West Africa gas pipeline (WAGP) is also connected to Nigeria through this pipeline. Some of the proposed gas projects in this region include the West African gas pipeline, Olokola (OK) 22mtpa LNG project which the IOCs pulled out from and the Trans-Nigeria Gas pipeline. Most of the major gas fields in this axis are in Delta states. Some of them include the Sapele field, fields around Oben hub, Odidi offshore field, Ughelli field, Eriemu Field, Uzere field, and Utorogu field. There are also some undeveloped fields in that axis including Iseni, Benadi and Okpokunou fields.

As we pointed out earlier, this axis supplies Lagos and Kano, some of the major businesses this axis caters/will cater to include the Geregu plant, Ajaokuta Steel, Azura IPP, Omotosho PP, WAGP, Egbin and other Lagos industry.

The **Eastern Domestic System** supplies gas to industry in that area. The major fields in this axis include Rumuji, Agbada, Obigbo and Alakiri fields which supply to the Notore Chemical Industries Limited, Afam, Alaoji, and the Ibom power plant.

The **Export System** is the gas Transmission system (GTS) and Offshore Gas Gathering System (OGGS). The Gas Transmission System (GTS) gather gas from fields around and transports it to NLNG processing plants for export. Some of the fields include Obiafu, Soku, Obite and Belama fields.

Major Gas Infrastructure and The Relevance of Those Infrastructure

The major infrastructure needed to augment Nigeria's gas industry is around constructing an extensive pipeline network that will connect the sources to different areas of demand in the country. Some of the major gas pipelines includes;

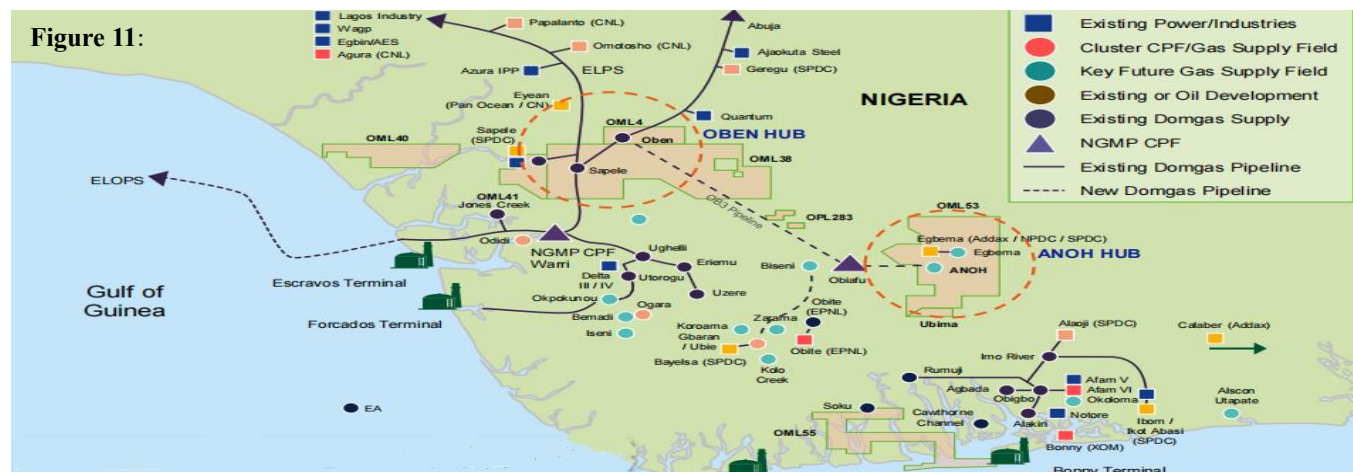
1. **OB 3 Pipeline:** The Obiafu-Obrikom-Oben gas project popularly known as OB3 is a 127km gas pipeline that passes Imo, Edo, Delta and Rivers states. Its main purpose is to connect the vast Natural gas resources in the East to regions of demand in the West. It practically connects the ANOH field (OML21, OML53) to the OBEN hub. It is 100% owned by the Nigeria State Oil Company (NNPC) and is expected to transport more than 2.2 bcf/d at full capacity. This project is expected to be completed any moment from now.

2. **The AKK pipeline:** The Ajaokuta–Kaduna–Kano gas pipeline project is a 614 km length pipeline that originates from the Ajaokuta terminal Gas station (TGS) in the Kogi state and passes through Niger state, Kaduna, and Kano. The major aim of this pipeline is to transport gas from southern Nigeria to Ajaokuta, Abuja, Kaduna and Kano. It is a part of the Trans-Nigeria Gas Pipeline project to connect Nigeria's large gas reserves to other African countries. It is owned by the Nigeria State Oil Company (NNPC).

