

Case Study From



Gas Monetization in Nigeria¹

Nigeria has an estimated 170 tcf of proven natural gas reserves, the 10th largest in the world. Abundant gas reserves exceed foreseeable needs of the domestic, regional and export markets. But Nigeria is experiencing power outages low capacity utilization in the refineries and industries, high unemployment and a declining standard of living. Due to limited gas distribution infrastructure, Nigeria today flares about 2.6 bcf/d of gas, representing 12.5% of all globally flared gas, which is 68% of the associated gas produced or 51% of the total gas production.

Nigeria extended the zero gas flaring deadline to 2008 from 2004 after operators argued that the earlier deadline was not feasible. In May 2000, representatives of the major oil companies operating in Nigeria announced that they would be able to meet the required phase-out by the following dates: ChevronTexaco, 2008; TotalFinaElf, 2008; Shell, 2008; Agip, 2005; and ExxonMobil, 2004.

Nigeria is now turning to its vast gas reserves as the money spinner of the future. With exports from the LNG plant on Bonny Island rising, Nigeria said it expects to see gas bringing in as much income in 10 years as oil does.

- *Despite the huge gas reserves, why has Nigeria not been able to develop a gas industry?*
- *Can gas flaring end in Nigeria by 2008?*
- *What strategy should Nigeria pursue to maximize the benefit from the flared gas?*



Background

¹ This case study was prepared using publicly available information.

Nigeria, with 123.3 million people and a land area of 356,700 sq. miles, is one of the most densely populated countries in the world. GDP was estimated as \$40.1 billion in 2000 and GNP per capita was estimated as \$950 in 2000. Nigeria's economy is heavily dependent on the oil sector. In 2001, oil exports accounted for around 80% of government revenues, 90% of export revenues, and over 90% of foreign exchange earnings. Nigeria's real GDP growth was 2.8% in 2000 and is projected at 4.3% for 2001. Nigeria's dependence on crude oil is expected to lessen as the natural gas industry develops. Nigeria's total external debt is estimated at approximately \$32 billion and the country annually spends \$400-\$500 million on debt servicing.

The government is working on a number of economic reforms including the privatization of state companies, exchange rate management, and the phasing out of subsidies. The first phase of the three-part privatization program involved the divestment of state holdings in 14 firms currently traded on the Nigerian Stock Exchange. Delays have pushed the conclusion of the first phase past its planned December 1999 deadline. The second part of the program, originally scheduled to conclude in 2000, entails the sell-off of various state-owned enterprises including hotels, vehicle assembly plants, paper mills and the state telecommunications firm. Of this goal only 77% has been completed by 2002. The final portion of the privatization program involves the selling of several major state-owned entities including the power utility, the NEPA, and the four oil refineries. The government had, by August 2001, successfully sold four Global System for Mobile Communications (GSM) licenses and brought to the point of sale Nitel and several other public enterprises. Progress on implementing the regulatory frameworks for telecommunications and power has been slower than originally envisioned.

Energy Profile

Nigeria has been a significant producer and exporter of oil for decades. In 2001, the proved reserves were estimated at more 22 billion barrels. In 2000, the country produced about 2.1 million barrels a day (mb/d) and exported more than 1.9 mb/d. Gas reserves are estimated by NAPIMS at 170 trillion cubic feet (tcf) in 2001 (significantly larger than 124 tcf reported by BP. However, the country produces only 5.1 bcf/d (or 52 bcm/yr) and consumes 2.6 bcf/d leaving about 2.5 bcf/d for exports. There are some coal reserves, but production and consumption are not significant, about 70,000 tons a year.

Fossil Fuel Reserves, Production and Consumption in Nigeria (01/01/2002)

	Proved Reserves	Production	Consumption
Oil	3.1 billion t. (22.5 billion b.)	104 MT/yr (2.1 mb/d)	14 MT/yr (292,000 b/d)
Natural Gas	4.8 tcm (170 tcf)	52 bcm (5.1 bcf/d)	27 bcm (2.6 bcf/d)
Coal	209 million short tons	0.07 million short tons	0.08 million short tons

Sources: Energy Information Administration, National Petroleum Investment Management Service (NAPIMS)

Power Sector

Nigeria faces a serious energy crisis due to declining electricity generation from domestic power plants. Power outages are frequent and the power sector operates well below its estimated capacity (power generation in July 2000 had fallen to 1,500 MW). Nigeria electricity consumption per capita is 111 kWh, which is one of the lowest in sub-Saharan Africa. This low level of consumption is a result of suppressed demand caused by deteriorated electricity supply infrastructure. Nigeria has 5,900 MW of generation capacity (three hydro-based and five thermal plants) and plans to expand its generation,

transmission and distribution systems. Currently, only 10% of rural households and 40% of total population have access to electricity. The National Electric Power Authority (NEPA) plans to boost this share to 85% by 2010. This would call for an additional 15,000 km (9,000 miles) of transmission lines, 16 new plants, and new distribution facilities.

