

SHELL IN NIGERIA

UNLOCKING NIGERIA'S POTENTIAL IN NATURAL GAS

Natural gas is the cleanest burning fossil fuel and is abundantly available in Nigeria, which has the largest reserves in Africa and the ninth largest in the world.

**LARGEST
NATURAL GAS
RESERVES IN AFRICA**

**9TH LARGEST
NATURAL GAS
RESERVES IN THE
WORLD**

90%

reduction in gas flaring **volume**
2002 -2018

80%

reduction in gas flaring **intensity**
2002 -2018

**SHELL NIGERIA GAS LOCAL GAS
DISTRIBUTION NETWORK HAS CAPACITY
TO SUPPLY OVER 400MW OF ELECTRICITY
DIRECTLY TO INDUSTRIES AND
MANUFACTURING PLANTS**

Approximately

7%

of global LNG production
capacity came from Nigeria
LNG in 2018

Around

13%

of Nigeria's grid-connected electricity
in 2018 supplied from **SPDC JV's
Afam VI power plant**

**ALL NEW SPDC JV FACILITIES
DESIGNED TO HAVE NO CONTINUOUS
FLARING SINCE 2000**

UNLOCKING NATURAL GAS TO HELP GENERATE ECONOMIC GROWTH

Large gas reserves in Nigeria

- The Federal Government of Nigeria (FGN) has made it a priority to unlock and harness the potential of this resource to increase domestic and industrial power supply, raise living standards and support sustainable economic growth and diversification.
- According to the Nigerian National Petroleum Corporation (NNPC) Nigeria has around 202 trillion cubic feet (TCF) of proven gas reserves plus about 600 TCF unproven gas reserves.
- However, despite having the largest gas reserves in Africa, only about 25% of those reserves are being produced or are under development today.

FGN aspires to increase electricity generation

- Nigeria currently has around 12 gigawatts (GW) of installed electricity capacity but often less than 5 GW is available in the grid due to inadequate transmission capacity and other challenges.
- The FGN has an aspiration to increase electricity generation from the current 5 GW to 20 GW and this represents a huge development opportunity for Nigeria's domestic gas industry.

THE ROLE OF SHELL COMPANIES IN NIGERIA SUPPLYING GAS TO MARKETS

Shell Companies in Nigeria continue to contribute to economic development in the country by supplying gas to meet domestic needs, such as power generation and industrial processes. Gas is also delivered to the Liquefied Natural Gas (LNG) export market.

The Shell Petroleum Development Company of Nigeria Joint Venture (SPDC JV)

- The SPDC JV's aspiration is to transform into a gas-oriented business designed to secure value across the entire gas value chain that creates a sustained positive socio-economic impact for Nigeria.
- It also aims to grow its gas production capacity to meet domestic gas supply obligations as well as commitments to supply gas to the Nigeria LNG (NLNG) plant for export.

Critical Gas Development Projects

The Shell Petroleum Development Company of Nigeria Ltd (SPDC), the operator of the SPDC Joint Venture (SPDC interest 30%) is working closely with its government partner, the Nigerian National Petroleum Corporation, to increase gas supply for power generation. To this end, in 2018 SPDC expressed its commitment to the Nigerian government in executing three out of seven Critical Gas Development Projects:

- Assa North/Ohaji South field, Imo State
 - A joint development involving SPDC, Nigeria National Petroleum Corporation (NNPC), Total E&P Nigeria Limited (TEPNL), Nigerian Agip Oil Company (NAOC) and SEPLAT, a leading indigenous producer.
 - SPDC is expected to supply 600 MMscf/d to two plants – a new SPDC JV processing plant and a new proposed SEPLAT processing plant.
 - The combined volume translates to almost 2,400 MW of potential electricity generation when it comes to fruition.
 - SPDC took a Final Investment Decision in December 2018 that targets 300 MMscf/d for the SPDC JV's gas processing plant.
 - 100 MMscf/d of the produced gas will directly provide energy to industrial and manufacturing plants in Nigeria via SPDC's local gas distribution network.

- Gas Supply to Brass Fertilizer Company, Bayelsa State.
 - A joint development of fields in OML 33 involving SPDC, NNPC and Brass Fertiliser Company Limited BFPCL.
- Okpokunuo/Tuomo-West Development, Bayelsa State.
 - Development of a unitized field comprising of both SPDC-JV's Okpokunuo and Nigeria Agip Oil Company (NAOC)-JV's Tuomo-West fields.

The three projects are expected to collectively deliver about 1.47 billion standard cubic feet of gas per day once they come onstream.

SPDC is also participating in the development of the 6.4 TCF Unitized Gas fields (Samabri-Biseni, Akri-Oguta, Ubie-Oshi and Afuo-Ogbainbri) in conjunction with the Nigerian Agip Oil Company JV.

