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# Impact of Gas Industry on Sustainable Economy in Nigeria: Further Estimations Through Eview

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**Abstract:** A key policy objective of sustainable economic development, especially in any developing country like Nigeria, is to establish energy development paths that are both economically efficient and sustainable. However, this depends significantly on full utilization of such resources. Distributed Lag (DL) model, dummy variable regression model and co-integration analyses were used in this paper to evaluate the impact and sustainability of Gas utilization in the Nigerian economy. The structure of gas flaring in Nigeria in relation to the imposition of fine on flared gas was also examined. The regression results and the co-integration analysis show that utilization of Nigerian natural gas impacts positively on the economy given three-year time lag; it is also sustainable. On the other hand, although the imposition of fine on flared gas has the potential to end or reduce flares; it has not significantly led to any structural change (sliding slope) on the level of flares since its imposition in 1984. Hence there is need for government to always employ Regulatory Impact Analysis (RIA) to evaluate its policy implementations.

**Key words:** Economy, government, gas utilization, sustainability of gas, gas flaring, distributed lag model, Co-integration

## INTRODUCTION

Energy is at the core of human existence. It is also the pillar of wealth creation. As such, modern society cannot seriously address issues of development if such consideration is not based on the foundation of effective energy planning and management that enhances optimal utilization, regular supply and availability of energy resources. Humans have been aware of the natural flammable gases from the earth for at least several thousand years. Gas was not used extensively as a fuel source until the nineteenth century. Although, natural gas was used as early as 1821 to illuminate the town of Fredonia, New York; its widespread use in the United States awaited the rise of the petroleum industry (Barnes *et al*., 2006).

Nigeria is richly endowed with energy resources. These include coal, tar sand, oil, natural gas, hydroelectricity, solar and so on. The commercial energy sector is, however, dominated by oil and gas, both of which jointly account for 71% of commercial domestic energy resources (Iwayemi and Adenikinju, 2001). Thus, oil and gas play significant role in the development of the Nigerian Economy.

Oil production has been going on in Nigeria for over 50 years together with the production of natural gas. Associated gases are routinely flared in the course of producing and processing oil. Flaring is a means of safely disposing of waste gases through combustion. This is carried out with an elevated flare through the top of a pipe or stack where the burner and igniter are located. This is a common practice in the oil production process. Hence, it is not necessarily an ecological or social crime to flare gas. However, the Nigerian case attracts more attention given the volume of gas flared since the beginning of commercial oil production in the country (Evoh, 2002). Traditionally, most oil companies do not like to find gas together with their oil Fields-Associated Gas (AG). Rather, they prefer to find gas without it being mixed up with oil-so called non-associated gas (non-AG). Finding AG means they have to find ways to dispose of it in order to profit from the oil, the lucrative driver. But while AG

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flaring has been increasingly frowned at in most parts of the world, in Nigeria it has flourished. Hence, Nigeria is reputed to be among the largest gas flaring country in the world. Therefore, understanding the sustainability and economic impact of gas utilization have become areas of critical studies; related to these is the government effort towards ending gas glaring. These are the objectives of this study vis-à-vis the Nigerian experience.

This is more so because natural gas is rapidly gaining importance both as a source of energy and as a feedstock for industry. This growth is being driven by a number of factors including:

- Growing energy demand from an expanding world economy
- An abundant resource base
- Environmental pressures for the use of gas which is a relative "clean" fuel in comparison to oil or coal
- Improving technologies for the production, transportation and conversion of natural gas

Thus, currently, most economies of the world are diversifying away from oil to gas as energy source (Barnes *et al*., 2006).

Generally, natural gas is a fossil fuel that contains a mix of hydrocarbon gases, mainly methane ($CH_4$), along with varying amounts of ethane ($C_2H_6$), propane ($C_3H_8$) and butane ($C_4H_{10}$). Carbon dioxide, oxygen, nitrogen and hydrogen sulphide are also often present. Natural gas is "dry" when it is almost pure methane, absence of the longer-chain hydrocarbons. It is considered "wet" when it contains other hydrocarbons in abundance. Those longer chain hydrocarbons can condense to form valuable light liquids (so-called natural gas liquids, or $NGL_S$). "Sweet" gas possesses low levels of hydrogen sulphide compared to "sour" gas. Natural gas found in oil reservoirs is called "associated" gas. When it occurs alone, it is called "non-associated" gas (Barnes *et al*., 2006).

