

Energy Policy and Sustainability: A Critical Analysis of Nigeria's Gas Sector

OMOBOLANLE DIANA BELLO
NUPRC

Abstract- Nigeria's gas sector is a key player in the country's economic development and sustainability efforts. With its large gas reserves, Nigeria aims to transition from an oil-based to a gas-based economy. Key policies, such as the National Gas Policy (NGP) of 2017, the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) guidelines, and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) regulations, aim to address gas production, transportation, and consumption. These policies focus on boosting domestic gas utilization, reducing environmental impacts, and achieving energy security. While progress has been made, challenges are still observable in enforcement, regulatory alignment, and reducing gas flaring. This study reviews existing policies, highlighting areas where further improvements could enhance policy effectiveness and suggesting strategies for advancing these efforts. These recommendations include enhancing sustainability frameworks, promoting cleaner technologies, and adopting stricter regulations to reduce gas flaring and emissions. The findings highlight the need for stronger energy policies to support Nigeria's long-term sustainability goals.

Indexed Terms- Nigeria Gas Sector, Sustainability, National Gas Policy, Gas Flaring, Environmental Regulations, Cleaner Technologies, Energy Efficiency, Regulatory Frameworks.

I. INTRODUCTION

The oil and gas sector in Nigeria represents the highest crude oil producer in Africa, positioning the country as a major player in the global energy market. Nigeria produced about 74 million metric tons in 2023, with a crude oil reserve second only to Libya (Statista, 2024). Nigeria possesses vast gas reserves that could drive economic growth and energy security. However, realizing this potential requires overcoming significant

hurdles and implementing effective policies. The oil and gas industry, historically dominated by oil production, has been riddled with environmental concerns, economic inefficiencies, and policy inadequacies. In recent years, the global push toward sustainability has brought increasing scrutiny to fossil fuel-dependent nations like Nigeria, urging reforms in energy policy and practices.

Nigeria's oil and gas sector boasts an estimated 200 trillion cubic feet (Tcf) of proven natural gas reserves, making it the ninth-largest in the world (PWC, 2020). Yet, its development has been limited by a long-standing focus on oil, limited operational capacity, and political instability. Historically, much of Nigeria's natural gas has been flared, with estimates showing that Nigeria flared approximately 5.3 billion cubic meters of gas in 2022 alone, accounting for a significant value of global gas flaring (World Bank, 2023). This has contributed greatly to environmental degradation and economic losses as these gases can either be used for productive purposes, such as generating power, or conserved. In response, the government has initiated policies to curtail gas flaring and promote gas utilization domestically and internationally, but results remain mixed. Over the past two decades, Nigeria has introduced several reforms aimed at transforming the sector, including the Gas Master Plan of 2008 and the Petroleum Industry Act (PIA) of 2021. To fully realize the potential of sustainable development, it is imperative to address ongoing challenges related to infrastructure and policy implementation.

Sustainability has become a major issue in global energy discourse, particularly in the oil and gas industry, where the environmental footprint is significant. For Nigeria, transitioning toward sustainability in its gas sector is important for reducing carbon emissions and addressing the country's obligations under international climate agreements such as the Paris Agreement. The gas sector

contributes approximately 33% of Nigeria's energy-related greenhouse gas emissions, largely due to practices such as gas flaring and methane leaks (CCAC, 2023). Consequently, adopting sustainable practices within this sector is not merely a formal recommendation but a critical priority, addressing both environmental and public health concerns. Adopting sustainable practices, such as reducing gas flaring, investing in clean technologies, and implementing stricter environmental regulations, could improve Nigeria's global standing as a responsible energy producer while boosting long-term socio-economic benefits. It is essential for diversifying Nigeria's economy, which has somewhat been reliant on oil and gas to create cleaner alternative fuel for power generation and industrial development.

Nigeria has made several attempts to align its energy policies with global standards. The Gas Master Plan, launched in 2008, sought to create a framework for developing gas infrastructure and markets. Similarly, to move the development of gas infrastructure and markets forward, the recent Petroleum Industry Act (PIA) of 2021 was created to address challenges by restructuring the oil and gas industry, promoting transparency, and encouraging investment in gas infrastructure.

This article aims to critically analyze Nigeria's oil and gas sector through the lens of sustainability, exploring the existing energy policies and assessing their effectiveness. It will examine the challenges that hinder sustainable oil and gas development and propose recommendations for aligning the country's energy sector with global sustainability goals. By evaluating the current regulatory framework, environmental concerns, and economic imperatives, this analysis seeks to provide a comprehensive understanding of the intersection between energy policy and sustainability in Nigeria's oil and gas sector.