In March 2000, President Obasanjo replaced the NEPA management with a nine-member technical committee to run the utility with the mandate of ending power cuts by December 2001. The Nigerian government is hoping to increase foreign participation in the electric power sector and is looking for independent power producers to generate and sell electricity to the NEPA. In October 2000, the NEPA signed a partnership agreement with South Africa's Eskom to help improve electricity supply. Eskom will help develop NEPA's repair capabilities, execute transmission line projects, and participate in rehabilitating, operate and transfer (ROT) schemes for the running of Nigeria's power stations. Shell announced in December 2001 that it had been awarded an ROT contract for units 1-4 of the Afam power plant, and a lease, operate and transfer contract for Afam's fifth unit. Eskom is expected to provide the management of maintenance and operations at Afam.

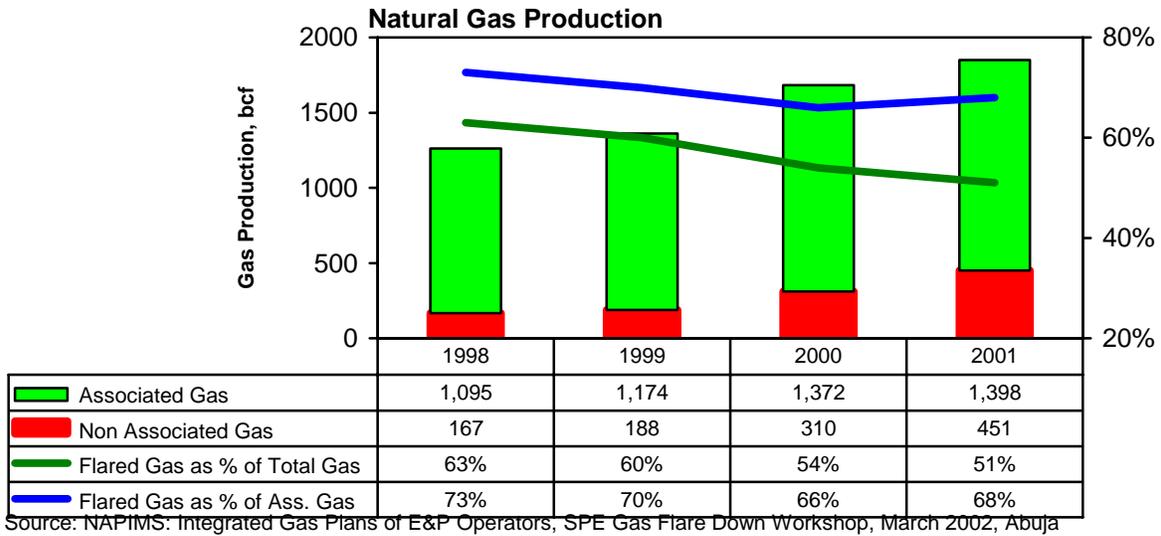
The government is moving forward with plans to privatize the NEPA. In October 2001, the Electric Power Sector Reform Bill (EPSRB) was submitted to the National Assembly. EPSRB authorizes the creation of firms to take over the various functions of the NEPA. The Nigerian Energy Commission and the Solar Energy Society of Nigeria are working on a solar power system to serve rural villages and communities not served by the NEPA power grid.

The Natural Gas Industry

The Nigerian Federal Government and oil producing companies had planned to achieve a gradual reduction and final elimination of gas flare in their upstream operations by year 2008, however that date was reset to 2004 in January of 2003. The upstream sector for 2001 showed that the percentage of gas flare had dropped to about 51 % whereas the percentage of associated gas flared increased in 2001 (see chart below); this was due to increased production while the quantity of associated gas used dropped slightly.