**Natural gas in Nigeria: reserve, production and utilization:** Nigeria's reserve of associated and non-associated gas is estimated in excess of 160 trillion cubit feet and that its reserves/production is estimated at 109 years. Geologists, however, insist that there is a lot more gas still to be found, if companies deliberately explore for gas, as opposed to finding it by chance whilst in search of oil. In affirmation to the fact that Nigeria ranks among the top ten largest concentrations in the world, Adenikinju (2008) and EIA (2011) assert that the country has an estimated 187 trillion cubic feet of proven natural gas.

Gas production in the country is undertaken by the major oil companies (Shell, Chevron, Agip, Texaco, Mobil, Elf, Ashland and Pan Ocean). Natural gas production has increased enormously from 125.55 Million Tones (MT) (310 million cubic metres) in 1961 to 14472.11 MT (36,036.6 million cubic metres) in 1998. It further increased to 101,976 million cubic metres in 2002. However, it is important to note that there is virtually no exploration for gas in Nigeria. Most gas reserves were discovered while exploring for oil. Therefore, high oil production implies that additional high volumes of associated gas will be produced (Okoh, 2001).

The main driver of gas utilization projects in Nigeria had been the government's desire to create more wealth and diversify the economy of the country. Since, the 1980s, there has been increasing utilization of gas in Nigeria for power generation, industrial heating, fertilizer and petrochemical manufacturing and as feedstock for direct steel reduction. But the largest gas users are the Liquefied Natural Gas (LNG) project and the Aluminum smelting industry. Nigerian's LNG project had been on the drawing board since the 1960s. It was not until 1990 that the NNPC concluded financial arrangements for the project. Established in 1992, the Nigerian Liquefied Natural Gas Company commenced execution of the project in 1993. The shipment of gas from the Bonny Plant to overseas buyers in Europe commenced late in 1999.

The National Gas Company (NGC) currently supplies gas for power generation, as source of fuel or as feedstock to current 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 (Kareem *et al*., 2012a). 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 (ECC, 2006).

Unlike what obtains in Nigeria, where power sector consumes about 90% of the total gas supply, industrial 4% and the chemical feedstock about 3%, the pattern of gas consumption in advanced economies such as the United States of America is entirely a different scenario. The consumption pattern for residential, industry, power plants and others includes chemical feedstock stands at 45, 25, 17 and 13% of the total gas supply, respectively. In the Eastern Europe, the situation is quit closer to what is obtainable in the USA (Kareem *et al*., 2012b). Consumption for residential stands at 45%, industry 30%, power sector 13% while others take 12% of the total gas supply (Douglas, 1996).

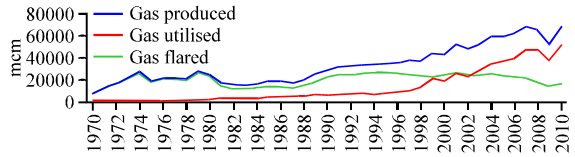


Fig. 1: Gas industry in Nigeria, data from NNPC (2010)

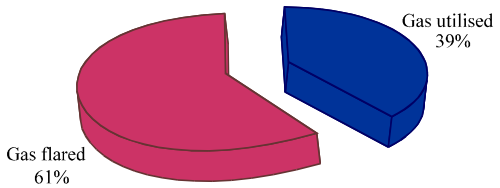


Fig. 2: Nigerian gas (mcm): 1970-2010, data from NNPC (2010)

Gas is a close substitute for other fuels in electricity generation, a complement to crude oil in revenue earning, a feedstock for fertilizer and petrochemical industries and environmentally more friendly, being cleaner than crude oil or coal. But natural gas in Nigeria has a problem and that is, most of it is flared (Ojinnaka, 1998). This leads to adverse effect on the environment (Fig. 1, 2).

