



# Nigerian Chemical & Engineering Industry

## MAGAZINE

A Four-Monthly Publication of Nigerian Society of Chemical Engineers  
(A Division Of Nigerian Society Of Engineers)

July - October 2022 | Vol. 5 No. 1 Edition



Oil Spill  
Management

Mr. Olaoluwa Okewole, FNSChE



Iron & Steel  
Industry

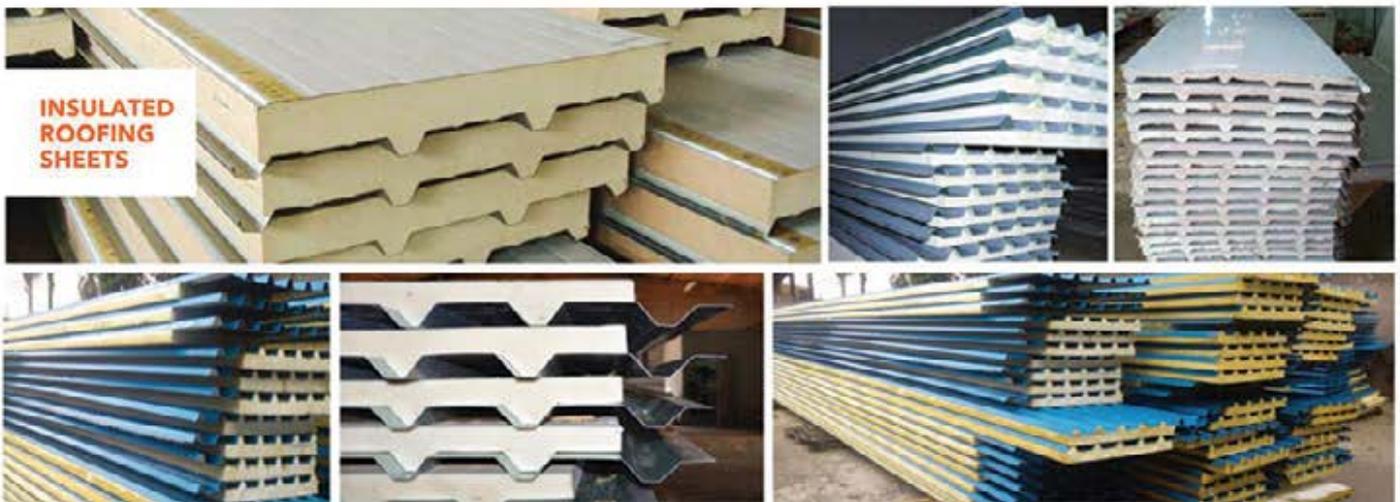
Dr. Oluwafemi Olayebi, FNSChE

# GAS UTILIZATION OPTIONS IN ENERGY TRANSITION ERA



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“To organize the Nigerian Society of Chemical Engineers into a virile professional body capable of promoting the relevance and versatility of the profession, achieving better training and updating of Chemical Engineers through its activities. Fostering of relationships with the academia, research institutes, industries, other professional bodies and government will be the basis for stimulating accelerated industrialization of the country and improving the quality of life of the Nigerian people”.

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# GAS UTILIZATION OPTIONS IN ENERGY TRANSITION ERA

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*“Human activity has exposed our planet earth to catastrophic events and if not checked may drive our dear planet into extinction.”*



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FROM THE

# Editorial SUITE

The community of engineers, stakeholders in infrastructural development and resources management as well as the general reading public will be gladdened in reading this latest edition of our popular magazine. The contents deliver value and pose food for thought on how to move Nigeria forward.

In the series of presentations, we have the write-up by Engr. Anthony Ogheneovo which educates and

reminds readers on the benefits of internet and websites to organizations. Organizations can pick some ideas from the presentation to forge ahead. The Editorial Team uses this opportunity to congratulate Engr. Anthony Ogheneovo on his recent appointment as the Executive Secretary of NSChE.

The Society conducted her Fellows Conference in Sheraton Hotel and Towers, Abuja on October 13, 2022. A concise report and memorable pictures are presented in this edition.

The cover story is on “Gas Utilization Options for Nigeria in the Era of Energy Transition” by Engr. Vincent Nnadi, FNSE, FNSChE, Chairman/CEO, Metierforte Ltd. The importance of natural gas and the values derivable through appropriate processing to leapfrog Nigeria’s Industrial development cannot be over-emphasized. This has become even more important and urgent in this era of energy transition to cleaner fuels. The subject is addressed in this edition to make a statement about its importance, particularly in this season.

Mr. Olaoluwa Okewole (of SEEAS-Process Management Consulting



**Engr. Donatus Uweh**, MNSChE  
(Editor-in-Chief)

*“The contents deliver value and pose food for thought on how to move Nigeria forward.”*



Limited & Centre for Petroleum, Energy Economics and Law’ Energy Management Consulting) shares knowledge on crude oil spill management using a sustainable model. There is no doubt crude oil spills have largely devastated the oil producing communities in Nigeria, particularly the Niger Delta region. The engagements of experts are necessary to ameliorate the negative effects of oil spills.

Another presentation of great value is on Nigeria’s Iron & Steel Industry by Engr. Dr. Oluwafemi Olayebi, MNSE, FNSChE (Sub-Dean, College of Engineering & Technology, Federal University of Petroleum Resources, Warri). Nigeria has clearly been left behind by the rest of the world in the Iron & Steel sector. This is surprising to well-meaning professionals considering the fact that Iron & Steel technology has been known to mankind for over a century. Can the Government rise up and do something. Nigerian citizens are waiting for that day Ajaokuta Steel Plant will go on stream and roll out its products to the benefit of the economy. Indeed, it does not make sense to keep the outside world working/ producing and we just keep buying and consuming Iron & Steel.

At this juncture, it is our pleasure to extend our appreciation to all the contributors who made the publication of this edition possible.

***Please relax and enjoy your reading!***

**Engr. Donatus Uweh**, MNSChE  
(Editor-in-Chief)

# WHAT ARE THE BENEFITS OF THE INTERNET AND WEBSITE TO ORGANIZATIONS?

## INTRODUCTION

As the Nigerian Society of Chemical Engineers goes live with her world-class website: [www.nsche.org](http://www.nsche.org), it is imperative for us to discuss about the benefits of the internet and websites. The invention and popularization of the internet has introduced a massive wave of changes to business and in the way the world does business. In fact, the internet made the global marketplace more accessible via immediate connections and lines of communication. Although the internet delivered loads of new advantages for businesses, the internet also created disadvantages for some business models. Video rental companies were replaced by streaming services, the compact disc faded with the invention of MP3 files and eventually streaming data, as well. Book stores are still around despite the internet. The major changes in the industry have about with the invention of eBooks. Physical retailers and the content with major online retailers as well as the entire supply chain have changed at the retail level.