3. **Escravos-Lagos Pipeline System:** This 439km pipeline was built to transport gas from Niger Delta to Industry around Lagos, it supplies gas to Egbin, Ugheli, WAPCO and other industries in that area.

4. **Trans-Nigeria Gas Pipeline:** This is a 4128km pipeline project that runs from Nigeria connecting OB3, AKK and passes through Niger to Algeria. It is owned by Nigeria, Niger and Sonatrach.

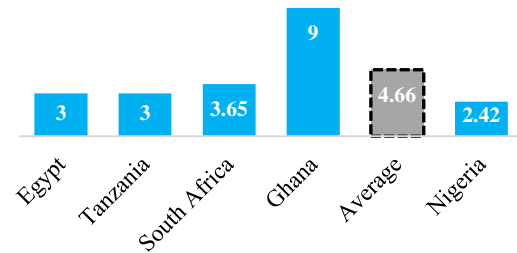
5. **West African Gas Pipeline:** This is a 678km pipeline that connects Nigeria to markets in Ghana, Benin and Togo. It is owned by NNPC, Chevron, Shell and two other entities. This pipeline will be connected to Nigeria at the Lagos ELPS terminal, it is expected to provide a diversification of export facility. The incessant losses in the transmission network, cost of transmission and difficulties in expanding the transmission network are the major reasons for the call for off-grid power generation.



Source: Seplat 2021 Capital Market Day Presentation, Zrosk IM

6. **NLNG:** Nigeria Liquefied Natural Gas is a strategic project that liquefies and export LNG from Nigeria around the world. Its Liquefaction plant is in Bonny and is supplied by the Offshore Gas Gathering System (OGGS) that gathers gases from offshore and the Gas Transmission System gathers gas from nearby onshore fields. Its 6 trains have a capacity of 22MTPA and the addition of another 8MTPA “train 7” is ongoing. It is owned by NNPC (49%), Shell (25.6%), TotalEnergies (15%) and Eni (10.4%).

Figure 12: Gas Prices (\$/mscf)



Source: Africa Oil and Gas, Zrosk IM

We also have other projects like the Olokola LNG project and Brass LNG which are capital-intensive but can impact the industry significantly. A lot of investment has gone into the upstream and even more will be needed to tap the abundant gas resources. We believe when there is enough demand and a fair playground in terms of gas pricing, players in the upstream will be incentivized to invest in these projects. They mostly require a lot of upfront initial investments, which discourages people from investing in face of a lot of uncertainty. Investment in processing and liquefaction are all important as well if we are serious about realising the full potential of gas as a country.

Gas Pricing

Another fixing needed to incentivize Nigeria's gas is around gas pricing. A comparison of Nigeria's Gas pricing to that of other African countries in **Figure 12** shows Nigeria's gas price is very cheap, especially when we consider the fact that limitation in infrastructure is stifling supply and upstream actually need the incentives to invest. The PIA provided a clear regulatory framework for the determination of a market-based pricing regime for the domestic gas market for strategic sectors, which according to the PIA should be at a level that makes the upstream bring gas to the domestic market voluntarily, not higher than average natural gas price in similar emerging markets and tied to international benchmark. Experts expected natural gas prices to go to the levels of \$3/mscf or more with the signing of PIA, but we have a situation where what we get is still “price fixing” as the domestic base price (DBP) \$2.42/mscf does not fully reflect the cost of producing gas according to upstream players.

In our view, the major challenge with the Willing Buyer Willing Seller model for domestic gas pricing is that a major off taker is the power sector (as many other sectors of demand are still in the infancy stage). Power charge customers a subsidized rate that is determined by regulators and supplies the most generated electricity through the TCN (government). Since the end user is subsidized, it implies that the gas price reflecting the market rate will mean more burden to the government which will pay the subsidy, which we believe is the main reason the government is not allowing the gas price to be determined by the market forces. Recent reports online show that government debt to GenCos is around 1 trillion and 60% of the debt is supposed to go to gas suppliers, even dissuading the power producers from consuming as much gas as they should in a normal situation. One trend we expected in the power sector is that prices charged will become more market reflective as subsidies go away and the power sector can then pass down the cost of gas to the consumer as it is a pass-through cost in a free market. This will, in turn, help in making gas prices more market reflective as GenCos will be willing to pay more. At that same time, as more channels for domestic gas consumption that are not subsidized become more mature and more export routes come to life, any supply that is not driven by the free market will become less feasible and will eventually die off, even with the Domestic Gas Obligation in play.