The recently discovered huge oil reservoirs in the deepwater Nigeria are expected to come on stream in 2003. High oil production in excess of 200,000 b/d is expected from each project. This implies that additional high volumes of associated gas will be produced. There is virtually no exploration for gas in the country; most gas reserves were discovered while exploring for oil. Nigeria is viewed as a gas province with significant oil accumulations.

The main drivers of gas utilization projects in the Nigeria had been the government's desire to create more wealth and diversify the economy of the country. A combination of new government incentives and pressure from the environment ministry to end flaring, coupled with rising domestic industrial demand for gas have now encouraged operators to go into gas projects. At least 20 different gas projects are now in progress for delivery between 2003 and 2008, with Nigeria's biggest oil producer Shell handling about a dozen.



Domestic Gas Market

The National Gas Company (NGC) currently supplies gas for power generation, as source of fuel or as feedstock to cement plants, fertilizer plants, glass manufacturing industries, food & beverage manufacturing industries, etc. and the demand is increasing. A large potential market exists for investors in this area. Domestic gas demand is about 400 million cubic feet a day (MMcf/d), which is very low compared to the size of Nigeria's population and its gas resources. The domestic market is limited by the low level of industrialization and the inadequacy of the gas transmission and distribution infrastructure. The power sector currently accounts for almost 90% of gas sales. Substantial growth in the power market is expected.

Gas based Projects

NNPC and other major E & P operators are currently embarking on several gas utilization projects. The major existing and future projects are:

1. LNG Projects

The \$3.8-billion LNG (liquefied natural gas) facility on Bonny Island was completed in September 1999. The facility is expected to process 252.4 bcf of LNG annually. Initially, the facility is to be supplied from dedicated non associated gas fields, but within a few years it is anticipated that half of the input gas will consist of associated (currently flared) gas.

Construction of a third LNG production train, with an annual capacity of 130.6 bcf, was completed and operational in December of 2002. The third LNG train increased NLNG's overall LNG processing capacity to 383 bcf per year.

NLNG has work underway for trains 4 and 5, or "NLNGPlus Project", with Halliburton and KBR as joint venture partners. When the NLNGPlus project is completed, the plant will have an overall production capacity of 16.8 million tons per year (MMT/y) of LNG, 2 MMT/y of LPG, and 1 millions tons of condensate. It will also utilize about 2,800 MMcf/d of gas. The planned start-up is mid-2005. Additionally, a sixth train is currently being planned.

The two new trains and associated facilities will increase the capability of the complex to process associated gas feedstock, enabling a major reduction in gas flaring in Nigeria. In addition to the environmental benefits, the expansion is expected to generate large export

earnings for Nigeria and establish NLNG as an increasingly significant player in the global natural gas industry.

In February 2001, Nigeria and ChevronTexaco, Conoco, ExxonMobil and Texaco signed a memorandum of understanding (MOU) to conduct feasibility studies for a second LNG facility that would be located in Nigeria's Western Delta. Other LNG projects that have been announced are the Agip/Phillips Brass GBS LNG, Statoil Floating LNG and Shell Floating LNG.

2. Escravos Gas Project

- Escravos Gas Project (EGP). EGP 1, the first major gas project to gather and process associated natural gas in Nigeria, came on stream in 1997. The project's second phase – extending capacity to 285 MMcf/d – began operations in 2000. A planned Phase 3 will process up to 400 MMcf/d. The completed project will export 40,000 barrels per day of liquefied petroleum gas and condensate. NGLs are stripped for export and the remaining gas is currently used domestically. The EGP-3 will process an additional 400 MMcf/d of gas from ChevronTexaco's northern offshore fields. Approximately 15,000 b/d of NGLs will be extracted and the remaining 300 MMcf/d of gas will serve as feedstock for a \$1.2-billion, the Nigeria Escravos Gas to Liquid (EGTL) plant, scheduled to come online in 2005.

- Escravos gas-to-liquids plant is scheduled to come online in 2005. Located adjacent to the EGP, the proposed 33,000-barrel per-day plant will utilize Johannesburg-based Sasol Ltd.'s proven synfuels conversion technology. The plant will produce premium-quality, ultra-low-sulfur diesel fuel and naphtha to be sold in Europe and the United States. Engineering and technical feasibility studies are nearly complete for the project, which is also a key element in ChevronTexaco's initiative to reduce flaring of natural gas.