**Engr. Anthony Ogheneovo**, FNSChE  
(Executive Secretary, NSChE)

## 2.0 THE DOT.COM BUBBLE

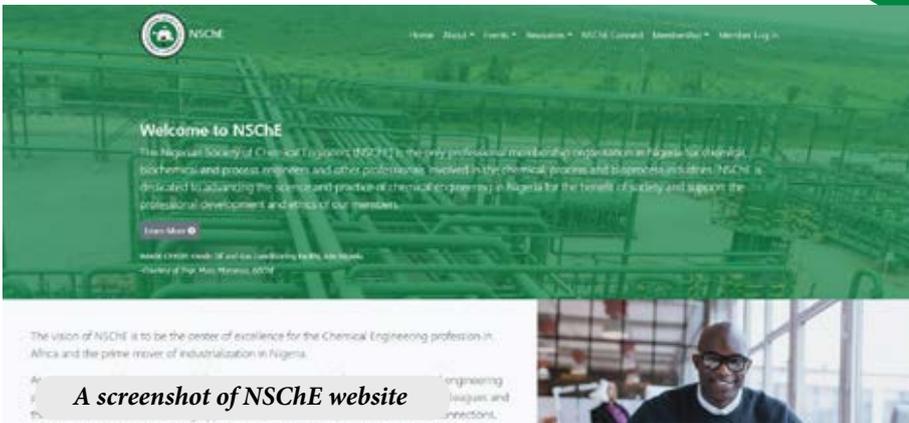
The internet experienced an incredible boom followed by a crash or leveling events of sorts. This is popularly referred to as 'the dot-com bubble'. The bubble peaked in the late 1990's and then the crash occurred around the millennium. This rapid growth is indicative of the value that the internet exerts on the market. Essentially, a massive piece of real estate was created for business and a rush to grab that real estate created a frenzy. Being a new entity, the real value of internet real estate and processes was not really known. Therefore, it exploded as investors and business people rushed to grab everything available while prices and values inflated at an incredible rate. Eventually, this reached a bubble and the market leveled out. Despite the initial bubble burst and leveling of the market, the internet has remained a hugely profitable tool for business owners. Within the bounds of the internet, innovative means of accessing audiences and of driving business are being created on a regular basis.

## 3.0 EARLY DAYS OF THE INTERNET

The early days were pretty basic and those days had a greater effect on internal rather than external business processes. Dial-up internet speeds were excessively slow and businesses focused on email and the ability to send and receive documents and spreadsheets online. The early internet was disorganized until major search engines started building algorithms and platforms to deliver information. The battle against spam and dark websites was prevalent until these algorithms were developed to the level of being able to filter and deliver the highest value of content. That said, businesses could send and receive emails and documents instantly without requiring physical mailing services. Overall, this increased the speed at which business could be accomplished. A business could also create a basic website to let the world know that this business exists. The major benefit of driving traffic to a business without requiring a physical location still exists today.

## 4.0 HIGH-SPEED REVOLUTION

High-speed internet added several value points for businesses. The ability to publish and play music and video added new elements to online advertising. This also increased the capabilities of a company website. Suddenly, a real estate agent had the bandwidth to load and deliver virtual tours; an artist could load large graphic files and larger media files could be transmitted between users. A sales representative could create intensive digital presentations and deliver them online; an amateur makeup artist could build a followership group on YouTube, and a land surveyor could print detailed satellite image from Google Earth to make his job more efficient. Eventually, more businesses and users would engage with the high-speed internet model. This started with DSL which were digital subscriber lines for high-speed access over a phone line. This enabled speeds to increase and then speeds increased again with fiber-optic cable lines.



A screenshot of NSChE website

messages efficiently. The ability to communicate quickly and to collaborate on documents and projects under a single program renders the internet extremely valuable. This ability improves efficiencies and quickly drives business forward. This ability also

## 5.0 MOBILE INTERNET ACCESS

Mobile internet added another internet element and business benefit. Business users can access potential customers from the mobile devices they have on their person nearly 24/7. Mobile integration with local business listings and map services empowers location-based business models. The business can use these features to drive customers right to the business owner's doorstep. This is especially useful when businesses do not have real estate on a busy corner. They can still access the audience, make their location easy to find and can garner positive reviews through a high level of performance.

## 6.0 ACCESS TO INFORMATION

The ability to access information quickly and easily is a major benefit for businesses. The internet has just about every fact and piece of information immediately available that a business may have need of. Are you forming an LLC, a corporation or a new business? Do a general search and you will find whatever information, paperwork and services you need. You will even find services that will file the paperwork on your behalf. You can access extensive legal libraries via internet-based services which enable you to research on competitors, locate contact information about potential business partners and gain access to critical information in a matter of seconds. Although some low-quality sources of information do exist online, savvy business people quickly see the difference between credible and non-credible websites and between credible and non-credible sources of online information.

## 7.0 INTERNET COMMUNICATION

The internet improves internal business communications specifically through email, connected calendars and chat services. Programs such as Slack, Asana and Basecamp connect employees, help organize tasks and deliver instant

holds individuals accountable for their time and effort while also contributing to the connected group environment.

## 8.0 GLOBALIZING PHYSICAL PRODUCTS AND THE SUPPLY CHAIN

Traditionally, the supply chain required visiting factories, sourcing products and running through a detailed process to create and brand a product. The internet has changed that process significantly. Today, a business can source multiple manufacturers of specific materials or products from any part of the world while also negotiating prices, quantities and delivery options without ever leaving home base. If a product is unique, some of the traditional elements of sourcing materials and moving to the production sample phase may still apply. Even in this scenario, the internet makes it easier to communicate by translating languages and delivering messages back and forth with little effort.

## 9.0 MARKETING AND AUDIENCE EFFECTS

One of the biggest advantages created by the internet is the ability to access and market to large audiences. Content marketing is essentially free and businesses can create content that their audience desires as a means of driving qualified traffic to the business. Search traffic is a powerful method of introducing a business to an audience. If a business does not want to spend the manual hours chasing down organic search traffic, they can purchase top locations in the search results and essentially buy segments of that specific audience. The audience is using specific search terms relevant to the business, so that the traffic is extremely qualified. The rate is typically built on bidding platforms with more competitive keywords garnering higher values. Additionally, a business can purchase banner advertisements through high traffic

websites, purchase viewers on social media platforms and utilize influencers and public relation tactics to drive website traffic.