**Why gas flaring in Nigeria?:** Historically, gas flaring in Nigeria began simultaneously with oil extraction in the 1960s by Shell-BP. Although, the British government subsequently acknowledged that the flaring was unacceptable, it was allowed to continue without any real efforts to change infrastructure and prevent the waste of the gas. This is in contrast to Britain's policies on gas flaring in their own territory where gas flaring has been reduced to a minimum. In fact, in Western Europe 99% of associated gas is used or re-injected into the ground. Gas flaring is generally discouraged and condemned by the international community, as it contributes greatly to climate change.

In an effort to encourage better use of natural gas and minimize adverse environmental impact of its flaring, government imposed fine on flares and has periodically adjusted it upwards. Government has, however, not sufficiently followed through with its decision to have more industries convert to the use of natural gas as a way of increasing demand for the product and making flaring less desirable (Kareem *et al*., 2012c).

Thus, the neglect of Nigerian natural gas was due to institutional and policy lapses. The joint venture comprises' primary preference was to extract crude oil and make their profit. Consequently the gas associated with crude oil was seen as a nuisance and had to be flared. Nigerian government enacted a law Associated Gas Re-injection Act in 1979 which allowed some conditions for specific exemptions or the payment of a fee of US $0.003 (0.3 cents) per million cubic feet with effect from 1984 which increased in 1988 to US $0.07 per million cubic feet and in January 2008 to US $3.50 for every 1000 standard cubic feet of gas flared. This fine is still considered meager and not a deterrent for companies which find it easier to just pay the fine. The augment that there was no market for selling Nigeria's gas or the technology for developing the gas turned out to be baseless as a number of projects later put in place to develop gas resources indicate (JINN, 2010).

Friends of the Earth (2004) states that several other reasons that have been put forward for continuing to flare, could be categorized into economic, commercial and technological issues. On the other hand, Evoh (2002) emphasized that the entire issues of gas flaring in Nigeria boils down to one question; who manages natural resources exploitation in Nigeria-the government or multinational corporations? It is quite astonishing that gas flaring has continued in the country despite the fact that flaring has been in general, illegal since 1984 pursuant to section 3 of the Associated Gas Re-injection Act, 1979.

Climate Justice (2006) asserts that the SPDC's (Shell) strategic plan states that it seems that the industry was seeking clearer guidance from the Federal Government of Nigeria (FGN) in meeting the 2008 zero flaring deadline and it is trying to "guess-out" true FGN intentions as meaning business this time or just another down the road deadline that this government would not live to see.

**Gas flaring and environmental issues:** Gas flares can have potentially harmful effects on the health and livelihood of the communities in their vicinity, as they release a variety of poisonous chemicals. Some of the combustion by-products include nitrogen dioxides, sulphur dioxide, volatile organic compounds like benzene, toluene, xylene and hydrogen sulphide, as well as carcinogens like benzapyrene and dioxin. Humans exposed to such substances can suffer from a variety respiratory problems which have been reported amongst many children in the Delta but have apparently gone uninvestigated. These chemicals can aggravate asthma, cause breathing difficulties and pain, as well as chronic bronchitis. Of particular note is that the chemical benzene which is known to be emitted from gas flares in undocumented quantities, is widely recognized as being a causative agent for leukemia and other blood related diseases.

Often, gas flares are located close to local communities and regularly lack adequate fencing or protection for villagers who may risk nearing the tremendous heat of the flare in order to carry out their daily activities. Many of these communities claim that nearby flares cause acid rain which corrodes their homes and other local structures, many of which have metal roofing. However, whether or not the flares contribute to acid rain is debatable, as some independent studies conducted have found that the sulphur dioxide and nitrons oxide content of most flares was insufficient to establish a link between flaring and acid rain (Friends of the Earth, 2004).

The problem of flaring gas is not debatable Ojinnaka (1998) states categorically that the problem has to do, mainly, with its adverse environmental impact on immediate communities whose corps and poultry and fishing activities are damaged due to pollution. This is part of what Stiglitz (2000) calls negative externalities.