Gbaran Ubie plant

Since 2010, the SPDC JV has also been producing gas at the Gbaran Ubie integrated oil and gas plant in Bayelsa State for domestic and export markets.

- Gas is supplied to the domestic market via the Early Production Facility (EPF), which is a dedicated 80 million standard cubic feet of gas per day (MMscf/d) processing facility.
- Current domestic gas off takers are the Gbarain Power Plant, owned by the FGN and the Bayelsa State Electricity Company for their power station at Imiringi.
- In 2017, production commenced at Gbaran-Ubie Phase 2 that will:
 - Help to sustain gas supply through the EPF to the domestic market and maintain supply to the export market.
 - Produce at peak approximately 175,000 barrels of oil equivalent (boe) per day, expected in 2019.
 - Process gas from Kolo Creek, Gbaran, Koroama and Epu fields, which will assist in further reducing the volume of flaring from SPDC operations.
- In 2018, SPDC made a significant near field gas discovery in the Epu that is expected to be processed further at the nearby Gbaran Ubie plant.



SPDC JV Gbaran Ubie Gas Plant, Bayelsa State

Natural gas flowline at Koroama Non-Associated Gas Facility, Bayelsa State



Kolo Creek to Soku gas pipeline

- Construction of a new pipeline between Kolo Creek and Soku was completed in July 2017 that connects the existing Gbaran-Ubie Central Processing Facility (CPF) to the Soku Non-Associated Gas Plant in Bayelsa State.
- Natural gas in a reservoir which contains no crude oil is called non-associated gas.
- This additional gas infrastructure will sustain gas supply to the Nigeria Liquefied Natural Gas Company (NLNG) plant at Bonny in Rivers State and continue to fuel a 225 MW capacity power plant built in Bayelsa State by the FGN under the Nigeria Integrated Power Project.



Workers doing maintenance at Afam VI Power Plant, Rivers State

Agbada and Okoloma Gas Plants and Afam VI Power Plant

- The SPDC JV continued to produce gas in 2018 from the Agbada Early Gas Production Facility in Rivers State, which will further boost gas availability on the eastern Niger Delta domestic gas network and enhance power generation with over 150 MW of electricity.
- Also, the SPDC JV-operated Okoloma gas plant supplies gas to the Afam VI power plant (both in Rivers State), which alone contributed approximately 13% of Nigeria's grid-connected electricity in 2018.
- Afam VI uses combined cycle gas turbine technology that burns 40% less gas than plants using older open cycle technologies. This also contributes significantly to the reduction of greenhouse gas emissions.

Shell Nigeria Exploration and Production Company Limited (SNEPCo)

- Other Shell Companies in Nigeria continue to play a crucial role in the national gas energy mix.
- The Bonga deep-water field operated by SNEPCo produces gas that is piped from the Bonga floating production, storage and offloading facility to the NLNG joint venture plant on Bonny Island where it is cooled to produce LNG for export to consumers around the world.
- Through its 25.6% interest in the NLNG joint venture, Shell has since the early 1990s played a key role in Nigeria's emergence as a global player in LNG.

Nigeria LNG Plant, Bonny Island, Rivers State



Shell Nigeria Gas Limited (SNG)

- SNG currently supplies natural gas to more than 100 industrial and commercial customers, mostly in Ogun, Abia, and Rivers States driving industrialization, providing employment for the skilled and unskilled local population in addition to directly improving internally generated revenues in these states.
- Among its customers are four compressed natural gas companies that make the gas available to other companies outside the SNG local pipeline network.

- In 2018, SNG increased its gas distribution capacity by 150% following the safe completion of its 2nd gas train as part of the Agbara Capacity Increase Project.
- At full capacity utilization, over 400MW equivalent of energy will be directly supplied to industrial plants and manufacturing companies.
- SNG staff is 100% Nigerian and the company is the only gas distribution company in Nigeria whose facility is ISO 14001 Certified.



Opportunities to expand gas distribution

SNG is exploring opportunities to expand its gas distribution network in new states as well as increasing the distribution capacity in existing states where it operates.

- In 2017, SNG entered into an agreement with the Rivers State Government for the distribution of gas to industries in the Greater Port Harcourt area and its environs, which is an opportunity to further promote gas as a more reliable, cleaner and cost-effective alternative to liquid fuels in the Niger Delta.
- In 2018, SNG signed agreements with an IPP consortium in Abia State to provide gas that will provide electricity to Araria market - one

of the largest open stall markets in West Africa (With over 37,000 shops). The construction of a circa 10km gas pipeline to the Osisioma Industrial area is also ongoing.