## 10.0 BENEFITS OF SOCIAL MEDIA

The benefits of social media for businesses are extensive. Some businesses actually build their entire customer base through social media channels. Social platforms are often centered around followers. Once you have a loyal base of followers, the business can really work hard to keep that group engaged while introducing new products and services. Having this audience immediately accessible is a huge benefit that was not possible before the existence of internet. Building a social media followership group is also possible without any capital. Putting in the effort to create and share great content related to your business and market can garner a followership group and increase your customer base.

Additionally, social platforms often offer advertising solutions with very specific audience targeting abilities. You can advertise to a specific age range, geographic location in line with the things people like and already engage with online. Facebook for example, allows you to choose pages which the audience already likes to create a profile of your typical customer. This puts your business in front of the most relevant and likely group of potential customers. The data and insights gained from performance in these paid campaigns also guides the business on how different product and service concepts can perform. The ability to test concepts while knowing your advertisement is reaching the correct audience is a powerful tool for business. Testing before investing fully on a product that may fail can save lost time and capital.

## 11.0 REVIEW SITES

The internet is loaded with review websites and review options on business listings. These reviews have a major impact on business as users carry out research and filter through positive and negative reviews before making purchase decisions. This works to the advantage of a business with positive reviews and often to the disadvantage of a business with negative reviews. The review ratings typically have the option for a business owner to respond and it reflects on their ability to engage and communicate with the customer.

## 12.0 BUSINESS AUTOMATION

Automation is a major internet driven trend in the business world. The ability to automate tasks that traditionally required a workforce ultimately saves businesses money and makes their operations simpler and more efficient. Everything from basic accounting practices to customer service has some automation abilities depending on the business model and requirements. A small business can automate receipt tracking and basic accounting through software services that connect to accounts and track and classify spending and income. At tax time, everything is already accounted for and ready to connect to filings for the Internal Revenue Service (IRS). Customer service automation is possible through chat bots with pre-written messages. Auto-responders answer emails and specific questions with common answers. Even marketing campaigns are built with some automation that save time in the long run. A business can build campaigns with spending thresholds, specific dates and times to serve the adverts and performance thresholds that will trigger more or less budget allocation based on audience response. When done manually, this requires a dedicated employee to monitor the campaign.

Entire dashboard software systems exist to utilize the power of the internet while combining paid and organic marketing data and operations under a single source where tasks and triggers can work under an automated or semi-automated setting. One can write 10 email marketing campaigns and set them to deliver on specific dates and times. This can happen in conjunction with a pre-planned Facebook advert spend that triggers around the same content at the same time or even a campaign that re-targets the social advertising click-throughs on display ads, wherever the user travels in the internet ecosystem. This means, the consumer shows some initial interest. Then, he is driven to view the business offering on other websites. Essentially, it follows them in increasing the brand reach to an interested audience that is more willing to engage and buy.

Automation through the internet has major reach and affects everything down to the manufacturer's level. A manufacturer using robotics to make specific items can connect to machines via the internet and it can use apps to monitor and control the production abilities on its machines.

**Engr. Ogheneovo Anthony**  
(Executive Secretary, NSChE)

## SOME HIGHLIGHTS FROM FELLOWS' CONFERENCE OF NSCHE

On the 13th of October, 2022, the 2022 Fellows' Confab was held at the Sheraton Hotel and Towers, Abuja. It was a hybrid meeting, so it was also on a Zoom Platform.

The Theme was **“NEW PERSPECTIVES FOR ADDRESSING UPSTREAM, MIDSTREAM AND DOWNSTREAM PETROLEUM ISSUES IN NIGERIA”**

A total of sixty-eight Fellows registered and forty-nine attended the Conference. It was the first time the Conference was held outside Lagos and it was a huge success.

The Chairman of the event was Retired Major General IBM Haruna. He was a highly decorated and celebrated Major General in the Nigerian Army.

Mallam Mele Kyari, A geologist, crude oil marketer and the Group Chief Executive Officer (GCEO) of the Nigerian National Petroleum Company Limited (NNPCL), was the guest speaker. He spoke on “Revamping the Refineries to Optimum Production Capacities for Overall Positive Socio-economic impact”. He explained the new structure of the NNPC Limited and the role of the

organization in improving the production and distribution of the Petroleum Products

He was conferred with an Honorary Fellowship into the NSChE, which was a crowning moment of the event. This Fellowship is awarded to Individuals who are not Chemical Engineers but have contributed immensely to the growth of the industrial sector of the country.

The Board of Fellows also elected seventeen new Fellows. In all, the event was enlightening and exciting. The event was a success and a good precedent for the coming 52nd Annual Conference AGM Conference taking place from 10th – 12th of November, in Ilorin.



*From left to right: Prof. Francis Ogunye, FAEng, Mallam Mele Kyari, Rtd General IBM Haruna, Engr. Saidu Mohammed, Engr. Tombomিয়ে Adokiye*



*Conferment of Honorary Fellowship Award to Mallam Mele Kyari, GCEO, NNPCL.*

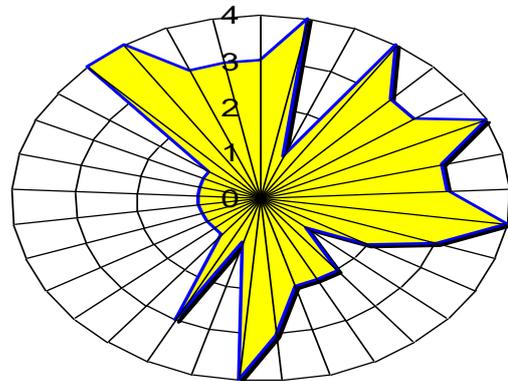
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# GAS UTILIZATION OPTIONS FOR NIGERIA IN THE ERA OF ENERGY TRANSITION

## 1.0 INTRODUCTION

Human activity has exposed our planet earth to catastrophic events and if not checked may drive our dear planet into extinction. The burning of fossil fuels, removal of forests and other human activities have contributed significantly to the increase in the concentration of Carbon Dioxide in the atmosphere.

According to studies, the concentration of CO<sub>2</sub> in the earth's atmosphere increased from about 280ppm (parts per million) in the pre-industrial times to over 400ppm in 2020. This is quite alarming and would require great effort to return the concentration of CO<sub>2</sub> to about 350ppm especially given the fact that 81% of the world energy supply still comes from fossil fuels (Coal, Oil & Natural Gas).



**Engr. Vincent Nnadi**, FNSE, FNSChE, FIPS  
(CEO, Metierforte Ltd)

Carbon dioxide is one of the main greenhouse gases, the others being Methane, Nitrous Oxide, Water Vapor etc. They are the gases that trap heat in the atmosphere and warm the planet which is famously referred to as “Global Warming”.

