

GAS FLARING

A REAL AND
PRESENT
DANGER





About BudgIT

BudgIT is a civic organisation driven to make the Nigerian budget and public data more understandable and accessible across every literacy span. BudgIT's innovation within the public circle comes with creative use of government data by presenting these in simple tweets, interactive formats or infographic displays.

Our primary goal is to use creative technology to intersect civic engagement and institutional reform.

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GAS FLARING

Gas Flaring: A real and present danger

Gas flaring, the burning of natural gas that accompanies crude oil pumped from ground level, is a hotly-debated issue amongst oil and gas experts in Nigeria today. Yet, very little is known about this phenomenon by the average citizen.

NIGER DELTA



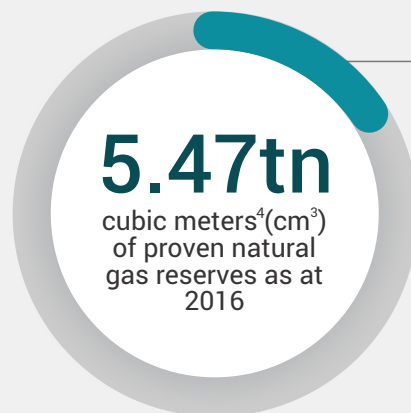
30m₁
Nigerian's health,
livelihood and survival
in the Niger Delta
under threat



2m₂ <>
barrels of crude oil
per day

N79.59tn₃
contributed to the federal
government revenue from
1981 to 2016

NIGERIA



14.33%
of gas produced
is currently flared



Over the next **75 years**

784.59bn

cubic meters of Nigeria's natural gas will be flared into Niger Delta communities and offshore regions



Nigeria accounts for

40%

of all gas flared in Africa.

Experts argue this could mean more deaths and health deformities within these communities, due to the toxic air indigenes breathe in. According to the United Nations Environment Programme (UNEP), approximately 600,000 people die in Africa every year as a result of air pollution; gas flaring is a key driver of air pollution in oil-producing communities, with Nigeria accounting for 40% of all gas flared in Africa.



600,000

deaths per year is the equivalent of wiping out a small oil-producing community like Polaku in Bayelsa State within a year.

The primary aim of this paper is to simplify the following: what really is gas flaring? Why does it persist? What are the real implications on host communities? What is Nigeria's government doing about gas flaring - and what should the government be doing?

Understanding the basics

Gas flaring is an integral part of the exploration, production and processing of natural gas, liquids and oil from shale⁵. In an emergency situation where equipment or piping comes under excessive pressure, special valves automatically release excess gas through piping to flare stacks - which then burns the gas into the atmosphere. In the absence of these safety flares, plants would be at higher risk of fires and explosions. Flares are also used as an outlet for gas during maintenance and equipment repairs. In these scenarios, the flare is operated temporarily, until the emergency situation is resolved, or until maintenance activities have been completed.

5. "Understanding the Basics of Gas Flaring" Division of Air Pollution Control, Ohio EPA, United States, 2014



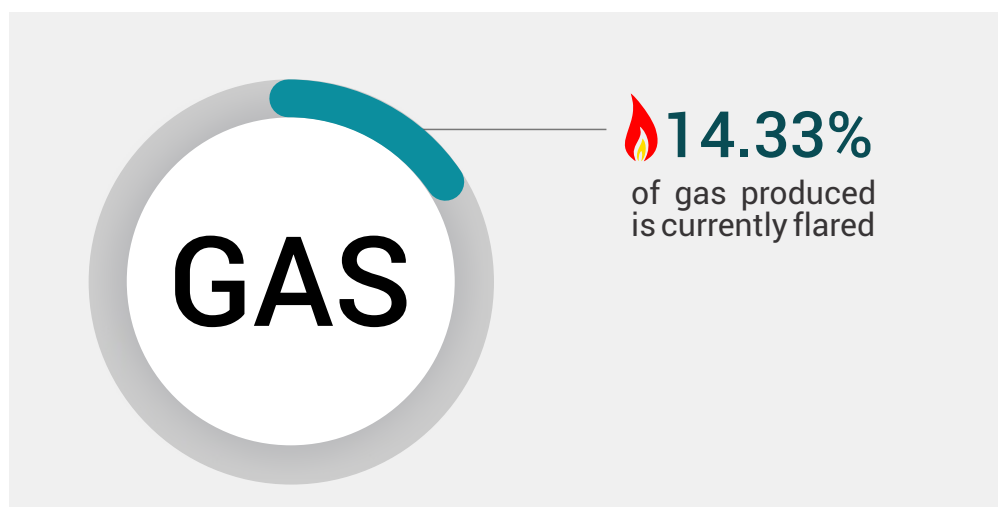
What is a gas flare system?