II. LITERATURE REVIEW

Globally, energy policies are increasingly shaped by the need to transition towards sustainable energy practices. According to the United Nations Framework Convention on Climate Change (UNFCCC), the 2015 Paris Agreement serves as a cornerstone in

international policy, aiming to limit global temperature rise by reducing carbon emissions across industries, particularly in energy production. The European Union's Green Deal, launched in 2019, establishes ambitious targets for achieving carbon neutrality by 2050. A key milestone in this framework is a planned reduction of net greenhouse gas emissions by 55% by 2030, relative to 1990 levels. This initiative specifically addresses the oil and gas industries, advocating a transition toward renewable energy sources to reduce dependency on fossil fuels and accelerate the shift to a more sustainable energy system.

Studies like those by Rissman et al. (2019) highlight how global efforts to decarbonize the energy sector necessitate substantial shifts in oil and gas consumption patterns. The World Energy Outlook (2022) by the International Energy Agency (IEA) reports that fossil fuel consumption, particularly natural gas, must be drastically reduced to meet global climate goals. It forecasts that investments in clean energy will exceed \$2 trillion annually by 2030, driven by policies like the U.S. Inflation Reduction Act and the EU's REPowerEU initiative. This shift is expected to increase solar and wind capacity significantly and bolster electric vehicle (EV) adoption. The International Renewable Energy Agency (IRENA) similarly advocates for a shift to renewables by 2050 while addressing the need to diversify energy portfolios in oil-dependent economies. It promotes the gradual phase-out of oil and gas in favor of sustainable alternatives like wind, solar, and bioenergy, while simultaneously improving energy efficiency (IRENA, 2019). The Clean Energy Ministerial promotes initiatives like Carbon Capture, Utilization, and Storage (CCUS) to reduce emissions from oil and gas production. This international initiative is significant for the oil and gas sector because it seeks to reduce greenhouse gas emissions while maintaining oil and gas as part of the energy mix during the transition period (CEM, 2020). The Global Methane Pledge launched at COP26, aims to cut methane emissions from oil and gas by 30% by 2030, which is important given methane's role in global warming. Countries like the United States, the European Union, and Nigeria are among the more than 100 nations that have committed to this pledge. This policy directly impacts oil and gas operators, as it encourages stricter regulations on

methane emissions, which are prevalent during production and transport (UNEP, 2022). Also, the Africa Renewable Energy Initiative seeks to encourage renewable energy use in oil-rich African nations to balance energy demands with sustainability goals. Africa Renewable Energy Initiative (AREI) seeks to achieve 300 GW of renewable energy capacity by 2030 while addressing energy poverty. This initiative encourages African nations to reduce their dependence on fossil fuels and embrace renewable sources, which has implications for long-term energy policies, including in oil and gas-rich nations like Nigeria (AREI, 2015).

Nigeria's Oil and Gas Sector: An Overview of Past and Current Policies and Regulatory Framework
Nigeria, a major producer of oil and gas in Africa, has enacted several policies to improve efficiency and sustainability within the sector.

The Petroleum Act (1969) and Subsequent Amendments

The Petroleum Act of 1969 was the cornerstone of Nigeria's legal framework for managing its oil and gas sector. Before this Act, there was little regulation over how oil exploration and production were conducted in Nigeria. The government, eager to tap into the economic potential of oil, entered into agreements with multinational oil companies, such as Shell and Mobil, that allowed them to control significant portions of oil exploration and production in the country. These agreements, however, often favored the interests of the foreign companies over those of the Nigerian people.

In response to the growing need for greater control over Nigeria's oil resources, the Petroleum Act of 1969 was enacted. This law provided the government with exclusive ownership of petroleum resources, ensuring that oil production could only occur under the direction of the government. The Act also provided a framework for licensing, the distribution of oil fields, and the regulation of the upstream oil and gas sector. The subsequent amendments to the Petroleum Act, particularly in the 1990s and early 2000s, were driven by the need to modernize the sector and address emerging challenges, such as declining oil reserves, environmental concerns, and the involvement of indigenous companies in the oil and gas industry.

The Nigerian National Petroleum Corporation (NNPC) Act (1977)

The establishment of the Nigerian National Petroleum Corporation (NNPC) in 1977 marked a critical turning point in Nigeria's oil industry. The NNPC was created to serve as the state-owned corporation responsible for the exploration, production, marketing, and refining of petroleum products. The aim was to centralize the control of Nigeria's oil resources and ensure that the benefits of oil extraction would remain within the country.