The effect of global warming has been noticed in rising sea levels, glacier retreat, changes in seasonal events, rise in extreme weather conditions. These changes have in turn led to displacement

of people, disruption of livelihood, impacts on food production, water crises and public health risks.

Practically, we have seen the following impacts on our planet:

- Rising sea levels, in fact the sea level is projected to rise by between 0.3 to 2.4m by the year 2100 if current carbon emissions are sustained.
- Severe droughts (See Fig. 1).
- Violent storms & Hurricanes
- Heat waves and wild fires
- Increase in precipitation (Rainfall) and flooding

Back home in Nigeria, the effect of the global warming and climate change is no longer news. The following impacts are very noticeable:

- i. **Reduction** in agricultural productivity as a result of irregular rainfall patterns. Little or no rainfall particularly in the north affects crop yields while

*“...CO<sub>2</sub> in the earth's atmosphere increased... to over 400ppm in 2020. This is quite alarming...”*



Fig. 1: Lakes drying up as a result of climate change



Fig. 2: An image of Lake Chad Basin

- heavy and excessive rainfall in the south leads to severe flooding and erosion with the consequent destruction of farmlands.
- ii. **Reduction** in available pasture, reduction in surface water resources, increases in water salinity all impact on livestock production.
  - iii. **Migration:** It is now known that the migration of herders from the north to the south is mainly due to the impact of climate change. This migration has led to farmers/herders clashes even though there is a criminal aspect of this migration
  - iv. **The Lake Chad:** Nowhere else is this effect of climate change more noticeable than in the lake Chad region of the continent (See Fig. 2). The lake Chad region covers four countries of Chad, Nigeria, Niger & Cameroun. It is one of Africa's fresh water bodies for 30million people. It is now known that the lake shrunk from 25,000sq kilometers in the 1960s to about 4,800sq kilometers in 2014 due largely to the effect of global warming. This has led to a huge humanitarian crisis with over 2million people displaced.

We should be responsible for finding solutions as global citizens and as Nigerians to these problems.

## 2.0 THE WORLD REACTS

Concerns for the protection of the environment have been as old as many centuries ago. But it was not until the 19th century that such concerns started gaining momentum through environmental movements and voluntary organizations. They acted as pressure groups to draw the attention of Governments at all levels to environmental impacts coming after the industrial revolution. The United Nations picked up

the gauntlet since the last 3 decades. The global body has been bringing all countries together to discuss and find solution to the world's environmental challenges. One of such efforts is the formation of the "Conference of Parties" (COP).

Since its formation, the COP has met every year apart from 2021 due to the COVID-19 pandemic. The last meeting was held in Glasgow in Scotland known as COP26 being the 26th Session of the Conference of Parties.

In this, as in other sessions, every country including Nigeria agreed to work together to limit global warming to below 2degrees by 2030 with the aim of achieving 1.5degrees by the half of the century.

*"It is now known that the lake shrunk from 25,000sq kilometers in the 1960s to about 4,800sq kilometers in 2014 due largely to the effect of global warming."*

*“This argument leads to no solution. Nigeria belongs to this planet and must be seen to be joining efforts with others to save the situation.”*

To deliver these targets, countries will need to do the following:

- Accelerate the phase out of coal
- Curtail deforestation
- Speed up the switch to electric vehicles
- Encourage investments in renewables

In reaction to these commitments, several countries have announced some ambitious programs to switch away from fossil fuels to renewables.

China, the world's largest consumer of energy and the largest consumer of coal has engaged on energy transition programs even though its track appears to be a long one but there is clearly an effort to move away from fossil fuels.

Following Russia's invasion of Ukraine, the European Union (EU) has also presented its program on energy transition that attempts to end its dependence on Russia's fossil fuels. The EU intends to achieve between 40 to 45% switch in favor of renewables by 2030.

### 3.0 NIGERIA: THE ERA OF ENERGY TRANSITION

Nigeria being a signatory to the COP initiatives will need to do something in this regard as part of its commitment to save the planet from itself.

Some have argued that Nigeria, indeed Africa which contributes very little to CO<sub>2</sub> emissions, should have no business with any energy transition program especially with its abundance of petroleum reserves.

This argument leads to no solution. Nigeria belongs to this planet and must be seen to be joining efforts with others to save the situation. Again, when the rain falls, it does not fall on one man's house. We are all impacted by the rising sea levels, the flooding, the drying up of lakes, the changing weather condition which are all linked to the usage of fossil fuels. More so, our huge deposit of petroleum reserves may become useless when the rest of the world switches

to other energy sources. We have no option than to engage in the energy transition process.

To achieve these initiatives may not be drastic. There has to be a

gradual movement from the heavy fossil fuels such as Coal and Oil to the more acceptable renewables such as Solar and Wind.

In between, Gas being 'a lesser evil' may have to serve as transition energy fuel.

### 4.0 GAS AS THE TRANSITION FUEL

Natural gas is the cleanest burning hydrocarbon. It has less carbon. It is colorless, odorless and non-toxic. Natural gas produces about half CO<sub>2</sub> than coal and contributes less than 10% of air pollutants.

Apart from its energy usage, it supports many industrial processes including paints, plastics, clothing etc. When cooled to -162°C, it becomes liquid making it transportable around the world as LNG. It is efficient and cost-effective when compared to other energy sources.

Nigeria has the largest proven gas reserves in Africa and the 9th largest in the world with over 200 trillion cubic feet of natural gas (as at 2018) and unproven reserves of 600 trillion cubic feet. With this huge resource and all the advantages stated above, gas has no competitor to become the transition fuel in this era. The country has recognized this fact and has taken three major actions to realize this ambition.

- The Gas Master Plan
- Launching of "The Decade of Gas"
- The Petroleum Industry Act (PIA)

#### 4.1 THE GAS MASTER PLAN

The Gas Master Plan was launched in 2008 with aims of developing the domestic gas supply and general gas infrastructure. It also contained a Gas Pricing Policy.

#### 4.2 THE DECADE OF GAS

In March, 2021, the Federal Government of Nigeria launched its "Decade of Gas" program. It declared January 2021 to December 2031 as the decade of gas.

This ambitious program which is designed to deepen



Fig. 3: Bonny LNG Plant

the usage of gas targets to increase LPG penetration in the country. This penetration is currently estimated at a paltry 13%. It is planning to reach 20 million homes in the gas expansion program. The expansion also includes increase in use of domestic gas, Auto gas and power generation, LPG jetties/terminals, storage facilities, cylinders manufacturing, bottling and retail. In addition to LPG, various gas facilities are shown in figs. 3 to 7.