It is good to point out that market reflective pricing can mean different things for different gas markets, based on the demand and supply dynamics in that region. On a macro basis, gas pricing can be based on energy content and the proximity of the demand centre from the supply.

Of the three divisions of the international gas market, only the Henry Hub in the US market have a fairly transparent pricing system, where gas price is determined by supply and demand at the hub and also the distance from the major sources of supply. For instance, gas prices in Texas & New Mexico should trade at a discount while that in California or New York will trade at a premium. For Europe, the gas pipeline is not as sophisticated as that of America, it is normally designed in a way to carry gas from supply to major areas of demand reducing free movement of gas. LNG disrupted the piped gas market and created room for the spot gas market in Europe. Most of these LNG imports come from the United States & Qatar, for pricing, virtual gas hubs such as the National Balancing Hub (NBP) in the UK and Title Transfer Facility (TTF) in the Netherlands are used. The Oil indexation, which links the gas price to the oil price and Gas-to-Gas pricing that takes into consideration the supply and

demand mechanism in that area to determine the gas price. Asia Pacific gas pricing can be based on a percentage of the oil price which doesn't protect buyer and seller at different oil prices, it can also be based on an oil price formula that looks like an "S curve" which means it caps at some oil price range, protecting buyers at high oil price and protecting sellers at low oil prices.

Economic Contribution of the Sector

According to the extractive industry report released in 2021, the total gas production for the year was 2.743 Tcf. Only 1.534Tcf was sold, the rest was either unaccounted for, flared, reinjected or used as fuel gas. Total sales value amounted to \$1.7B for LPG, NLNG feedstock and domestic gas sales. This shows a picture of how much the sector contributes to the country. The flare penalty for 2023 was N140B and the NLNG dividend to Nigeria from inception to 2022 amounts to \$19.6B according to NLNG 2022 facts and figures. Also, the government receives taxes from NLNG and other gas-producing companies.

Gas provides a major source of generating electricity, about 77.8% of installed generation capacity (including steam) is powered by natural gas. It has provided cleaner cooking energy for homes in Nigeria through LPG. The sector also creates direct and indirect jobs and has attracted a significant amount of foreign direct investments (FDIs).

PIA and Nigeria Gas Industry

The 2021 Petroleum Industry Act was a big win for the Nigerian gas industry, as it brought in a lot of incentives specifically directed towards encouraging the local gas industry. The Petroleum Profit Tax of 85% was reduced to 30% Company income tax and 30% Hydrocarbon tax for the industry. However, for non-associated gas fields, the 30% Hydrocarbon Tax does not apply to it, effectively reducing the tax associated with it to just the Company income tax of 30%. At that same time, there is also a 5-year tax break for investment in this sector. Investment in pipelines will also attract an additional 5-year tax break as well making it a total of 10-year tax break. In terms of royalty, the PIA also reduced royalty for gas to 5% and 2.5% for gas consumed in the country. Flared gas penalty is also made non-tax deductible to discourage it, and E&Ps are mandated to supply some percentage of their gas production for the domestic market to encourage growth and demand in the domestic market. The PIA also make sure that there are other incentives not directed specifically to gas but are very helpful to the sector as well (An example is the new structure of the petroleum prospecting and mining licenses).

Possible Opportunities

Investment in the natural gas space cuts across a very wide and diverse range. Starting from the capital-intensive investments in E&P infrastructure, pipelines and processing facilities. There are also opportunities to take advantage of this industry through businesses in the space. For instance, as the industry grows in Nigeria, we expect to see businesses that will focus solely on collecting the LPG and LNG from midstream and ensuring adequate supply to their customers that have contracts with them, more like what we see happening in Europe, where industries sign a long-term supply contract with suppliers to ensure they have enough gas to meet their day to day need. CNG will create entrepreneurs in downstream that will try to replicate what we see with PMS filling stations as well when the adoption of CNG vehicles (it is believed that CNG energy is 50% cheaper when compared to PMS) increases.

Also, a very important use of Natural gas is for heating. With greater availability of natural gas to different areas of demand, it is expected that more industrial businesses involved in manufacturing processes that require a lot of energy like glass producers and metal refiners will spring up as well. In summary, greater availability of power created by natural gas will eventually bring a lot of opportunities to Nigeria as a country.