**Gas flaring and Nigerian economy:** Iwayemi and Adenikinju (2001) identify the theoretical condition linking resource rents to economic sustainability. However, despite the various ways in which natural gas can be used in Nigeria, approximately 75% (by 1998), 63% (by 2000) and 24.30% (by 2010) of the total gas output were flared. For instance, if you take gas which is flared in Africa which is around 40 billion cubic meters each year, with Nigeria contributing 46% and if you used that to generate power in efficient modern power plants, you could actually double the power production in sub-Saharan African, excluding South Africa (Kareem *et al*., 2012c).

Ojinnaka (1998) describes flaring gas as enormous loss of revenue that could have been realized. However, he notes that some percentage of gas is sold in the domestic market to industries like cement, brewery, glass and aluminum as complement to the use of diesel and fuel oil to operate private generators. As liquefied natural gas, there is high demand for gas in the international petroleum market. Therefore, investors are showing more interest in gas production in Nigeria because of its high economic potential and higher efficiency when compared with other fuels.

In his discussion on gas flaring as an economic loss, Ogbonna (1999) asserts that against the massive economic loss, natural gas should and can play some vital roles in the Nigerian economy. These roles include stimulant for industrial development, foreign exchange earner, improved capacity utilization of Nigeria industries and provision of employment opportunities.

**Ending gas flaring in Nigeria:** The federal government of Nigeria had extended the zero flaring deadline to 2008, replacing the previous apparent date for ending the flaring of 2004. This was done after the major operators argued that the earlier deadline was not feasible. In May 2000, representatives of the major oil companies operating in Nigeria had announced that they would be able to meet the required phase-out by the following dates: Chevron Texaco-2008; Total Final Elf-2008; Shell-2008; Agip-2005; and ExxonMobil, 2004 (ECC, 2006). Although, some oil the major oil companies made significant efforts towards meeting the deadline, flares has continued. The efforts made by SPDC, Mobil and Chevron to end flaring can be seen in the reduction of the proportion flared in 2010 in Fig. 3.

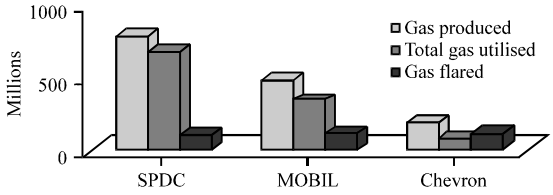


Fig. 3: Gas produced utilized and flared by select oil firms in Nigeria, 2010, data from NNPC (2010)

However, Social Action (2009) insists that there is a form of conspiracy theory practiced by the oil company in disclosing information on flared gas in Nigeria. For instance, Social Action insists that the oil majors are reluctant to sincerely disclose how much associated and non-associate gas they produce and how much they flare. They believe that flaring of associated gas has not reduced significantly; rather, it is the increase in non-associated gas production that makes the percentage of volume of gas flared to fall.

**Previous empirical studies:** Climate Justice (2006) carried out an extensive study on "Gas flaring in Nigeria." According to that report, more gas is flared in Nigeria than anywhere else in the world. Again, they opine that estimates are notoriously unreliable, but roughly 2.5 billion cubic feet of gas associated with crude oil is wasted in this way everyday. This is equal to 40% of all Africa's natural gas consumption in 2001 while the annual financial loss to Nigeria is about US$2.5 billion. This is unlike the British attitude to flaring North sea gas where flaring of associated gas was over 90% at the start of crude oil production, but has decreased over the last 25 years to around 2%, with onshore flaring at between 6-14% since 1991.

Furthermore, they observed that despite its oil and gas, Nigeria is one of the poorest countries in the world. This is difficult to believe. Until it is recalled, for example that 28 of the 45 years since independence have been under military rule and that the Economic and Financial

crime commission estimates 45% of Nigeria's oil revenues are reported wasted, stolen or siphoned away by corrupt officials.