The country is investing in the Ajaokuta - Kaduna-Kano (AKK) gas pipeline currently under construction. Other initiatives in this direction include the following:

- Partnership for the establishment of 80MMScfd of gas processing plant in Kwale State and Delta State
- Partnership for the establishment of 10,000MT/d of Methanol plant at Odiana in Bayelsa State
- Partnerships for the establishment of LPG bottling plants and depots in Abuja and 10 Northern states
- Building of the \$10b NLNG train 7 plant in Bonny, Rivers State
- The Trans Sahara Gas Pipeline Project

*“This ambitious program which is designed to deepen the usage of gas targets to increase LPG penetration...”*

### 4.3 THE PETROLEUM INDUSTRY ACT

The third most important factor which supports the Gas utilization options as a transition energy resource is the enactment of the **Petroleum Industry Act (PIA)** which was enacted in 2021. The Petroleum Industry Act introduces many changes which will affect the gas sector. These include:

#### 4.3.1 Governance and Institutions

- i. The Nigerian Upstream Regulatory Commission regulates the upstream operations while the Nigerian Midstream and Downstream Petroleum Regulatory Authority (Authority) regulates the midstream and downstream operations
- ii. Establishment of the NNPC Limited to assume the assets, liabilities and responsibilities of NNPC in relation to gas assets
- iii. Establishment of a progressive cost-reflective pricing framework with a structure for market intervention through Domestic Gas Supply Obligations and a wholesale natural gas market

#### 4.3.2 Promotion of Investment in the Sector

- i. The establishment of the Midstream and Downstream Gas Infrastructure Fund (MDGIF) to promote equity investments in midstream and downstream gas infrastructure
- ii. Provision of clauses to ensure that investor's returns on existing Oil Mining Licenses are protected and a framework for voluntary conversion
- iii. The introduction of the Incorporated Joint Venture for existing Joint Venture Agreements

to promote efficiency in the management of gas assets

- iv. Alignment of the Act with the existing network transport code for gas, existing domestic gas supply obligations and long-term export gas supply arrangements

#### 4.3.3 Fiscal Environment

- i. Profits from upstream gas operations will be subject to income tax in line with the provisions of the Companies Income Tax Act (CITA). Hydrocarbon tax will not apply to such profits
- ii. A royalty rate of 5% will apply for natural gas and natural gas liquids production. This is reduced to 2.5% where the natural gas is produced and utilized in Nigeria.
- iii. For royalty purposes, condensates will be treated as crude oil and natural gas liquids as natural gas.
- iv. 0.5% of the wholesale price of petroleum products sold in Nigeria to fund the Regulatory Authority
- v. 0.5% of the wholesale price of petroleum products and natural gas sold in Nigeria to fund the Midstream and Downstream Gas Infrastructure Fund

- vi. The above stated levies will be remitted by the licensed operator within 21 days of the sale of the relevant products subject to additional regulations to be issued by the Authority.

- vii. Gas flaring penalty will be determined by Regulation. Such penalty will not be tax deductible or cost recoverable. Monies received from gas flaring penalties shall be transferred to the Midstream and Downstream Gas Infrastructure Fund for investment in infrastructure within the host community.

- viii. Tax incentives for midstream petroleum operations, downstream gas and large-scale industries including ten (10) years tax holiday for investment in the gas pipeline

These initiatives by Government are indeed incentives to encourage investments in the Gas sector.

## 5.0 GAS VALUE CHAIN

The value chain of Gas Utilization is a very long one including the following:

- Gas to Power
- Gas to Industries
- Liquefied Natural Gas (LNG)
- Liquefied Petroleum Gas (LPG)
- Petrochemicals
- Fertilizers
- Chemicals
- Biofuels
- Transportation



Fig. 4: A gas storage facility



*Fig. 5: A gas processing plant*

Any of the above areas of investment constitute an industry of its own and provide wide options for gas utilization in Nigeria.

## 6.0 CONCLUSION

This treatise has established the need for energy transition because of the dangers posed by fossil fuels to our planet. It has also highlighted the need to create widespread awareness on these dangers.

The actions recommended by the United Nations including actions being taken by various sovereign governments are brought to the fore. This treatise has also explained why Nigeria as a nation should be part of these actions to save the earth.

The natural thing to do is to change from fossil fuels to renewables. As this change cannot happen overnight, there is need for a transition period. With gas being 'a lesser evil' coupled with its abundance in Nigeria, a good case has been made for gas utilization in this era of energy transition.

It has been noted that the government is already providing an enabling environment but the challenge to this transition

remains the weak gas gathering and distribution infrastructure, inadequate fiscal and regulatory policy, gas pricing, funding, lack of adequate private sector participation and of course the security situation in the country.

One question that is often asked when making case for gas utilization is: "What do we do with our vast oil reserves?" It is indeed a good question considering that most of the gas being produced today comes as "Associated Gas" (AG) produced with the oil. This is one of the reasons why the transition should be gradual with the transition period having a mix of both oil and gas. It should also be noted that technology exists today to re-inject produced oil back to the reservoir just like gas. This may serve as a



*Fig. 6: A section in a gas plant*



Fig. 7: Gas storage vessels

solution while switching production of gas to “Non-Associated Gas” (NAG) reservoirs.

As already stated, the government must take deliberate steps to deepen the use of domestic gas. Indeed, there are several investors who want to invest in the simple technology of converting flared gas to bottled gas for domestic use. The government, on its own, can start a gas utilization revolution by tasking all the IOCs & NOCs to make available flared gas to communities where they operate in an enterprise format. All that is needed is cleaning, compression and bottling of the flared gas.

This alone will eliminate the cutting down of trees for use as a source of energy. This will start a revolution that is ‘bottoms-up’ from rural communities to urban centers.

Gas utilization identifies with United Nations sustainable development goal-7 (SDG-7). This alignment further supports treated natural gas bottling option for Nigeria as desirable in this era of energy transition.