3. Oso NGL Project

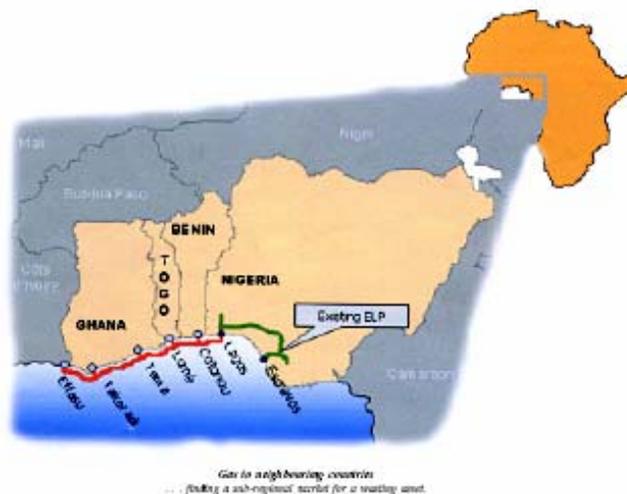
MOBIL JV NGL plant located at its OSO field in the southeastern part of Nigeria started production for export during the third quarter of 1998. The Oso Phase 2 Project is to provide additional gas make-up for the Oso NGL as well as maintain condensate production at the expected plateau.

4. Belema Gas Injection project

SHELL JV Belema Gas Injection project is aimed at reducing flares in five flow stations by re-injecting some of the gas, some for gas lifting, and some for use as fuel by local industries and the excess for backing out NAG that is currently used to meet various existing contractual obligations. The contracts for the execution of the EPC and gathering pipelines are still in the early stages of execution. About 80 MMcf/d of gas is expected to be utilized.

5. The West African Gas Pipeline Project (WAGP)

This project would transport gas from Nigeria to Ghana, Benin and Togo. The \$400-million WAGP will traverse 620 miles (1,033 kilometers) both on and offshore to its final planned terminus at



Effasu in Ghana and will initially transport 120 MMcf/d of gas to Ghana, Benin and Togo beginning in 2004. Gas deliveries are expected to increase to 150 MMcf/d in 2005, 210 MMcf/d in 2010 and be 400 MMcf/d by the end of 2020. Among the key conditions are the following:

- The sale, transmission and purchase of natural gas must be performed on a commercial basis.
- Third party access to WAGP must be granted on a non-discriminatory basis.
- The pipeline company and the sellers of natural gas must be guaranteed settlement in hard currency.

It is also possible that the WAGP will be extended to markets in Cote d'Ivoire. Negotiations are currently in progress with a number of prospective buyers in the sub region.

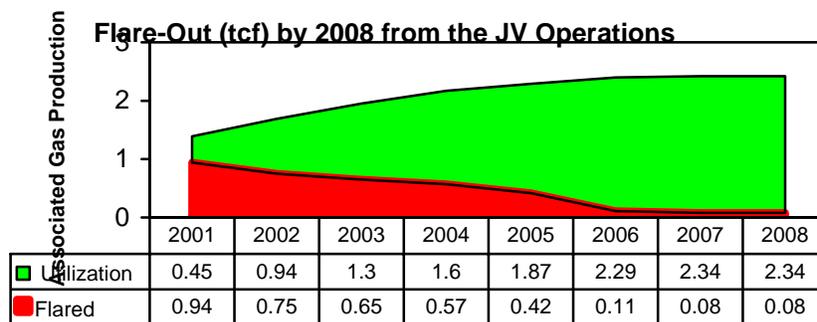
6. Trans-Saharan Pipeline

Nigeria underlined its determination to penetrate the European gas market when it signed preliminary agreements with Algeria in October 2001 on a planned Trans-Saharan Pipeline running through the North African country. The project would seek to connect the Nigerian gas field with that of Algeria, to the European market.

7. Expansion of domestic gas distribution network

Several distribution schemes are planned to help promote Nigerian consumption of natural gas. The proposed \$745-million Ajaokuta-Abuja-Kaduna pipeline will deliver gas to central and northern Nigeria, while the proposed \$552-million, Aba-Enugu-Gboko pipeline will deliver natural gas to portions of eastern Nigeria. The Lagos State government and Gaslink Nigeria Limited (Gaslink), a local gas distribution company, are developing a pilot program to deliver natural gas to nine residential neighborhoods in the state. Gaslink recently began supplying gas to nearly 30 industrial customers in Lagos Ikeja industrial district.