This consists of a flare stack and pipes that feed gas to the stack. Gas flare size and brightness are related to the type and amount of gas, or liquids in the stack. Flares generate heat and noise; larger flares can be quite noisy because of the volume and velocity of the gas going through the flare stack.⁶

When does gas flaring become irresponsible?

It is not always the case that gas is flared for safety reasons - this is when industry procedures cross the line and tend towards endangerment of lives and property.

“When crude oil is extracted and produced from onshore or offshore oil wells, raw natural gas also comes to the surface; in areas of the world like Nigeria which lack adequate gas pipelines and other gas transportation infrastructure, this gas is commonly flared”⁷ - releasing pollutants including sulphur oxides, nitrogen oxides, carbon disulphide, carbonyl sulphide, carbon dioxide and volatile organic components into the atmosphere. In 2016, gas flared constituted 14.33% of the total gas produced in Nigeria.



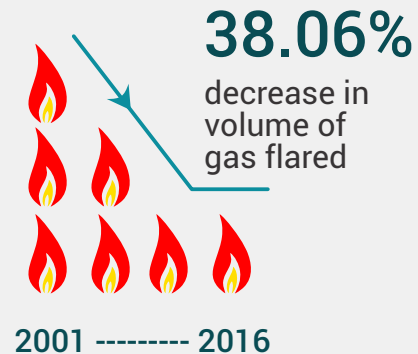
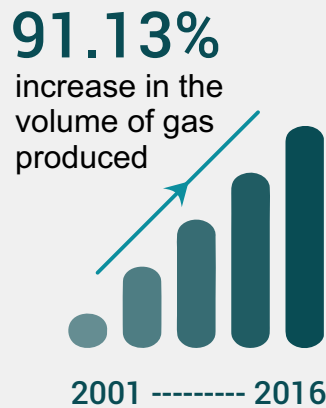
6. "Understanding the Basics of Gas Flaring" Division of Air Pollution Control, Ohio EPA, United States, 2014
7. <https://www.fluenta.com/news/what-is-flare-gas-and-why-is-it-important/>



Gas flaring - a historical trend

Although some progress has been recorded in the fight against routine gas flaring over the last 20 years, analysis by BudgIT's Extractives team shows that between 2001 and 2016, the volume of gas produced increased by 91.13%, whereas the volume of gas flared reduced by only 38.06%.

This shows that although oil companies are investing more money in gas production activities, they appear to neglect to invest sufficiently in technologies and infrastructure aimed at reducing routine gas flaring.