Before the creation of NNPC, the exploration and production of oil in Nigeria were largely dominated by foreign oil companies, and there was a strong push to nationalize the sector. The creation of NNPC allowed for greater government involvement in the oil and gas sector, giving Nigeria more control over its oil revenues and facilitating the establishment of joint ventures between NNPC and international oil companies.

The Nigerian Oil and Gas Industry Content Development (NOGICD) Act (2010)

In 2010, the Nigerian Oil and Gas Industry Content Development (NOGICD) Act was introduced to promote local participation in Nigeria's oil and gas sector. This policy emerged from a historical context where, despite Nigeria being one of the largest oil producers in Africa, the benefits of the oil sector were not sufficiently distributed among the local population, especially in terms of employment, skills development, and local business opportunities.

The NOGICD Act was designed to ensure that Nigerian companies and workers benefited more from the oil and gas sector by prioritizing local content. It set clear targets for the participation of Nigerian businesses in the supply chain of the oil and gas industry, including exploration, production, and refining activities. The Act also mandated that oil companies operating in Nigeria give preference to Nigerian contractors and use Nigerian manpower wherever possible.

The introduction of the NOGICD Act was driven by the desire to reduce the country's dependency on foreign expertise and goods, thereby stimulating local

economic growth and creating jobs for Nigerian citizens.

The Nigerian Gas Master Plan (NGMP) (2008)

The Nigerian Gas Master Plan (NGMP), developed in 2008, came into being as a response to the underutilization of Nigeria's vast natural gas resources. While Nigeria has some of the largest natural gas reserves in the world, much of the gas was flared, and the country relied heavily on crude oil for its export revenues. The NGMP was introduced to diversify Nigeria's energy portfolio by encouraging the use of natural gas for domestic energy consumption, industrialization, and export.

The NGMP aims to establish a comprehensive gas infrastructure to reduce the country's reliance on oil revenues, improve the energy supply for domestic industries, and enhance the capacity for gas-based power generation. It focuses on infrastructure development, such as gas pipelines and LNG terminals, as well as policy incentives for gas utilization in Nigeria's power and manufacturing sectors.

The Petroleum Industry Bill (PIB) and the Petroleum Industry Act (PIA) (2021)

The Petroleum Industry Bill (PIB) has been one of the most significant pieces of legislation in Nigeria's oil and gas sector. First introduced in 2000, the PIB underwent numerous revisions over the years due to political delays and disagreements between the government, industry players, and stakeholders. The bill aimed to overhaul the regulatory framework of the Nigerian oil and gas sector, introducing reforms to address issues such as underinvestment, inefficiency, and lack of transparency.

In 2021, after over two decades of deliberation, the Petroleum Industry Act (PIA) was finally signed into law. The PIA introduced substantial reforms, including the establishment of new regulatory bodies like the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA), both of which are tasked with overseeing the upstream, midstream, and downstream oil and gas operations.

The PIA also addressed fiscal and tax incentives to encourage investment in the sector, such as the introduction of a new petroleum tax regime that aims to balance the needs of the government with the interests of investors. Additionally, the PIA mandates the environmental remediation of oil-producing communities, ensuring that they receive compensation for the environmental impacts of oil exploration activities.

The Gas Flaring (Prevention of Waste) Act (1979)

The Gas Flaring (Prevention of Waste) Act was passed in 1979 in response to the environmental degradation caused by the widespread flaring of natural gas associated with oil production. Gas flaring has become a major environmental issue in Nigeria, contributing to air pollution and greenhouse gas emissions. The act sought to regulate and eventually eliminate the flaring of natural gas, encouraging oil companies to utilize gas rather than flare it.

This law also introduced penalties for companies that flared gas without authorization and established the legal framework for incentivizing gas utilization. However, despite the act, gas flaring continues to be a significant issue in Nigeria, primarily due to insufficient infrastructure for gas processing and transportation.

The Nigerian Extractive Industries Transparency Initiative (NEITI) (2004)

The Nigerian Extractive Industries Transparency Initiative (NEITI) was established in 2004 as part of Nigeria's commitment to the global Extractive Industries Transparency Initiative (EITI), which was launched by the United Kingdom government in 2002. NEITI was introduced to promote transparency and accountability in the management of Nigeria's extractive sector, which had been plagued by corruption, mismanagement, and lack of public disclosure.

