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**NATURAL GAS UTILIZATION IN NIGERIA  
INDUSTRIES: THE WAY FORWARD**

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## **Abstract**

The abundant of Natural gas reserve in Nigeria places as the seventh largest reserve in the whole world. The gas has wide applicability in Industries and can be used to generate a lot of revenue for the country domestically. Natural Gas reserve is about 187 trillion standard cubic feet per day, while that of Malaysia has 89 trillion standard cubic feet per day. The utilization level of Nigeria is 1 billion cubic feet per day with an infrastructural distribution coverage of only 1250km of the country compared with Malaysia 3 billion standard cubic feet per with 2270km infrastructural distribution covering a wide area of Malaysia.

This paper examines the availability of this gas reserves in Nigeria vis-à-vis the current level of Natural Gas utilization. Some of the recommendations are;

- (a) Adequate research into economic usage of natural gas and stoppage of gas flaring to improve the environment,
- (b) Encouragement of design of automobile that will rely more on consumption of Natural Gas,
- (c) Sensitizing stakeholders to invest in the upstream and downstream ends in order to harness the wide potentials Natural Gas offers.

## **Introduction**

Energy is a paramount parameter in industries. Nigeria is endowed with abundant petroleum energy sources, such as liquid fuel, diesel, petrol, and fuel oil, gas such as natural and Liquefied Petroleum Gas (LPG) used as fuel in industries. Mostly the predominant fuel used is one which is available and one with relatively higher energy value. Natural gas is a mixture of gases of hydrocarbons and non- hydrocarbons that occur naturally in underground rock reservoir as either non associated gas or with crude oil known as associated gas. Methane gas is dominant portion of natural gas (about 70% to 95%) and few percentages of ethane, propane, butane, pentane and other heavy hydrocarbons. This gas comes along with some impurities like water vapour, carbon dioxide, sulphides and so on. (NGC, 1994, Wikipedia, 2012)

Natural gas is about 187 trillion cubic feet in Nigeria, making Nigeria to be on the 7th position in the world. The natural gas reserve comprises of 55% associated gas and 45% non associated gas (Uche, 2011). A larger percentage of the associated gas is being flared into the atmosphere; this flaring has not completely stopped but reduced as a result of government effort to stop it Madueme (2010).

The domestic utilization level of natural gas is very low at 1 billion standard cubic feet (scf) (Adeoye, 2011). Consumption of natural gas in Africa is low, however countries like Egypt, Algeria, and South Africa have relatively high consumption levels (see Table 1) (The African Development Bank Group, 2010)

**Table 1: Natural Gas: Consumption (Billion cubic feet per day)**

<b>Region</b>	<b>2005</b>	<b>2009</b>	<b>Change 2009 over 2008</b>	<b>2009 share of total</b>
<b>Total North America</b>	75.0	78.5	-1.2%	27.8%
<b>Total S. &amp; Cent. America</b>	11.9	13.0	-4.2%	4.6%
<b>Total Europe &amp; Eurasia</b>	107.8	102.4	-6.8%	35.9%
<b>Total Middle East</b>	27.0	33.4	4.4%	11.7%
Algeria	2.2	2.6	5.5%	0.9%
Egypt	3.1	4.1	4.4%	1.5%
<b>Other Africa (Nigeria inclusive)</b>	<b>2.4</b>	<b>2.4</b>	<b>-16.9%</b>	<b>0.8%</b>
Total Africa	7.7	9.1	-1.9%	3.2%
Total Asia Pacific	38.5	48.0	3.4%	16.8%
European Union	47.8	44.5	-5.9%	15.6%
OECD	136.4	139.2	-3.1%	49.1%
Former Soviet Union	56.7	54.1	-7.3%	19.0%
Other EMEs	74.7	91.2	2.9%	32.0%

Most of the Nigeria natural gas utilization is outside the country as Nigeria government exports Liquefied Natural Gas (LNG) to Europe and other part of the world (Uche, 2011). The major utilization of natural gas in Nigeria is in power generation which has some hiccups. (Gas monetization in Nigeria, 2010)