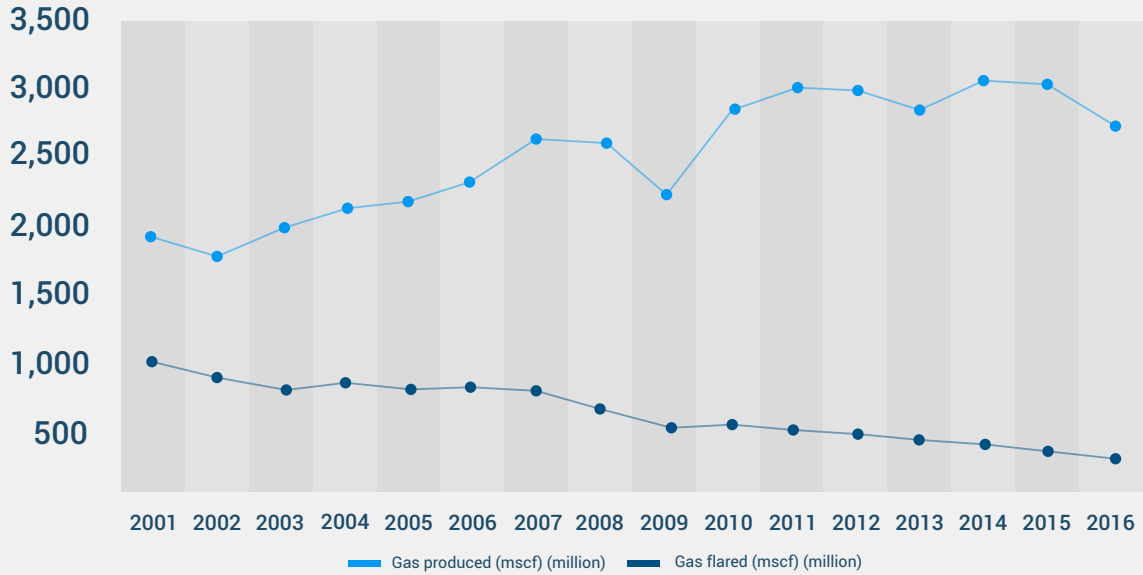
Gas flared by year vs Gas produced (2001-2016)

Year	Gas produced (mscf) (million)	Domestic Gas Sold (mscf) (mil)	Gas flared (mscf) (million)	Percentage of Gas flared
2001	1,943.59	141.06	1,000.74	50.01%
2002	1,751.13	111.43	920.92	46.00%
2003	1,903.32	214.18	801.46	40.01%
2004	2,110.17	262.89	851.64	42.50%
2005	2,135.33	234.78	805.51	40.18%
2006	2,289.89	326.26	820.42	40.90%
2007	2,606.86	279.97	816.64	40.69%
2008	2,580.39	232.16	670.78	33.41%
2009	2,228.11	237.28	536.36	26.70%
2010	2,819.68	285.80	544.72	27.10%
2011	2,966.65	344.48	503.94	25.06%
2012	2,996.03	372.04	465.25	23.12%
2013	2,811.98	391.43	427.97	21.26%
2014	3,048.54	424.73	393.83	19.55%
2015	3,003.17	445.26	330.93	16.42%
2016	2,711.80	382.22	288.91	14.33%

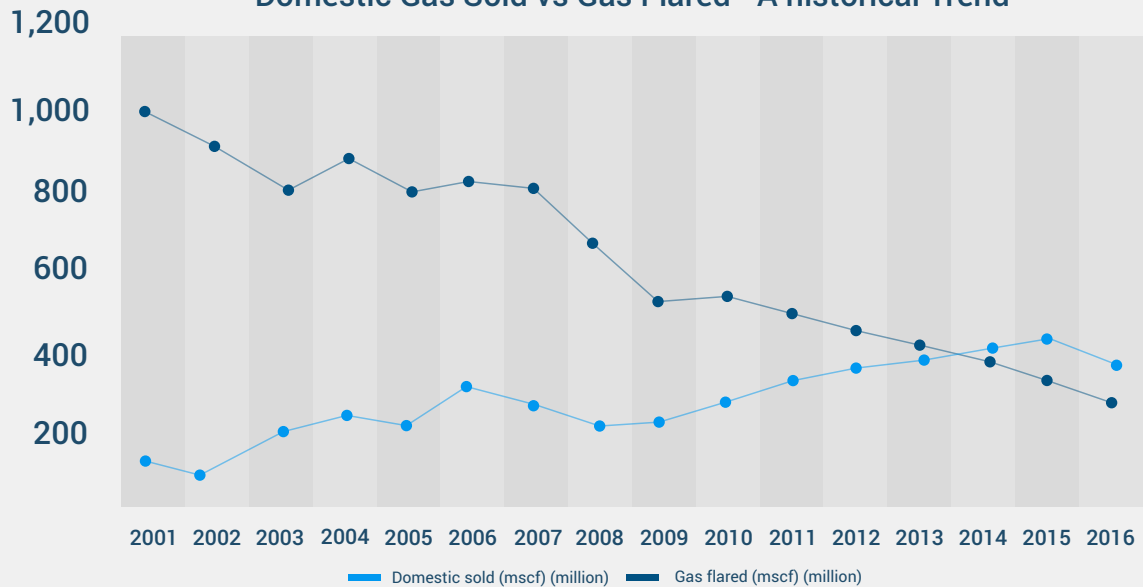
Source: Department of Petroleum Resources, 2016. Oil and Gas Annual Report, Table 47, page 60.