*“This treatise has established the need for energy transition because of the dangers posed by fossil fuels to our planet. It has also highlighted the need to create widespread awareness on these dangers.”*

## REFERENCES

1. *The Petroleum Industry Act “Redefining the Oil and Gas landscape. pwc, August 2021*
2. <https://www.unfccc.int/>
3. <https://www.un.org/>
4. <https://ukcop26.org/>
5. <https://en.wikipedia.org/>
6. *The Nigerian Gas Master Plan. https://www.researchgate.net/publication278849838*
7. *Gas as a transition fuel in Africa. https://thecable.ng*

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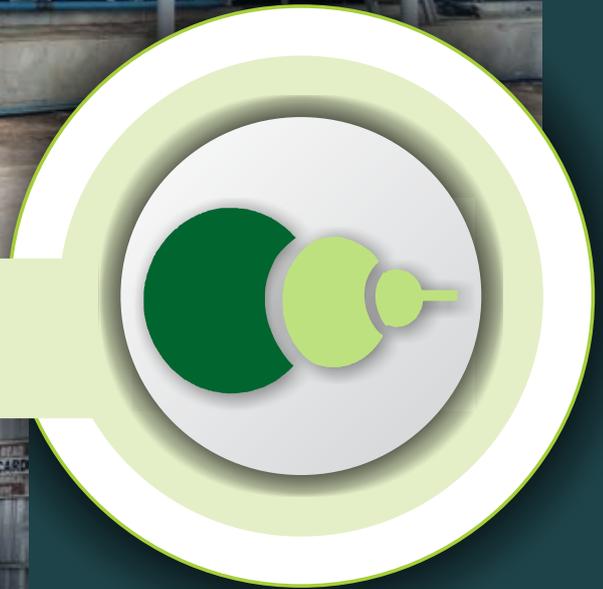
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## **CELEBRATION OF A TITAN AND EMERITUS PROFESSOR OF CHEMICAL ENGINEERING AT 80**

On behalf of the Board of Directors, Council and the entire Members of Nigerian Society of Chemical Engineers, I congratulate a Foundation Fellow and the 6<sup>th</sup> National President of our Great and Prestigious Society, Engr. Prof. Ayodele Francis Ogunye, *FNSChE, FNSE, FAEng* on this joyous occasion of your attaining the age of 80 years today.

**You are the Great Professor of our noble Chemical Engineering profession, the teacher of teachers, the professors of Professors, a great community leader and philanthropist.**

You distinguished yourself by dint of hard work, focus, determination, resilience and unwavering commitment to ethics, professionalism and excellence coupled with exemplary leadership.

As we celebrate with you today, we pray that God will grant you more years of service to humanity in sound health, vitality and prosperity

**80 Hearty Congratulations to you and Happy Birthday Sir!!!**

**Engr. Saidu A. Mohammed, *FNSChE, FNSE*  
National President  
Nigerian Society of Chemical Engineers**

# OVERVIEW OF THE BENEFITS & CHALLENGES OF OIL SPILL MANAGEMENT IN THE NIGERIAN PETROLEUM UPSTREAM SECTOR

## 1.0 INTRODUCTION

The relevance of the oil and gas industry to national development of Nigeria cannot be overemphasized. Operations within the entire value chain of the industry can be clustered under the Upstream, Midstream and Downstream sectors as illustrated in Fig. 1.



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(SEEAS-Process Management Consulting Ltd & 'Centre for Petroleum, Energy Economics and Law' Energy Management Consulting)

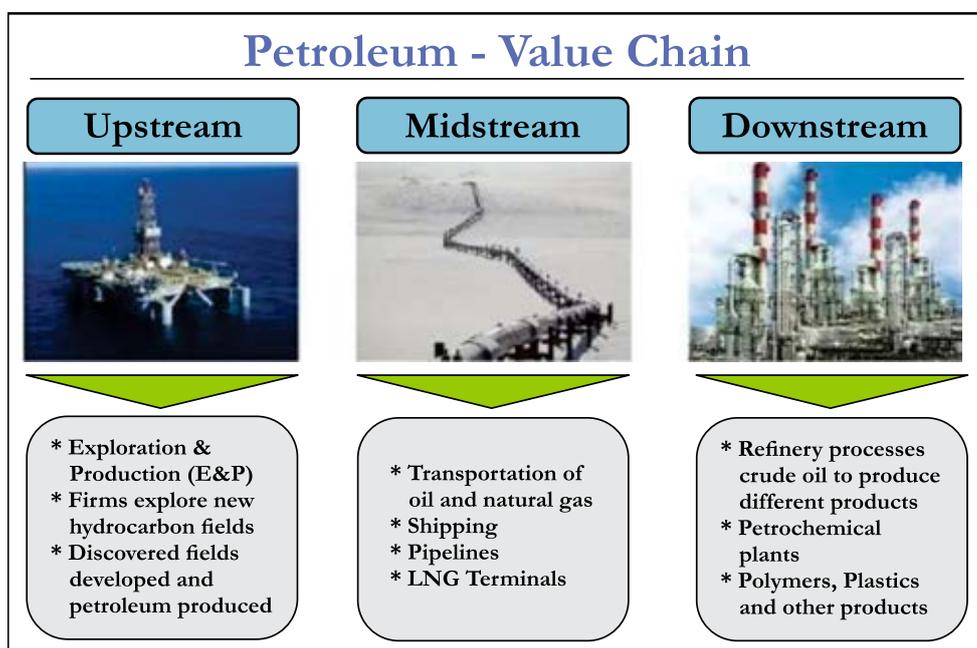


Fig. 1: Summarized value chain of the Oil and Gas Industry

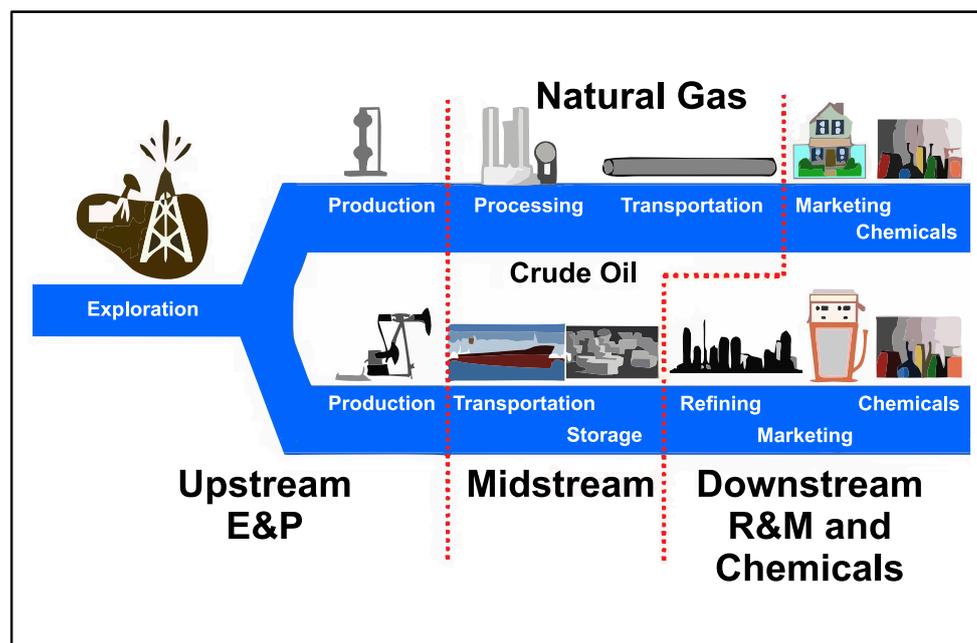


Fig. 2: Focus on Oil Spill Management in the Upstream Sector

This article focuses on the operations of Upstream sector covering the sustainability performance of the unit operations in the course of exploration and production of crude oil, with particular attention to the management of crude oil spills. See Fig. 2.