NEITI aims to ensure that the Nigerian public can access information on how oil and gas revenues are generated and how they are used. It mandates that oil companies report their financial transactions, including taxes paid and revenues generated, and that the government publishes these details. NEITI has played a critical role in shedding light on the opacity

of Nigeria's oil sector and ensuring that oil revenues are accounted for in national development.

The Nigerian Oil Spill and Environmental Damage Fund (OSEDf)

The Oil Spill and Environmental Damage Fund (OSEDf) was introduced in response to the widespread environmental degradation caused by oil spills, particularly in the Niger Delta. The region has been heavily impacted by oil exploration activities, resulting in severe ecological damage, loss of biodiversity, and health problems for local communities.

The OSEDf was created to provide financial resources for the remediation of environmental damage caused by oil spills and other forms of pollution. It was also designed to compensate communities affected by oil spills. However, the effectiveness of the fund has been limited by poor management and inadequate enforcement of penalties on oil companies for environmental violations.

The National Oil Spill Detection and Response Agency (NOSDRA)

The National Oil Spill Detection and Response Agency (NOSDRA) was established in 2006 to address the rising concerns over the environmental and health impacts of oil spills. NOSDRA's mission is to detect, respond to, and manage oil spills in Nigeria's oil-producing areas, particularly in the Niger Delta.

NOSDRA operates under the Ministry of Environment and is tasked with monitoring oil operations to prevent spills, ensuring timely response when spills occur, and enforcing laws to protect the environment. Despite efforts to curb oil pollution, enforcement challenges and the weak capacity of NOSDRA continue to hinder its success.

Environmental Impact of the Oil and Gas Sector

Nigeria's oil and gas sector is responsible for significant environmental degradation, particularly due to gas flaring and oil spills. A study by Olujobi et al. (2022) highlights the detrimental environmental effects of gas flaring, which contributes heavily to greenhouse gas emissions. Similarly, Bello, A. and Nwaeke, T. (2023) detail the ecological damage caused by oil spills and gas leaks, which affect

biodiversity and dislodging local communities' means of livelihood.

The Nigerian government has made efforts to curtail these environmental impacts through legislation such as the Gas Flaring (Prohibition and Punishment) Act and the National Oil Spill Detection and Response Agency (NOSDRA) regulations. As noted by Ite et al (2016), enforcement of these regulations remains inconsistent, with oil companies often evading penalties. Elenwo, E. and Akankali, J. (2014) noted the prospects and the positives in implementing this policy.

III. METHODOLOGY

This study utilized a qualitative methodology to analyze Nigeria's gas sector policies and assess their effectiveness in promoting sustainability. The research employed a combination of document analysis, case studies, and industry publications to gather a comprehensive understanding of the regulatory framework and its implications.

Document analysis involved reviewing key governmental reports, including the National Gas Policy (NGP) of 2017 and guidelines issued by the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) and the National Environmental Standards and Regulations Enforcement Agency (NESREA). These documents provided critical insights into the legal structure, policy objectives, and enforcement gaps within Nigeria's gas sector.

In addition, specific case studies, such as the Oredo Gas-to-Power project and the Nigerian Gas Flare Commercialization Programme (NGFCP), were examined to evaluate the applications of these policies. These case studies illustrated both the successes and challenges in policy implementation, particularly regarding gas flaring reduction and domestic gas utilization.

Furthermore, industry publications, including analyses from organizations like PwC and global energy agencies, contributed valuable perspectives on private sector involvement and investment trends within the gas sector. By integrating these data sources, the study

aims to provide a well-rounded assessment of Nigeria's gas policies, their sustainability impacts, and potential areas for improvement.

IV. ANALYSIS OF EXISTING POLICIES IN NIGERIA'S GAS SECTOR

Nigeria, endowed with vast natural gas reserves, presents a significant opportunity to harness this resource for domestic consumption and export. However, realizing the full potential of the gas sector hinges on effective policy frameworks. This analysis delves into existing policies and their impact on the sector's development.

Key Policies and Their Impact

1. The Petroleum Industry Act (PIA) 2021:
 - Impact: This landmark legislation has introduced significant reforms to the Nigerian oil and gas industry, including provisions for gas development and utilization. It aims to create a more conducive environment for investment and development.
2. The Nigerian Gas Master Plan (NGMP):
 - Impact: The NGMP outlines a comprehensive strategy for the development and utilization of Nigeria's natural gas resources. It aims to increase domestic gas consumption, reduce gas flaring, and promote gas exports.
3. The National Gas Policy:
 - Impact: This policy provides a framework for the development of the Nigerian gas industry. It outlines the government's vision for the sector and sets targets for gas production, utilization, and export.