Gas Produced vs Gas Flared - A historical Trend

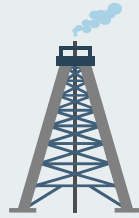


Domestic Gas Sold vs Gas Flared - A historical Trend

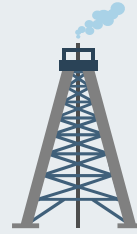




Gas flaring sites in Nigeria



The Federal Government said it has discovered **178** gas flare sites across Nigeria in December 2017



222

flare sites across Nigeria today, according to Gas Flare Tracker, a data portal that monitors live data of active flare sites within the country

- ▶ It is unclear if these figures capture flares caused by illegal bunkering activities.

A looming disaster

Field visits to Niger Delta communities by BudGIT's Extractives team in April 2017 show that in many cases, gas flares occur in close proximity to neighbourhoods; specifically Polaku and Ogu communities in Bayelsa and Rivers States respectively.

Environmental consequences associated with gas flaring have a calamitous effect on local populations, often resulting in depleted air and groundwater quality that ultimately leads to severe health crises. Studies show that gas flaring causes deformities in children, lung damage, pneumonia, asthma, bronchitis, blood disorders and a host of other fatal health conditions.

CHEMICAL NAME	EFFECTS ON HEALTH
Aromatics: Benzene, Toluene, Xylene	Poisonous and carcinogenic, these also cause blood abnormalities
Sulphide hydrogen	Affects the eye and nose, resulting in insomnia and headache
Dioxide of sulphur	Stimulates respiratory system, aggravating asthma and bronchitis




CHEMICAL NAME	EFFECTS ON HEALTH
Alkanes: Methane, Ethane, Propane	Causes swelling, itching and inflammation; may also result in eczema and acute lung swelling
Alkenes: Ethylene, Propylene	Causes weakness, nausea and vomiting
Dioxide nitrogen	Affects lungs and respiratory pipes; aggravates asthma symptoms and results in meta-haemoglobins, which prevents absorption of oxygen by the blood

Source: Eman A. Emam, 2015. Gas Flaring in Industry: An Overview, *Petroleum & Coal* 57 (5)

Opportunity cost of Gas Flaring

Nigeria loses


 **\$2.5bn** 
yearly to gas flaring

Nigeria's

 **N51 bn**
2017 health capital budget

x **18**

If gas flaring proceeds
at the current pace in
Nigeria

Nigeria could lose
 **N9tn**
in the next 10 years

Opportunity cost of Gas Flaring

 **N9tn**
could provide



2.5GW

Power supply
generation



35,000

Primary Health
Care Centers, over
the next 10 years



10,000km

paved road networks

Nigeria's gas flaring Legislative and Regulatory framework

Various constitutional measures to curb gas flaring in Nigeria have been in place since 1969. Since 1984, it has been illegal to flare gas in Nigeria without the written permission of the Minister of Petroleum Resources.⁸

Specifically:

1969 - Petroleum Drilling and Production Regulations: This required licensees or lessees to adopt practicable precautions, including the provision of up-to-date equipment approved by the Director of Petroleum Resources, to prevent the pollution of inland waters, rivers etc. It provides regulations for protecting sacred lands, water and the environment, mandates accurate record keeping by licensees and provides process of abandonment of oil wells.