In addition, with reference to the OPEC figures for Nigeria for 2001-16.8 bcm $y^{-1}$-they assert that Nigeria comes out as the world's number one flare on both absolute and proportionate bases. Estimating the total world flaring volume in 2001 at 84.87 bcm, Cedigaz data indicates that Nigeria accounted for 19.79% of the global amount. The Nigerian amount is more than the second and third countries combined and four times higher than the nearest African country, Algeria which is recorded as having flared and vented 4 bcm. European flaring is put at 2.54 bcm, or 0.76% of gross production, US flaring at 2.92 bcm, or 0.43% of gross production. According to them, a recent study carried out for the Bureau of public Enterprises of Nigeria estimate that each year the country losses between US$500 million and US$2.5 billion to gas flaring.

Iwayemi and Adenikinju (2001) applied the Computable General Equilibrium (CGE) model framework to evaluate Energy-Environment-Economy linkage in Nigeria. They observe that the share of petroleum products in energy consumption declined from 74.6% in 1970-46.5 percent in 1992 and further to 37.7% in 1999. On the other hand, the share of natural gas increased from about 5% to 29.3 per cent in 1992 and to 53.2% gas flaring between 1965 and 1987 amounted to $3.15\times10^{11}m^3$.

A cost-benefit analysis of gas production in Nigeria carried out by Okoh (2001) reveals that during the project horizon of 38 year (1961 to 1998), Nigeria lost a total of 234.02 billion tones of gas valued at N936.09 trillion (at N4000/tonne;1997 government price) to gas flaring. According to her findings, the NPV for gas production in Nigeria over a 38-year project horizon (1961-1998) at the interest rate of 7 per cent was -N759.30 trillion in constant 1998 naira. The negative sign indicates that gas production in Nigeria at this current state is not economically or socially worthwhile. That is, it is not profitable to the society.

Deckor (2002) equally did a research on the impact of gas flaring. But he was rather interested in the impact of gas flaring on the wetland soils of the Nigeria Delta.

On the other hand, Egbuna (1987) studied the environmental hazards of the natural gas industry. He observed that in 1986, the total gas flared from over 300 fields in Nigeria yielded a wasted heat equivalent of about $60\times10^9$ kwh which is approximately equal to all the total Electric Power PLC (NEPA) that year from all sources. He states that the economic loss estimates puts the price of flared natural gas at about fifty million naira (or over 30 million dollars, indexed at 1985), per day.

## MATERIALS AND METHODS

**Data and analytical technique:** Our analyses are confined to the period 1970-2010 due to data availability. The data were drawn from Central Bank of Nigeria (CBN, 2010) Statistical Bulletin and Nigerian National Petroleum Corporation (NNPC), apart from the dummy variable which was generated by the researchers given the theory underlying. The estimations were carried out using the Eview. The variables were used at the order of their stationarity at 1% level of significance.

**Methodology:** The theoretical framework adapted in this work is the neoclassical augmented production function-solow model as stated below:

$$Q = f(A\ KL)$$

Where:
Q = Output
L = Labour
K = Capital
A = Exogenous productivity term

The above equation states that output is a function of capital and labour including a productivity term. Thus, in this paper energy resources are considered as a form of capital and so they are expected to be positively associated with national output.

**Model 1:** Distributed lag model:

$H_o$: Gas utilization has no significant effect on the performance of Nigerian economy:

$$O = \beta_0 + \beta_1 \sum_{i=0}^{n} Gu_i + \beta_2 \sum_{i=0}^{n} Co_i + \beta_3 \sum_{i=0}^{n} Ir_i + \mu \quad (1)$$

Where:
O = Gross Domestic Product (N'm); Gu = Gas utilization (mcm);Co = Crude oil export (mcm)
Ir = Inflation rate; $\mu$ = stochastic term; i = lag length
n = Maximum lag length (determined during the estimation)

**Model 2:** Dummy variable regression model:

$H_o$: The imposition of fine on flared gas has no significant effect on the level of flares:

$$Gf = \alpha_0 + \alpha_1 GfF + \alpha_2 Gp + \varepsilon \quad (2)$$

Where:
Gf = Flared gas
Gp = Gas produced:

$$GfF = \begin{cases} 1 - \text{post fine era} \\ 0 - \text{pre fine era} \end{cases}$$

**Recall:** From the reviewed literature, it was observed that fine on flared gas was introduced in 1984 in pursuant to section 3 of the Associated Gas Rejection Act, 1979. (Climate Justice, 2006).