Due to the variety of natural gas constituents, it finds wide range of application either as an energy source or as feedstock to the chemical and petrochemical industries. Madueme (2010) reviewed the work of Abdulkareem and Odigure (2010) who worked on the Economic Benefit of Natural Gas Utilization in Nigeria based on a Case Study of the Food Processing Industry. The results revealed the following: that up to 69% on diesel, 29.85% on low pour fuel oil, and 69% on electricity could be saved by the company, translating to millions of dollars in five years if conventional fuel and energy is substituted with natural gas. Therefore natural gas is cheap fuel when compared with other fuel either liquid or solid fuel.

Nigerian Oil and Gas Publication reported that Nigeria's natural gas resources have never been fully exploited (Uche, 2011). The objective of this paper is to review the activities of the

Nigerian Gas Company vis-à-vis the industrial utilization of gas in Nigeria in contrast with Malaysia with only about half of gas reserve of Nigeria. Gas utilization data was collected from two companies in Ota Industrial Estate to underscore the overall implication on our economy.

### **Natural Gas - Uses and Derivatives**

Natural gas is a multipurpose and environmental friendly fuel which makes it a fuel for energy source and as well as feedstock for diverse purposes as follows:

- Feedstock to produce many intermediate chemicals and finished products such as acetylene for welding chemicals, ammonia for fertilizer, methanol for adhesives and fuel,
- Fuels for high temperature uses in cement production, earthenware, metallurgical productions etc
- Fuels for medium temperature uses as in food industries, and other industries.
- Used in low temperature environment like paint, pulp and papers, agriculture for crop drying and textile mills.
- Natural gas liquids can be fractionalized to produce ethane, LPG and natural gasoline

### **Comparative analysis of natural gas infrastructures: Nigeria and Malaysia**

A comparative analysis of Nigeria (187 trillion cubic feet per day) and Malaysia (89 trillion cubic feet per day) (Ahmad, 2010) on Natural gas reserve and infrastructures reveal a wide gap in the development advantage of Malaysia over Nigeria when measured against the indices of utilization and number of natural gas infrastructures and spread index.

**Nigeria:**

Nigerian Gas Company which is at the fore front of natural gas development and utilizations in Nigeria has the following infrastructures in place for distribution of domestic utilization of natural gas ([www.ngc.com](http://www.ngc.com)):

**Table 2: Natural gas supply systems in Nigeria**

No.	Gas Pipeline Facilities	Gas Pipeline Facilities	Remarks
1.	The Aladja Gas Pipeline System	Delta Steel Company, Aladja	
2.	The Oben-Ajaokuta-Geregu Gas Pipeline System,	Ajaokuta Steel Company, Dangote’s Obajana Cement Company and PHCN Geregu Power Plant	This is the back-bone of the proposed Northern Pipeline System
3.	The Sapele Gas Supply Systems	PHCN Power Station at Ogorode, Sapele.	
4.	The Imo River-Aba System	International Glass Industry Limited PZ, Aba Textile Mills and Aba Equitable Industry.	
5.	The Obigbo North -Afam system	PHCN Power Station at Afam,	
6.	The Alakiri to Onne Gas pipeline system	National Fertiliser Company (NAFCON) now Notore Chemicals for fertilizer production	
7.	The Alakiri -Obigbo North -Ikot Abasi system	former Aluminum Smelting Company of Nigeria (ALSCON) Plant now Rusal Industries in Ikot Abasi.	
8.	The Escravos-Lagos Pipeline (ELP)	NEPA's Egbin Power Plant near Lagos,	
9.	The Escravos-Lagos Pipeline (ELP) spur lines	West African Portland Cement (WAPCO) Plants at Shagamu and Ewekoro, PZ Industries at Ikorodu, City Gate in Ikeja Lagos, PHCN Delta IV at Ughelli, and Warri Refining and Petrochemical Company at Warri.	
10.	Ibafo – Ikeja Gas Supply Pipeline System	Ikeja City Gate: Gaslink distributes to the Lagos Industrial Area (LIA).	
11.	Ikeja – Ilupeju – Apapa Gas System	Gaslink for Gas Supplies to Greater Lagos Industrial Area	
12.	Ajaokuta-Geregu Gas System	Geregu PHCN Power Plant.	
13.	Ajaokuta – Obajana Gas Pipeline System	Dangote’s Obajana Cement Plant (OCP).	