Note: This legislation lacks appropriate enforcement mechanisms, showing no clear provisions for penalties. Furthermore, by requiring that information provided by licenses remains confidential, it promotes a lack of transparency.



1979 - Associated Gas Re-Injection Act: This is a legal framework for gas utilization which applies to both land and the Exclusive Economic Zone (EEZ). It is defined as an Act to compel every company producing oil and gas in Nigeria to submit preliminary programmes for gas re-injection and detailed plans for implementation of gas re-injection. It also regulates actual gas flaring of gas by oil and gas companies in Nigeria.

1984 - Associated Gas Re-injection (Continued Flaring of Gas) Regulations

1992 - The Environmental Impact Assessment Act: This sets out the general principles, procedure and methods to enable the prior consideration of environmental impact assessments on certain public or private projects.

What else is being doing to reduce Gas flaring in Nigeria?

A. Nigeria Gas Flare Commercialization Program (NGFCP):

The federal government notes it initiated this programme with an objective to provide a commercial approach to the elimination of routine gas flares by 2020 and to drive positive social, environmental and economic impacts in the Niger Delta by mobilising private sector capital towards gas flare capture projects.

NOTE

 **\$3bn**
could provide



20m

tons CO₂ emissions
per year eliminated



30,000

jobs created
approximately



600,000

metric tonnes of Liquefied
Petroleum Gas every year.



B. Zero Routine Gas Flaring Program:

Introduced by the World Bank, this program brings together governments, oil companies, and development institutions who recognize gas flaring is unsustainable from a resource management and environmental perspective. All parties therefore agree to cooperate to eliminate routine flaring no later than 2030.

Nigeria is one of the 27 governments that have endorsed World bank's Zero Routine Flaring by 2030. This means her government will enable the requisite legal, regulatory, investment; an operating environment conducive to upstream investments; ensure the development of viable markets for utilization of the gas, as well as provide the infrastructure necessary to deliver the gas to these markets.

Oil companies that endorse the initiative will develop new oil fields they operate on, according to plans that incorporate sustainable utilization or conservation of the field's associated gas, without routine flaring.

C. Nigerian Gas Master Plan:

Approved on 13 February 2008, the Gas Master Plan is geared towards solving:

1. Gas availability
2. Gas Infrastructure
3. Gas commercialization framework
4. Gas affordability

To mitigate these challenges, the Master plan has three components: improving domestic gas supply obligations, optimizing gas pricing frameworks and implementing the Gas Infrastructure Blueprint.

Challenges for Nigeria's Gas Master Plan to tackle



Availability:

The challenge of availability of gas for local supply stems from;



The export focus of the gas sub-sector since inception - *key companies*



formed in this sector were optimized for the export of gas, not necessarily domestic utilization. This makes it cheaper to export gas, as opposed to selling to the domestic market. Companies' capacity will therefore need to be enhanced, to reflect the current market conditions

The fact that *Nigeria has finite gas resources that are exhaustible means more reserves need to be explored, and developed.*



Affordability and Commerciality is dependent on the:



Pricing of gas (products)



Securitization of revenue, where potential revenue should serve as collateral/security to access financing for gas infrastructure



Inadequacy of bankable gas business agreements.

Strategies for Gas Infrastructure Development

The Gas Infrastructure development framework has two main modes of deployment, namely:



Development of a central gas gathering and processing facility

This involves establishing three hubs dedicated to gas processing in Nigeria, with specific locations being:

1. West Delta (Warri and Forcados environs)
2. Obiafu (West Port Harcourt)
3. Akwa Ibom and Calabar axis

The plan is to constitute these location into centres for treating wet gas, extracting Liquefied Petroleum Gas/Natural Gas Liquids and exporting lean gas into transmission systems.



Development of gas pipeline transmission systems and gas compressor stations

This entails creating infrastructure for gas pipeline transmission systems (and compressor stations), to efficiently distribute gas to areas of need in-country.