## 2.0 WHAT IS CRUDE OIL SPILL?

Crude oil and natural gas are naturally occurring hydrocarbon substances which are produced as a result of the effect of temperature and pressure weathering applied on organic matter buried within the pore spaces of sedimentary rocks or in off-shore ocean beds over long periods of time.

The kerogen produced as a result of the action of these forces are further acted upon by other weathering factors namely, chemical, biological and geo-tectonic.

While crude oil {because of its tremendous energy density} is extracted and cracked into

valuable energy fractions, each having its unique energy intensity, the exploration of oil & gas resources has resulted in a myriad of environmental hazards with attendant and significant health, economic and socio-political adverse effects.

### 3.0 CAUSES OF CRUDE OIL SPILLS

Broadly speaking, there are different modes of classification of oil spill, namely:

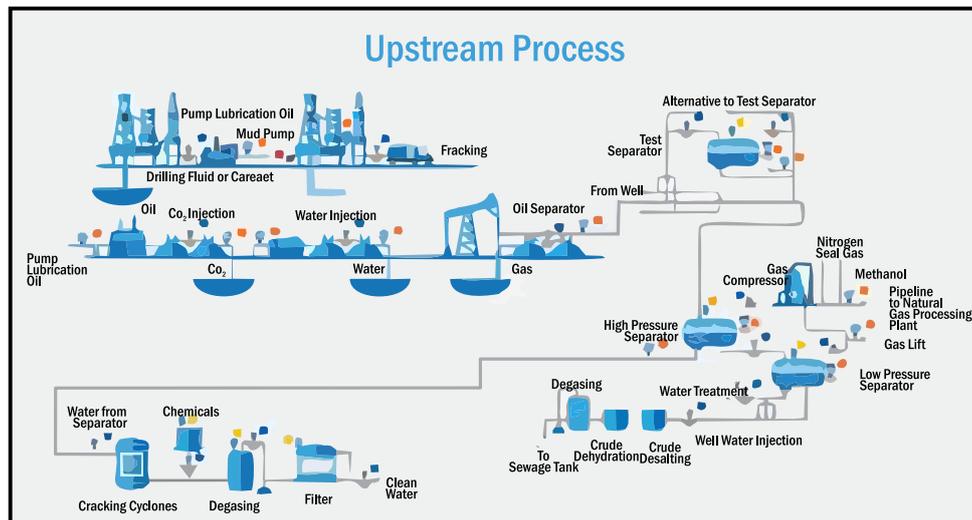
- Classification according to polluted receptor
- Classification according to type of hydrocarbon waste
- Classification according to point source

In order to address the causes of oil spills in the petroleum upstream sector, there is a need to focus on the point sources(s) of oil spill generation.

#### 3.1 POINT SOURCES OF OIL SPILL GENERATION

Oil spills can be caused by human error, natural disasters, technical failures or deliberate releases. The intention of the author is to limit the discussion to operational causes {i.e. human errors and technical failures}.

It is estimated that 30 - 50% of all oil spills are directly or indirectly caused by human error with approximately 20 - 40% of oil spills being attributed to equipment



**Fig. 3: Unit Operations in the Petroleum Upstream Sector**

failure or malfunction; this is in addition to pipeline corrosion as a result of high electrochemical activity in marine environments caused by the presence of high concentration of salts.

Records show that most of the largest oil spills {in scale} occurred due to a mix of human errors and technical failures. These include the Exxon Valdez, Atlantic Empress, Ixtoc 1, BP Deepwater Horizon, Mingbulak, Kolva River and Amoco Diaz oil spills.

Oil spills also result from operational discharges from vessels which are estimated to account for 21% of oil releases from vessels. They occur as a consequence of failure to comply with regulations or arbitrary discharges of waste oil and water containing such oil residues.

Oil spills are generated in the course of the execution of certain unit operations during exploration and production. See Fig. 3 and Table 1. Table 1 shows some of the unit operations and the unit equipment from which oil spills are typically generated.

While oil spills occur in both onshore and offshore environments, the scales of oil spills in marine environments are far higher at a factor of 8.0.

Table 2 indicates the point sources of oil spill generation during offshore petroleum operations and the relative frequency of each.

The three main operational causes of oil spills during offshore petroleum production are the loss of well control, platform failure and operational discharges.

The operational discharges from routine operations such as drill cuttings might also have damaging cumulative effects and are regulated at the national and regional levels.

S/N	Unit Operation	Unit Equipment
1	Appraisal drilling	Well head
2	Exploratory drilling	Well head
3	Production	Well head; BOP stack
4	Fracking {oil seep into nearby water table}	Fracking pipes
5	Ballast water discharge	Ballast Outlets
6	Transportation in Pipes	Pipes

**Table 1: Unit Operation and Unit Equipment Sources of Oil Spill Generation in the Petroleum Upstream Sector**

S/N	Point Sources	Frequency
1	Oil tankers and vessels	21%
2	Offshore oil platforms	3%
3	Pipelines	1%

**Table 2: Oil Spills and Frequency during Offshore Operations**

However, the biggest risk to the marine environment is arguably posed by a possible large-scale oil spill resulting from a loss of well control.

Loss of well control (such as a well blowout) occurs when ‘formation pressure exceeds the pressure applied to it by the drilling column of drilling fluid’. A blowout can be caused by a pocket of oil under high pressure, human error, a technical failure or a combination of all of the above. Well blowouts are responsible for the two biggest known oil spills resulting from offshore petroleum development activities – the Deepwater Horizon and Ixtoc 1.

Platform failures relate to incidents occurring on the platform itself that can lead to a fire, explosion and subsequent loss of well control. One example is the 1988 Piper Alpha disaster on the UK continental shelf leading to the explosion that took 167 lives. Hydrocarbon pollution of the environment may also arise from oil well drilling, production operations, transportation and storage operations in the upstream industry. See Figs, 4 & 5.



Fig. 4: Oil spill discharged into an onshore environment



Fig. 5: Oil spill discharged into an offshore environment

#### 4.0 CRUDE OIL SPILL ACCIDENTS – CASES IN THE NIGERIAN UPSTREAM PETROLEUM SECTOR

According to the National Oil Spill Detection Agency (NOSDRA) data, the total number of oil spills recorded from 2015 to March 2021 is 4,919.