Challenges and Opportunities

While these policies have laid the groundwork for the development of Nigeria's gas sector, several challenges persist:

- Infrastructure Constraints: Inadequate infrastructure, including pipelines and processing facilities, hinders the efficient transportation and utilization of gas.
- Regulatory Framework: Complex regulatory frameworks and bureaucratic hurdles can delay project implementation and discourage investment.

- Security Challenges: Security issues in certain regions can disrupt gas production and transportation.
- Financing Constraints: Access to affordable financing remains a challenge for many gas projects.

However, Nigeria possesses significant opportunities to leverage its gas resources:

- Domestic Gas Market: Expanding domestic gas utilization can fuel industrial growth, power generation, and household consumption.
- Liquefied Natural Gas (LNG) Exports: Nigeria has the potential to become a major LNG exporter, capturing global demand for cleaner energy sources.
- Gas-to-Power: Developing gas-fired power plants can enhance electricity generation capacity and improve power supply reliability.

Recommendations

To fully realize the potential of its gas resources, Nigeria should:

- Prioritize Infrastructure Development: Invest in the expansion and modernization of gas infrastructure to facilitate efficient transportation and utilization.
- Streamline Regulatory Framework: Simplify regulatory processes and reduce bureaucratic hurdles to attract investment.
- Enhance Security: Strengthen security measures to protect gas infrastructure and personnel.
- Promote Public-Private Partnerships: Encourage collaboration between the public and private sectors to accelerate gas development and utilization.
- Diversify Export Markets: Explore new markets for Nigerian gas, including emerging economies in Asia and Africa.

V. CASE STUDIES

Case Study 1: Success of Domestic Gas Utilization Policies

The Nigerian government has also focused on promoting domestic gas utilization, particularly for power generation and industrial use. The National Gas Policy (2017) set ambitious targets to increase

domestic consumption of gas and decrease reliance on oil. One of the success stories comes from the Oredo Gas-to-Power project. The Oredo Gas-to-Power project stands as a significant success story in Nigeria's efforts to harness its gas resources for energy generation. Located in the Oredo Field in Edo State, the project exemplifies how gas previously wasted through flaring can be converted into a valuable resource for local power generation. This initiative is part of Nigeria's broader gas commercialization strategy aimed at reducing flaring, improving domestic gas utilization, and contributing to energy security. The Oredo project, developed by the Nigerian Petroleum Development Company (NPDC), includes an LPG extraction facility and a gas processing plant. It has been instrumental in capturing and processing gas that would have otherwise been flared, turning it into fuel for electricity generation. The processed gas is then supplied to the national grid, improving local power availability. This initiative not only reduces the environmental impact of gas flaring but also supports sustainable energy production in Nigeria. By generating electricity from previously flared gas, the Oredo project aligns with the objectives of the Nigerian Gas Flare Commercialization Programme (NGFCP), which aims to promote the efficient use of Nigeria's large gas reserves. Furthermore, the project demonstrates the potential for similar ventures to contribute to Nigeria's energy transition, reduce carbon emissions, and enhance economic development in gas-producing regions (Ed Reed, 2020).

Case Study 2: Impact of Gas Flaring on Health in Niger Delta Communities

Nigeria has implemented several policies to reduce gas flaring, a significant environmental challenge. A key policy is the Associated Gas Re-Injection Act of 1979, which mandated oil companies to either re-inject or utilize associated gas instead of flaring it. However, despite the law and subsequent amendments, gas flaring remained prevalent. The introduction of the Gas Flare Commercialization Program (NGFCP) in 2016 aimed to tackle this issue more aggressively through the gas flare (Prohibition and Punishment) by introducing levies against companies that fail to report gas excess to the regulating body (Ishaya, 2018). A recent report by HumAngle highlights the severe health impacts faced by Niger Delta communities due

to the high levels of gas flaring. Residents in communities like Obrikom and Egbeme report suffering from chronic respiratory issues, skin diseases, and other health problems linked to the toxic emissions from gas flaring. The report states that while gas flaring policies exist, enforcement remains weak, particularly in rural and underdeveloped regions of Nigeria.