The main strategy is the:

1. Development of three gas transmission systems based on independent operation; and the
2. Management of an interconnected gas transmission system.

What is being done presently?

Implementation of a Strategic Aggregator

Commercially, it is more expensive to transport gas as opposed to crude oil; hence, oil and gas companies find it cheaper to flare gas. The Nigerian Gas Master Plan makes a case for the existence of a 'Gas Aggregator' possessing the requisite infrastructure and storage facilities, to which oil and gas companies can send their gas directly. This would markedly reduce the burden of investing in infrastructure for the oil companies.

In this light, the government set up the Gas Aggregation Company Nigeria Limited (GACN) in 2010.

The GACN acts on behalf of groups of producers to collect supplies and sell the gas to end-users, and does this via four distinct roles:

- Gas Demand Management
- Aggregate Price/ Securitization/ Escrow Management
- Network/System Administration
- Trading Platforms

What else can be done?

Technologies and strategies exist to reduce the amount of gas flared into the atmosphere. However, some irresponsible oil companies are unwilling to make the investment necessary to deploy the right technologies and infrastructure in Nigeria.

1. Strengthen penalty enforcement

Commendable regulations exist, which are supposed to compel oil companies to operate responsibly. Unfortunately, weak enforcement allows many companies get away with destroying local communities through irresponsible gas flaring.

The federal government has potentially lost

 **N2.86tn**

due to weak enforcement of penalty rates.



A total of

4.085tn SCF

of gas was flared by oil and gas companies operating in the country from 2008 to October 2016



N40.85bn

accruable to the Federation Account (using the old penalty rate of **N10 per 1,000 SCF**)



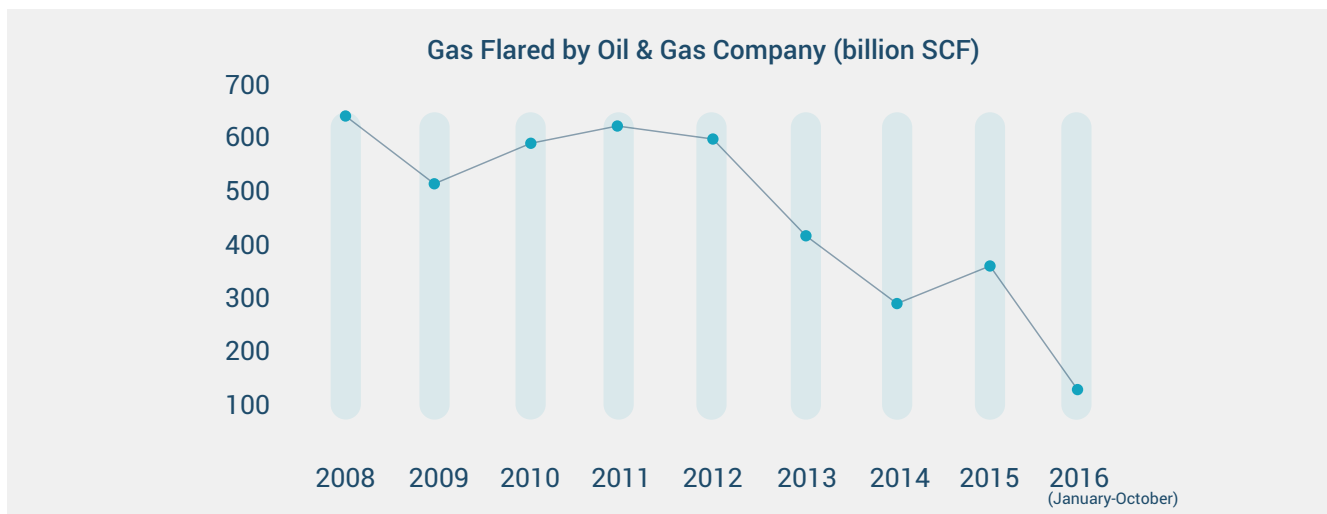
N2.86tn

if Nigeria used the new penalty rate of **\$3.5 per 1,000 SCF** of gas and the exchange rate of **N200 to a dollar**



Year	Gas Flared by oil & gas companies (billion SCF)
2008	631.19
2009	509.35
2010	581.568
2011	619.033
2012	588.667
2013	409.31
2014	285.762
2015	341.37
2016 (Jan - Oct)	119.15

Source: Vanguard News. 2018. *Home - Vanguard News*. [ONLINE] Available at: <https://www.vanguardngr.com>. [Accessed 3 March 2018].