NAPIMS projected path to flare-out by 2008 is shown in the following chart. This is based on the announced projects. The table at the end contains a summary of the projects.



Source: NAPIMS: Integrated Gas Plans of E&P Operators, SPE Gas Flare Down Workshop, March 2002, Abuja

New Fiscal Incentives for Natural Gas Utilization

In view of the domestic gas market that is yet-to-be-developed, low returns greatly impacted by low purchasing power in country, and the huge capital investment required to commercialize gas for purposes of power plants and industrial uses, the government approved various incentives most of which were designed around specific project requirements.

By 1998 associated gas utilization projects are subject to corporate income tax (CIT) rather than Petroleum Profit Tax (PPT). The CIT rate was reduced to 30% from 35%. Gas projects qualify for pioneer status and, as such, enjoy an initial three-year tax holiday, which may be extended for a further two years. Gas projects also qualify for a number of investment allowances. Costs attributable to associated gas will be accounted for separately where it is possible to separate such costs and treated as allowable against income from sales of associated gas for CIT purposes. However, cost that cannot be separated will be charged as part of the oilfield and be an allowable expense against income from sales of crude oil for PPT purposes.

From January 1999, the tax treatment of non-associated gas production and processing facilities is the same as that applying to associated gas. In January 2001, Nigeria raised the domestic price of gas supply to its thermal power plants by more than 400%. The gas price was increased to 12.32 Naira (10 cents) per Mcf, from 3 Naira.

Issues

Some of the issues that need to be addressed in order to develop a domestic gas market include the following:

- The NAPIMS participation stands at 55% in Shell and 60% in ChevronTexaco, Mobil, Agip, and Elf. This had, in the recent past, posed a major burden on Nigeria's ability to allocate adequate funding to cover their share of the funds required for proposed E & P projects. Therefore the E & P companies had been using various creative financing schemes to implement the new projects.
- The lack of a well-articulated domestic energy policy with gas as centre-piece and a structured approach to liberalisation/deregulation of the gas industry appear to have hampered the development of gas resources.
- NGC owns the majority of the transmission capacity. The government is considering the unbundling of the gas chain to allow transparent and efficient development of the separate segments. At present the gas pipeline systems operate below capacity and are ageing, with no interconnection between the East and West and are limited to the south. The major consuming industries are privatized so that they can be re-activated and made more efficient.
- A commercial gas pricing framework that would enable investment in sustaining and growing gas supply, especially in power generation seems to be needed. Fuel price deregulation would further enhance the cost advantage of gas.

Summary of Gas Projects in Nigeria

Project	Type	Company	Design Capacity MMcf/d	Gas Utilized MMcf/d	Cost \$Mm
Oso Phase II	NGL & LPG	MPN	600	600	800
Gas To Liquids	Synthetic Fuel	ChevronTexaco	300	300	1,200
Escravos Gas plant	NGL & LPG	ChevronTexaco	Phase 1 - 165 Phase 2- 135 Phase 3 - 400	700	550 - 1000
Belema Project	Gas Injection	Shell	80	80	N/A
NLNG	LNG	SHELL (25.6)/ ELF (15)/ AGIP (10.4), NNPC (49)	Train 3,4 & 5	3000	N/A
Lagos-Ikeja Gas lines	Distribution & Marketing	UNIPETROL, Gas link	20	20	35
Ota,/Agbara & Aba Gas lines	Distribution & Marketing	Shell Nig Gas (SNG)		N/A	35
West Africa Gas Project (WAGP)	Distribution & Marketing	ChevronTexaco, SHELL (SPDC), NNPC(NGC), TOGO(SoToGaz), GHANA(GNPC), BENIN(SoBeGaz)	180 620 miles of 18" diameter pipeline	180	400
Escravos-Lagos Gas pipeline phase 1,2&3	Distribution	NGC	Phase 1- 80, Total Phase 3 - 160	160	N/A
TNEP Phase 1-3	Dist., Mkt'g & power	ChevronTexaco, ABB		N/A	2,500
Elf Gas Comp	Gas gathering	Elf		N/A	400
Lagos Emer. Power Purchase	Power Generation	AES Corporation	Supply 270MW	N/A	800
ABB - IPP	Power Generation	ABB Group	Phase 1 2 & 3 300 MW	N/A	N/A

N/A - Not Available