According to the article, local efforts to address these health concerns have been largely ignored and communities feel abandoned by both the government and oil companies. The environmental damage and public health crisis continue to inflate poverty and underdevelopment in the region, with little accountability. This case demonstrates the gap between policy creation and enforcement in the Nigerian gas sector, highlighting the urgent need for improved oversight and health protections in gas-flaring communities (HumAngle Media, 2024).

Pollut ants	Readings at gas flare site (mg/m ³)	Readings in Obrikom community (mg/m ³)	WHO standard for 24-hour average exposures (mg/m ³)
Co	10.88	3.56	0.004
SO ₂	2.56	3.67	0.04
O ₃	0.0	0.018	0.1
PM _{2.5}	0.02	0.02	0.015
PM ₁₀	0.032	0.047	0.045

Source: HumAngle Media, 2024

Fig 1: The air quality within the Ogba-Egbema-Ndoni area

To mitigate these negative impacts, it is imperative to strengthen enforcement mechanisms, promote sustainable gas development practices, and invest in community health and environmental programs.

International Comparisons

When comparing Nigeria's gas sector policies to other gas-rich nations like Qatar and Norway, significant differences in implementation and enforcement are apparent as they serve as the foundation for promoting sustainable development by reducing carbon emissions and investing in green technologies. Qatar holds the world's third largest natural gas reserves and according to the U.S. Energy Information Administration (EIA), (2023), Qatar holds almost 30% of Middle East reserves. In August 2021, QE

announced its intent to reduce its GreenHouse Gas (GHG) emissions by 25% by 2030 and allocated \$170 million to this effort. This announcement was made in conjunction with the first update of the 2015 Nationally Determined Contribution (NDC) targets in the United Nations Framework Convention on Climate Change (UNFCCC), which focuses on flare and methane reduction efforts. Such decarbonization initiatives are expected to generate significant opportunities for U.S. companies offering efficient products and services in the LNG production process (International Trade Administration, 2022).

Similarly, Norway's policies under the Norwegian Petroleum Directorate mandate that flaring is only allowed under exceptional circumstances, resulting in very low flaring rates (International Energy Agency (IEA), (2022)). Key projects like the North Field Expansion focus on increasing LNG production while maintaining strict environmental safeguards. Despite Qatar's extensive efforts to diversify its economy through Vision 2030, revenues from hydrocarbons continue to contribute more than 50% to the nation's total government income. Significant business opportunities exist for U.S. companies in the liquefied natural gas (LNG) sector, especially as Qatar undertakes the \$30 billion North Field Expansion (NFE) project. This ambitious plan will see the development of six mega LNG trains, boosting Qatar's liquefaction capacity from 77 million tonnes per annum (mtpa) to 126 mtpa with an increase of approximately 64% by 2027. Qatar's approach emphasizes integrating renewables and cutting emissions, positioning the country as a leader in transitioning from fossil fuels to sustainable energy sources (International Trade Administration, 2022).

In contrast, Norway's energy policy is centered around the Norwegian Climate Action Plan (2021-2030), which aims to drastically reduce greenhouse gas emissions. The Green Tax System incentivizes sustainability, pushing industries to lower emissions through a combination of taxes and subsidies to reduce greenhouse gases to NOK 2000/tCO₂eq in 2030 including CO₂ removals and emissions cuts in the LULUCF. Norway's Petroleum Activities Act has also been updated to emphasize environmental protection, particularly focusing on reducing flaring and emissions in oil and gas production (International

Energy Agency (IEA), 2021). The Norwegian Energy White Paper further strengthens these efforts, promoting hydropower and wind energy as key sources in Norway's goal of decarbonization. These initiatives highlight Norway's balanced approach to maintaining its petroleum industry while heavily investing in renewable energy to meet its climate goals (Miljøverndepartementet, 2012).

In comparison, Nigeria's energy policies are less focused on renewable integration but prioritize leveraging its natural gas reserves. The National Gas Policy (2017) focuses on transitioning from oil to gas, intending to increase domestic gas utilization and reduce environmental impact through projects such as the Gas Flare Commercialization Program (2018), aimed at reducing gas flaring by turning flared gas into energy. Research by WEF 2023 states that 71% of Nigerians lack access to energy with further details on the Nigerian government's effort to achieve universal energy access by 2030. Nigerian Electrification Project emphasizes rural electrification using solar and mini-grid solutions, which parallels Qatar's investment in solar energy but lacks the scale and diversification of Qatar's and Norway's renewable energy projects. Furthermore, Nigeria's National Renewable Energy and Energy Efficiency Policy (NREEEP) promotes energy efficiency across sectors but is still in the early stages of implementation compared to the well-established renewable policies in Norway and Qatar. Nigeria's environmental regulations, overseen by NESREA, aim to minimize ecological degradation, but enforcement remains a challenge, particularly concerning methane emissions and gas flaring, an area where both Norway and Qatar have made substantial progress (Aluko & Oyebo, 2024; World Economic Forum, (2023).