**Co-integration analysis:** Co-integration test was used to ascertain if gas utilization can sustain the Nigerian economy or not. The test was conducted between GDP and gas utilization. According to Gujarati, 1995), co-integration implies the existence of long-run relationship-that is, sustainability.

## RESULTS AND DISCUSSION

**Model 1:** Distributed Lag (DL) model a.

This model evaluates the following hypothesis:

$H_0$: Gas utilization has no significant effect on the performance of Nigerian economy

The above result (Table 1) shows that the gas utilization impacts Nigerian economy positively at lag 3. For instance, the result shows that a unit increase in gas utilization will lead to about 109 units increase in the gross domestic product (O). The negative significant impact of gas utilization (in its current year) on GDP can be explained by the fact that as a production input, it could take some time before its positive effect will be felt by the economy. On other hand, it is evidence that crude oil export has positive significant impact on Nigerian economy. The hypothesis (I) was therefore rejected as we since gas utilization has significant impact on the Nigerian economy.

**Model 2:** Dummy Variable Regression (DVR) model:

Table 1: DL model

Dependent Variable: D(O,2)
Sample (adjusted): 1975-2010
Included observations: 36 after adjusting endpoints

| Variable | Coefficient | t-statistic | p-value |
|---|---|---|---|
| C | -27325.38 | -0.369042 | 0.7150 |
| D (GU) | -59.05996 | -2.215992 | 0.0353 |
| D (GU(-3)) | 108.8390 | 3.144587 | 0.0040 |
| D (CO,2) | 0.776589 | 7.658011 | 0.0000 |
| D (CO(-1),2) | 0.449966 | 3.444785 | 0.0019 |
| D (CO(-2),2) | 0.500771 | 3.522107 | 0.0015 |
| D (CO(-3),2) | 0.630002 | 4.880025 | 0.0000 |
| D (IR) | -1078.347 | -0.343588 | 0.7338 |
| ECM (-1) | -0.631798 | -5.536632 | 0.0000 |

$R^2$: 0.912499, F-statistic: 35.19590, Durbin-Watson stat: 2.012782, p-value (F-statistic): 0.000000

$H_0$: The imposition of fine on flared gas has no significant effect on the level of flares

The Table 2 above shows that the imposition of fine in 1984 did not significantly impact on the level of flared gas. Rather, the total volume of produced gas has remained the significant determinant of the level of flares. Therefore, we accept the null hypothesis (II) and affirm that the imposition of fine on flared gas has not significantly affected the level of flares. This is further illustrated in Fig. 4 below where the trend of gas flaring maintains upward slope, though not as much as gas utilization.

Using 1988 as the intervention year, when the fine on flared gas was increased from US $0.003 (0.3 cents) per million cubic feet in 1984 to US $0.07 per million cubic feet, Table 3 above shows that the probability of the imposed fine causing a structural change on flared volume increased about 0.056 point from 1984. However, the impact remained insignificant-though with negative slope. (Fig. 4).

**Co-integration analysis:** Sustainability of fine on flared gas:

Ho: Gas utilization is not sustainable in Nigerian economy

The result co-integration test between the gross domestic product (O) and gas utilization established evidence of co-integration between the two variables. Therefore, we reject the null hypothesis and conclude that gas utilization is sustainable in Nigerian economy. In

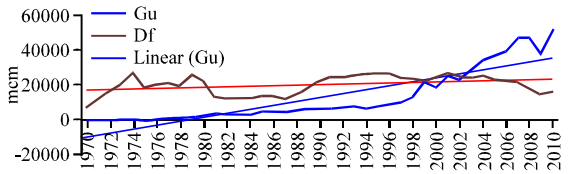


Fig. 4: Utilised and flared gas in Nigeria, data from NNPC (2010)

Table 2: DVR Model (with 1984 as intervention point)

Dependent Variable: D(GF)
Sample (adjusted): 1971-2010
Included observations: 40 after adjusting endpoints

| Variable | Coefficient | SE | t-statistic | p-value |
|---|---|---|---|---|
| C | 52.81713 | 658.6376 | 0.080191 | 0.9365 |
| GFF | -788.4495 | 807.2386 | -0.976724 | 0.3350 |
| D (GP) | 0.463837 | 0.076990 | 6.024658 | 0.0000 |