- All these facilities comprise of over 1,250 km of pipelines ranging from 4" to 36" in diameter

- Overall design capacity of more than 2.5 billion standard cubic feet of gas per day (bscf/d), the utilization level is less than 50% of design or installed capacity
- 16 compressor stations and 18 metering stations. (NGC, 2012)

### Malaysia:

The following Table depicts the level of utilization in Malaysia and the infrastructural development in gas industry.

**Table 2: Natural gas infrastructures in peninsular Malaysia**

Project and Phases	Gas Processing and Pipeline Facilities	Complementary Facilities	Dates of Commissioning
PGU-I	Two 40 km LPG pipelines to Export terminal 32km HP pipeline to -Sultan Ismail Power Station -Perwaja Steel Mill - Kertih Township	1 unit of 250 mmscfd GPP LPG export facilities -5 loading arms -14 m deep harbor	1984
PGU-II	i) 714 km natural gas mainline system from: -Telok Kalong to Segamat -Segamat to Kapar, Port Klang (west) -Segamat to Pasir Gudang & Singapore (south) ii. 40 km propane pipeline from Telok Kalong to Gebeng iii. 40 km butane pipeline from Telok Kalong to Gebeng	3 units of 250 mmscfd GPP	Pipelines completed in 1991/92 GPPs completed in 1992/93
PGU-III	450 KM NATURAL GAS PIPELINE FROM Port Klang to Malaysia –Thai border	2 units of 500 mmscfd GPPs	1988
PGU-Loop1	265 km looping of the PGU-II pipeline from Kertih to Segamat		Completed in 1999
PGU-Loop2	227 km looping of the PGU-II pipeline from Segamat to Meru in the west coast		Completed in 2001

- Total gas distribution pipeline length is 2270 km
- Malaysia natural gas reserve is at 89 trillion standard cubic feet (13th in world reserves)
- Natural gas fired power plants: 24 plants
- Petrochemical projects utilizing natural gas (244mmscfd) in operations:
- Methane 10, Ethane 22, Propane 7, Butane 3, Aromatic 12

- Utilization level stands at about 3.0 billion standard cubic feet of gas per day (bscf/d)

### **Inference from the contrast of Nigeria and Malaysia natural gas infrastructure and utilization**

From the above figures the utilization level of Nigeria is at 1 billion standard cubic feet per day as reported by (Adeoye, 2011) while that of Malaysia is about 3 billion standard cubic feet per day (Ahmad, 2010). The infrastructure of the Malaysia is evenly spread in the country but the infrastructural distribution in Nigeria is in Southern part of the country (East and West) except Ajaokuta pipe line that is proposed to link the north of Nigeria. There is only one petrochemical based industry in the gas distribution of Nigeria while 64 are in operation in Malaysia using natural gas as their feedstock.

The industries in Nigeria that are using gas as either feedstock or fuel are underutilizing the design or installed capacity of the infrastructures. There are 24 gas powered plant in Malaysia utilizing gas while in Nigeria there only seven (4) namely, Sapele, Ughelli, Afam, and Egbin as at 2003 as reported by Menkiti et al (2004), Geregu and other two by Lagos and Rivers State Governments which have independent power projects that utilize natural gas of which quantity is not known which makes the total seven (7).