VI. RECOMMENDATIONS FOR POLICY IMPROVEMENT

To ensure a more sustainable and environmentally responsible gas sector in Nigeria while also promoting economic growth and energy security, various initiatives and stringent policies should be introduced. Nigeria's gas sector could greatly benefit from stronger regulations to ensure sustainability across all phases of gas production, transportation, and consumption.

Environmental Regulations for Gas Production

- **Flare Gas Reduction and Monitoring:** Stronger regulations could mandate a phased reduction of gas flaring, supported by technology that captures and utilizes the gas for electricity generation or other productive purposes. Regulations could also include penalties for companies that exceed flare gas limits and set mandatory deadlines for the implementation of gas capture technologies.
- **Carbon Emission Standards:** As global attention on climate change intensifies, Nigeria could implement stricter emission standards for gas facilities, aligning with international protocols such as the Paris Agreement. Regulations could require companies to adopt best practices in managing greenhouse gases (GHGs) and methane leaks.
- **Impact Assessment and Monitoring:** A robust Environmental Impact Assessment (EIA) process should be required for all gas production projects. This includes continuous monitoring of the environmental impacts throughout the lifecycle of the project. Regulators could enforce compliance with mitigation measures to prevent soil, water, and air pollution.

Stronger Transportation and Infrastructure Regulations

- **Pipeline Safety and Maintenance Standards:** In order to prevent accidents, vandalism, and leaks from any outdated pipelines, regulations could impose higher safety standards for pipeline construction, operation, and maintenance, including regular inspections, leak detection systems, and prompt repair of damaged infrastructure.
- **Regulation on Pipeline Vandalism and Theft:** Stronger enforcement of laws and regulations against pipeline vandalism, coupled with incentives for local communities to protect infrastructure, could enhance security.
- **Third-Party Access and Open Access Rules:** To ensure efficient transportation and reduce bottlenecks, the government could regulate third-party access to transportation infrastructure. Open access rules would allow independent companies to transport gas through existing pipelines,

fostering competition and reducing monopolistic practices.

- **Regulation of Gas Storage Facilities:** Regulations on the construction and operation of gas storage facilities would ensure that these infrastructures are safe, secure, and optimized for peak demand periods. Regulatory oversight could include ensuring adequate storage capacity, especially to avoid disruptions during periods of supply shortage.

Regulations for Sustainable Gas Consumption

- **Energy Efficiency Standards:** Regulations should be introduced to improve the energy efficiency of gas-consuming industries and households. For instance, setting minimum efficiency standards for gas-fired power plants, industrial boilers, and household appliances (e.g., cookers) would help reduce waste and optimize the use of natural gas.
- **Regulation of Domestic Gas Pricing and Subsidies:** The Nigerian government could enforce fair pricing regulations to ensure that natural gas remains affordable for local consumers while also encouraging private sector investments in the gas sector. Additionally, targeted subsidies for household users, especially in low-income areas, could promote greater adoption of clean and sustainable cooking methods.
- **Promotion of Liquefied Petroleum Gas (LPG) Use:** Regulations could be introduced to incentivize the substitution of traditional biomass fuels with cleaner alternatives like LPG. This could include tax breaks, subsidies for LPG cylinders, and the creation of distribution networks in underserved areas, helping to reduce the environmental impact of cooking and heating.

Governance and Regulatory Oversight

- **Strengthening Regulatory Institutions:** Nigeria could enhance the capacity of regulatory bodies such as the NUPRC. This would involve better funding, staffing, and the introduction of advanced regulatory tools to monitor and enforce compliance.
- **Transparency and Accountability in Licensing and Contracts:** Regulations could include stronger oversight in the awarding of exploration and production licenses to ensure that they are issued

transparently, without corruption, and in line with national development goals. This would also involve stricter compliance with environmental standards and royalty payments.

- **Public Access to Information:** Regulations requiring the publication of data regarding gas reserves, production levels, and financial transactions could help enhance transparency in the sector and reduce the risk of mismanagement and corruption.