$R^2$: 0.495411, F-statistic: 18.16347, Durbin-Watson stat: 1.874395: p-value (F-statistic): 0.000003

Table 3: DVR model (with 1988 as intervention point)

Dependent Variable: D(GF)
Sample (adjusted): 1971-2010
Included observations: 40 after adjusting endpoints

| Variable | Coefficient | SE | t-statistic | p-value |
|---|---|---|---|---|
| C | -1.340415 | 574.3527 | -0.002334 | 0.9982 |
| GFF | -842.2017 | 766.3005 | -1.099049 | 0.2788 |
| D (GP) | 0.468006 | 0.077137 | 6.067163 | 0.0000 |

$R^2$: 0.498764, F-statistic: 18.40876, Durbin-Watson stat: 1.909319: p-value (F-statistic): 0.000003

Table 4: Co-integration test

Sample: 1970-2010
Included observations: 36
Test assumption: Linear deterministic trend in the data
Series: D(O,2) D(GU)
Lags interval: 1 to 1

| Eigenvalue | Likelihood ratio | 5% Critical value | 1% Critical value | Hypothesized No. of CE(s) |
|---|---|---|---|---|
| 0.742279 | 59.01503 | 15.41 | 20.04 | None** |
| 0.246804 | 10.20345 | 3.76 | 6.65 | At most 1** |

*,**R rejection of the hypothesis at 5% and (1%) significance level, respectinety, L.R.: Test indicates 2 cointegrating equation(s) at 5% significance level

other words, if this industry is developed, it can sustain Nigerian economy in the long run just as crude oil is doing at present. This implies that in the light of economic diversification, natural gas can be considered as one of the major sources of national income even in the long-run. Thus, any investment towards the development of gas industry in Nigeria will be worthwhile (Table 4).

## CONCLUSION AND RECOMMENDATION

This study examined the implications of the availability and utilization of gas resource in Nigeria by using econometric models. The results reveal that gas utilization has significant positive impact on the economy and it is also sustainable. On the other hand, it reveals that since the imposition of fine on flared gas in 1984, no significant structural change has been observed on the level of flares.

Therefore, there is an urgent need for the government to provide environment that is conducive for investment in the gas industry as this will lead to additional income to both the people and government of Nigeria. The passage and signing into law of the proposed Petroleum Industry Bill (PIB) could as well be the answer to the puzzle obstructing the development of Nigerian gas industry as it will enhance investors' confidence in the industry.

Based on the findings from these analyses, the researchers make the following recommendations:

- Gas flaring should stop immediately since its continuation is not only humanly and environmentally harmful, but also constitutes a huge source of revenue loss to the people and government of Nigeria
- Approval for exploration and new oil field development must be at the conditionality of providing facilities for the utilization of associated gas
- Effective legal obligations must be imposed to require associated gas to be used at Bonny LNG plant and in the West African Gas Pipeline before any non-associated gas is used
- Government should continue to promote private investment and ownership in major gas facilities
- Nigerian government should adopt a pricing regime more conducive to providing companies with an incentive to find and produce gas. If gas is able to compete on price with alternative energy forms in the market, the full value and potentials of Nigerian gas reserves will be realized. However, consumer subsidy for gas should be considered to keep the product affordable
- The on-going improvement on international market access for gas should be pursued vigorously
- Government should investigate any possible need for subsidies (may be in the form of tax exemption) for flaring reduction projects at remote fields
- Kareem *et al.* (2012c) that the progress which Indonesia and Malaysia (two countries that were on the same level of economic development as Nigeria in early 1960s) have made in recent times is attributable mainly to political and economic stability brought about by credible, consistent and visionary leadership. Government should, therefore, provide investment-friendly environment as investors will naturally like to go to areas where their assets are safe and profits can be easy to repatriate
- Government should always endeavor to fulfill its obligations, such as cash payment and so on, in the operations of the joint venture partnership. Else, it cannot credibly enforce gas flaring laws or penalize any defaulting oil company

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