2. Strengthen legal frameworks

According to Finance Minister, Kemi Adeosun: *"In current documents that cover the gas flaring penalty, the penalty was drafted as a charge. A charge is tax deductible; so when international oil companies flare the gas, they pay the charge on which they get tax relief."*⁹

The guiding legal framework for deterring gas flaring needs to be reviewed, to prevent companies from taking advantage of loopholes like these.

3. Faithfully execute the National Gas Plan

The government should muster the political will necessary to execute Nigeria's gas master plan and to enforce regulations aimed at tangibly achieving Zero Routine Gas flaring.

4. More investment in quality gas flare stacks

This will reduce unintended and routine flaring, thereby stopping the progression of environmental degradation in communities.

5. More investment by stakeholder companies in natural gas capture infrastructure

6. Fund Health Research Centers

Proceeds from gas flare penalties can be channeled towards funding health-related research in the Niger Delta region, to safeguard the lives of residents, and increase their quality of life.



Conclusion

Gas flaring is a menace which has caused, and continues to contribute to irreversible environmental degradation, posing hazards to human health. Whatever the reasons for flaring, the practice remains a waste of valuable resources much-needed for economic development.

We acknowledge that companies have made some effort at reducing gas flared, as can be seen in the obvious drop in the volume of flared gas, from 56.7% of gas produced in 2000, to 14.33% of gas produced in 2016. As a result, there is the tendency for the Nigerian government to believe the problem of gas flaring is under control.

However, it is important to note that flaring 14.33% of gas produced annually still translates to flaring 119.15 billion SCF of gas annually; this volume of gas would go a long way if used in generating electricity for Nigerians, not to mention the loss of potential revenue and health hazards that accompanies flaring such large volumes.

As A. C. Christiansen and T. Haugland noted in *Gas Flaring and Global Public Goods*: “the one flaring-related issue that is unresolved, and where some collective efforts possibly could make a difference, is the development of markets for the un-flared gas in Nigeria and the region.”

What Nigeria has at the moment is potential for the consumption of un-flared gas. Therefore, the supply framework, infrastructure and market systems necessary for un-flared gas to reach its end users needs must be collectively and sustainably developed by all stakeholders.



References

1. 2009. The Nigerian Gas Master-Plan: Establishment of a Strategic Gas Aggregator, *A Presentation*.
2. Aregbe, A.G., 2017. Natural Gas Flaring - Alternative Solutions. *World Journal of Engineering and Technology*, Vol. 5, 139-153.
3. Christiansen, A.C. and Haugland T., 2001. *Gas Flaring and Public Goods*, page 8.
4. Dennis Otiotio, 2013. Gas Flaring Regulation in the Oil and Gas Industry: *A Comparative Analysis of Nigeria and Texas Regulations*
5. Department of Petroleum Resources, 2016. Oil and Gas Annual Report, Table 47, page 60.
6. Dr. Uwem Udok & Enobong Bassey Akpan, 2017. Gas Flaring in Nigeria: Problems and Prospects. *Global Journal of Politics and Law Research*, Vol. 5, No. 1, 16-28.
7. Eman A. Emam, 2015. Gas Flaring in Industry: An Overview, *Petroleum & Coal* 57 (5)
8. OPEC : Home. 2018. OPEC : Home. [ONLINE] Available at: <https://www.opec.org>. [Accessed 3 March 2018].
9. Vanguard News. 2018. *Home - Vanguard News*. [ONLINE] Available at: <https://www.vanguardngr.com>. [Accessed 3 March 2018].



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