### **Natural gas utilization in Ota industrial estate: advantages and prospects**

Ota industrial Estate in Ogun State hosts a number of industries, however two companies; one food processing industry and the other metal processing industry were considered. The food processing industry uses natural gas to power their boiler and the metal processing industry uses it to power their foundry.



The following tables indicate the monthly gas consumption for a three-year period of 2008 to 2010.

**Table 3a: Gas consumption by Food Processing  
Company for 2008 – 2010 (in cubic feet per day)**

Month	2008	2009	2010
January	21,305.51	23,831.22	21,305.51
February	21,183.46	22,431.07	23,714.01
March	23,226.09	21,801.99	23,941.63
April	22,501.41	28,552.03	21,094.74
May	24,319.44	24,341.09	25,339.20
June	24,117.17	21,362.87	24,287.12
July	24,304.57	22,314.40	25,528.40
August	23,473.09	24,611.37	27,384.47
September	21,863.99	23,040.09	29,095.43
October	22,174.59	21,371.03	24,170.30
November	22,095.43	24,391.38	26,431.63
December	25,660.51	20,301.53	26,431.63
Total	276,225.26	255,919.00	298,724.07
Average	23,018.77	23,265.36	24,893.67

**Table 3b: Gas consumption by Metal Processing  
Company for 2008 – 2010 (in cubic feet per day)**

Month	2008	2009	2010
January	71,716.42	94,966.23	74,369.36
February	69,602.31	92,236.01	75,698.35
March	70,820.13	94,236.13	73,889.36
April	76,318.21	94,456.35	74,878.56
May	68,431.41	94,654.26	73,556.32
June	74,818.23	95,265.36	74,990.29
July	75,962.13	94,125.69	75,896.37
August	74,358.62	95,369.37	74,524.26
September	66,517.44	93,624.25	74,236.96
October	68,300.21	94,899.37	52,654.12
November	71,345.38	94,964.72	73,558.70
December	72,135.67	94,896.49	74,258.24
Total	860,326.17	1,133,694.23	872,510.89
Average	71,693.85	94,474.52	72,709.24

An in-depth analysis of the data above showed that gas utilization by industries translates to a cheaper production cost and a greener environment. Hence, it should be encouraged all over the country.

### **Economically**

- i. Natural gas is cheaper and hence savings from energy costs can be utilized in other areas of production thereby improving the economy. Furthermore, this will have a salubrious effect on local consumption since more goods are produced.
- ii. It eliminates logistic problems associated with liquid fuel.
- iii. Large scale export of gas and problems products brings about a reduction in importation and thereby improving the balance trade and our economy. There will be more employment for the citizens if there is optimum utilization of our natural gas

### **Environmentally**

Natural gas is described as the cleanest fossil fuel, for its production of less carbon dioxide per unit of energy delivered than either coal or oil and far fewer pollutants than other hydrocarbon fuels. Furthermore, it produces far lower amounts of sulfur dioxide and nitrous oxides than any other hydrocarbon fuel (fossil fuels).

Reduction of trucking of liquid fuel which will reduce the damage caused by the fuel trucks on the roads; this will equally reduce accident on the road and save lives and properties. Generally, extensive usage of natural gas will engender a clean environment.

### **Conclusion**

- Apart from climate change, effect of gas flaring is of high economic waste. Research must be geared towards increase consumption of natural gas at home and in the industries.

- Design of automobiles and procurement of technology based/production driven facilities/equipment should focus on gas fuel. This is to increase our local consumption of natural gas and also improve the environment through clean Technology economy.
- Natural gas will become one of the strong pillars of the Nigerian economy in the near future if every hand is on deck to harness the wide opportunities which natural gas offers.

### **Recommendations**

- The Government should follow the successful step of Malaysia with Strategic planning, incentives and partnerships.
- Government should legislate in favour of gas driven economy to re-orientate Nigerians into clean Technology for improved environment
- Increase gas infrastructural distribution to spread across the country and encourage establishment of more industries that will be production driven by natural gas.
- Establish more petrochemical industries that will use more gas for production.

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