- In Bayelsa state, agreements have also been signed with industrial offtakers to supply gas to an industrial cluster close to the Gbaran Ubie world class gas facility.
- During the year, SNG also explored opportunities to distribute gas to the Lagos State Government as part of the 'Lights Up Lagos' initiative aimed at using embedded power through public-private partnerships to generate up to 3 GW of power by 2022.
- SNG is also exploring an opportunity in partnership with SPDC, Shoreline Energy and Gasland to develop opportunities to market and distribute natural gas to wholesale and retail customers in Victoria Island, Ikoyi, Lekki and Epe areas of Lagos area.

HARNESSING ASSOCIATED NATURAL GAS

SPDC continues to make progress in close collaboration with its joint venture partners and the Federal Government of Nigeria towards the objective of ending the continuous flaring of associated gas. Associated gas refers to natural gas found in association with oil within a reservoir.

Reduction in gas flaring

- Since 2000, all new SPDC JV facilities have been designed to eliminate continuous flaring of associated gas.
- In parallel, a multi-year programme has been successfully implemented to install equipment for capturing associated gas from older facilities.
- As a result, flaring volume from SPDC JV facilities was reduced by nearly 90% between 2002 and 2018 and flaring intensity (hydrocarbon flared divided by total hydrocarbon production) decreased by 80% over the same period. Divestments also contributed to a further reduction.

- Flaring from SPDC JV's operations in 2018 decreased by around 9% compared to 2017 and flaring intensity (also) decreased by around 10% from the previous year. The decrease in 2018 is (partly) attributed to improved compressor availability and facility outages in the Western Delta.

Solutions to reduce gas flaring

The SPDC JV has developed solutions to reduce gas flaring though flaring still takes place at several of their facilities.

Non-routine operational flaring

- Some facilities only have non-routine operational flaring e.g. Soku, Bonny, Gbaran and Agbada because they have fully functional solutions to address routine flaring.

Routine flaring

- Other facilities have routine flaring but solutions have been identified to capture the associated gas and commercialise it for the domestic market.
- For example, the Bonny Associated Gas Solutions (AGS) facility was commissioned in 2016, while Adibawa and Otumara/Saghara AGS projects came on stream in November and December of 2017, respectively.

New gas gathering projects

- The planned start up dates for two gas gathering projects - Forcados Yokri Integrated Project and Southern Swamp AGS Project - have historically been delayed due to lack of adequate joint venture funding.
- Nevertheless, with funding now restored, the projects are expected to come on stream in 2019.

Nigeria Flared Gas Commercialisation Program

- Remaining sites with low volume flares are located in remote areas and since late 2016, SPDC has been working with third parties to develop small-scale projects to capture the associated gas from these sites for domestic utilisation.
- Following successful engagement with the FGN, the SPDC JV has included these sites into the 'Nigeria Flared Gas Commercialisation Program', which is expected to address these remaining sites.

GAS SUPPLY CHALLENGES

Unlocking Nigeria's natural gas potential will require partnerships between the Nigerian government and oil and gas companies that have the ability to innovate, capacity to deliver major projects, and willingness to take on long-term commitments.

There are several challenges that need to be overcome in order to successfully develop growth projects for the domestic gas market.

New funding regime

- A new funding regime for joint venture oil and gas operations in Nigeria has been operationalised, which is expected to resolve Nigeria National Petroleum Corporation's funding constraints in the SPDC JV.
- This would increase gas production by optimising existing operations as well as accelerating the completion of new gas development projects.

Unpaid deliveries of power and gas

- A second challenge is to clear the backlog of deliveries of both power and gas to customers that have not been paid for.
- Without the payment of outstanding gas and power invoice arrears, and securitization of current and future revenues, operators are reluctant to commit additional investments to grow domestic gas supply.

Investment to develop infrastructure

- Another challenge deals with the need to attract investment to further develop infrastructure along the gas value chain, for example, to create a more robust pipeline network to improve reliability and security of supply.
- The reliability of the existing power transmission also needs improvement. For example, SPDC JV's Afam VI power plant, which has the capacity to generate up to 650 MW, only generates between 350-450 MW most of the time because the power transmission system is unable to evacuate the full output.

Contracts, regulatory framework and security

- Finally, ensuring a conducive business environment is essential to attracting investments and running reliable operations.
- This includes a respect for the sanctity of existing contracts, predictable regulatory, commercial and legal framework across the country.
- Overcoming security challenges in the Niger Delta that has experienced an increased risk to personnel and property as well as the disruption to operations is also very important.

EXPANSION OF GAS PRODUCTION

- The SPDC JV continues to boost the production of natural gas for domestic power generation and export.
- SNEPCo's growth ambitions in deep water includes expansion of natural gas production.
- SNG is at the forefront of providing domestic gas to industrial customers and manufacturing plants.
- NLNG remains a strategic asset in a growing and increasingly competitive global LNG marketplace, in which the Shell Group has a world-class portfolio.