Regulations Promoting Local Content Development

- **Local Content Policies:** Strengthening local content regulations would promote the participation of Nigerian companies in the gas sector. Regulations could require a higher percentage of local ownership, local sourcing of materials and services, and training programs for Nigerian workers to build technical expertise within the sector.
- **Support for Small and Medium-Sized Enterprises (SMEs):** Regulations could provide support for SMEs in the gas sector, helping them access funding, technology, and training opportunities to build capacity and contribute to the sector's growth.

Investment in Clean Technology and Innovation

- **Incentives for Clean Gas Technologies:** The government could introduce regulations offering tax breaks or grants to companies investing in cleaner gas technologies, such as carbon capture and storage (CCS), gas-to-liquids (GTL) technology, and efficient gas turbines for power generation. This would encourage investment in innovation and help the sector align with global sustainability trends.
- **Research and Development (R&D) Incentives:** Regulations could be designed to encourage R&D investments, focusing on improving the efficiency of gas production, transportation, and consumption processes. Collaboration with universities and research institutions could be incentivized to spur innovation and find sustainable solutions.

Promoting Cleaner Technologies and Innovations

A significant opportunity exists in the Nigerian gas sector to adopt cleaner technologies, particularly in

reducing gas flaring and methane emissions. Investment in renewable energy solutions, carbon capture and utilization technology, as well as innovations in gas-to-power projects, can greatly reduce the sector's environmental footprint. Countries such as Qatar have already taken steps in this direction by implementing technologies that minimize emissions in liquefied natural gas (LNG) production (International Trade Administration, 2022). Nigeria could also incentivize private sector investment in clean technologies by offering tax incentives and subsidies to companies that pioneer innovative gas utilization methods. Also, increasing research and development funding for sustainable practices in the gas industry will accelerate the transition to greener energy systems.

Strategies for Reducing Environmental Impact

The environmental impacts of gas flaring and inefficient energy practices continue to be a pressing issue in Nigeria's gas sector. The Nigerian government needs to intensify efforts to reduce gas flaring through strict enforcement of existing regulations and increased collaboration with local and international stakeholders. Strengthening partnerships with companies that have successfully reduced gas flaring, such as those involved in the Oredo Gas-to-Power project, will provide blueprints for wider industry adoption. Increasing energy efficiency across the entire gas supply chain, from extraction to end-use, will reduce emissions and also maximize the economic value of Nigeria's gas reserves (Brown & Cleverline, 2021). By studying countries like Norway, which has implemented successful policies for carbon management in its gas sector, Nigeria can position itself as a leader in sustainable gas production (IEA, 2021).

CONCLUSION

This analysis reveals the important role that regulatory frameworks and environmental policies play in shaping Nigeria's gas sector. The study highlights the significant strides Nigeria has made in establishing policies aimed at optimizing gas utilization and reducing the environmental impact of gas production, including efforts to minimize gas flaring. However, the review also describes persistent gaps in policy enforcement, particularly regarding sustainability

measures, as many regulations remain ineffective without proper oversight and compliance mechanisms. Countries like Norway and Qatar demonstrate how strong enforcement of environmental guidelines and the promotion of cleaner technologies can lead to a more sustainable gas sector, providing valuable lessons for Nigeria.

The future of Nigeria's gas sector hinges on the adoption of more firm and comprehensive energy policies. Strong regulatory frameworks are essential to ensure environmental sustainability while maximizing the economic potential of Nigeria's large gas reserves. As global energy shifts toward cleaner and more sustainable sources, Nigeria must prioritize the enforcement of existing policies and the development of new ones that emphasize environmental protection. By adopting practices that promote energy efficiency and innovation, Nigeria can enhance its energy security, reduce its environmental impact, and become a key player in the global transition toward sustainable energy.

FINAL RECOMMENDATIONS FOR POLICYMAKERS

Policymakers in Nigeria should consider revising and strengthening existing gas sector regulations to address the gaps in sustainability practices. This includes more firm penalties for gas flaring and non-compliance with environmental guidelines, as well as incentivizing the adoption of cleaner technologies. There is also a need to improve inter-agency coordination to reduce regulatory overlaps, particularly between agencies such as the NUPRC and NMDPRA. Furthermore, Nigeria should look to international examples, such as Norway's carbon management policies and Qatar's energy efficiency initiatives, to enhance its environmental policies. Implementing these measures will be important in achieving Nigeria's sustainability goals and ensuring the long-term viability of its gas sector.

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