Between January 2019 and April 2021, 12 states in Nigeria recorded 881 cases of oil spillage, according to data obtained from NOSDRA, a government-run satellite tracker. About 77 per cent of these spills occurred in only three oil-producing states: Bayelsa, Delta and Rivers. The three were among Nigeria’s highest oil producers for that period. See Fig. 6.

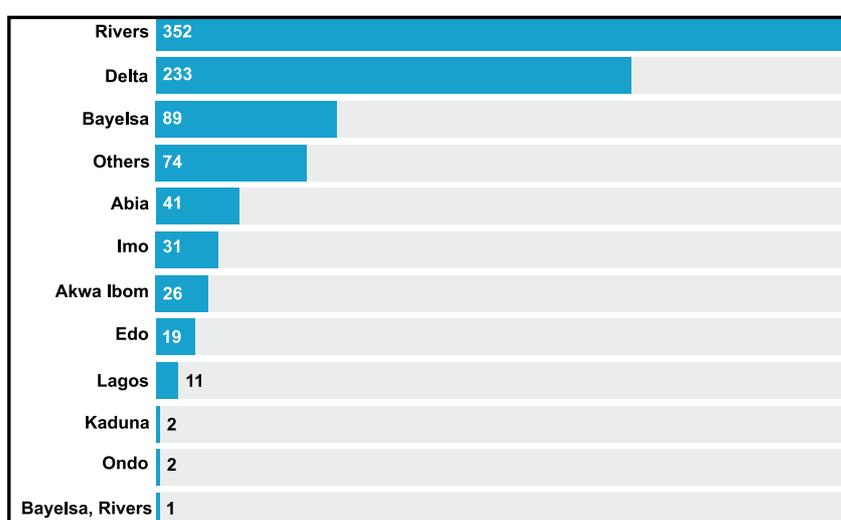


Fig. 6: States where Oil Spills were recorded between 2019 and 2021

The total spillage reported within this period amounted to about 43,000 barrels of oil worth over US\$3 million (at \$70 based on the May 5 crude price in the international market), which is equivalent to N1.23 billion (at N410 to a dollar).

The NOSDRA tracker indicates that the data is fluid and changes “on an ongoing basis” as new spills are reported. The quoted toll is as of May 1, 2021. NOSDRA only has records of the state-by-state breakdown for the past three years.

*“According to the National Oil Spill Detection Agency (NOSDRA) data, the total number of oil spills recorded from 2015 to March 2021 is 4,919.”*

Figs 7 - 15 show some case examples of oil spill incidents recorded previously.

## 5.0 NEGATIVE IMPACTS OF CRUDE OIL SPILLS

Principal among oil spill hazards is the issue of environmental pollution of components of the environmental matrix {comprising of the atmosphere, the biosphere, the hydrosphere and the geo-lithosphere} with harmful hydrocarbon-contaminants generated in the course of industrial operations in the upstream sector.

The resultant effect of this being adverse human health impacts for indigenes of the host community and occupational safety hazards for E & P company workforce working in the affected area inclusive of operational work terrain and security issues.

In addition to these and other unfavourable socio-economic effects, there are issues of legal / regulatory challenges resulting in operational downtime for the upstream operations of the company involved.

## 6.0 REMEDIATION / TREATMENT TECHNIQUES & CHALLENGES

There are different remediation techniques for both marine and soil, ground and water oil spills. Generally, the most suitable remediation for oil spill is determined by considering the physical and chemical

*“...the most suitable remediation for oil spill is determined by considering the physical and chemical properties of the oil...”*



Fig. 7: Bonga Oil Spill



Fig. 8: Ogony Oil Spill showing damaged well head/BOP



Fig. 9: Funiwa Oil Spill



Fig. 10: An Oil Spill coursing through a farmland in the area



Fig. 11: The Nembe Oil Spill; occurred as a result of the damaged Wellhead



Fig. 12: Nembe oil spill contingency team working to repair the damaged wellhead



Fig. 13: Oil spill management team working to contain the oil spill at Nembe



Fig. 15: SEPCO FPSO Accident; off the coast of the Niger Delta; during which reports say that oil spill was generated / discharged



Fig. 14: Trinity FPSO Accident; off the coast of the Niger Delta; during which reports say that oil spill was generated / discharged

properties of the oil; the physical, biological and economical characteristics of the spill location, ambient weather conditions; and the amount of spill.

It is popularly believed that bioremediation is the most environment friendly and most successful of the remediation techniques.

## 7.0 SUSTAINABILITY MANAGEMENT CONCEPTS & BENEFITS

The concept of industrial sustainability is applied to industrial systems that promote the 3Ps {Profits, People and Planet}. Such systems engender sustainable development. Building

S/N	Remediation Technique	Ideal Scenario where Applicable	Challenge in the Nigerian Petroleum Upstream Industry
1	<b>CHEMICAL TREATMENT</b>		
	Chemical Stabilization	The chemical stabilizer matches the chemical property of the oil spill; valuable in marine environments where wind currents set off waves that can destabilize the structure of the oil spill.	Ineffective real-time monitoring; Cost / budgetary factors; Lack of readily available baseline data; Performance evaluation results to incentivize companies; and Lack of readily available technology for adoption.
	Soil Vapour Extraction	Fitting in oil spills which occur onshore and where the viscosity is low.	
Dispersants	Fitting in oil spills which occur offshore; and where the oil spill volume-to-waterbody volume ratio permits thinning below safe / regulatory limits.		
2	<b>BIOLOGICAL TREATMENT</b>		
	Bioremediation	Valuable where there is an effective bioagent {oil digesting microbes} for biodegradation; applicable both onshore and offshore.	Ineffective real-time monitoring; Cost / budgetary factors; Lack of readily available baseline data; and Performance evaluation results to incentivize companies.
Phytoremediation	Efficient in onshore operational environments; and where there is an effective phytoremediator.		
3	<b>THERMAL TREATMENT</b>		
	Thermal Desorption	Applicable with highly viscous oil spill-soil sludges; and where off-site transportation of polluted soil for ex-situ treatment is less preferable, logistics wise.	Ineffective real-time monitoring; Cost / budgetary factors; Lack of readily available baseline data; and Performance evaluation results to incentivize companies.
Incineration	For low density oil spills; which have high flash points; and in marine environments where the oil spill volume is relatively small; companies do this while managing remediation funds.		
4	<b>PHYSICAL / MECHANICAL TREATMENT</b>		
	Pump and Treat Systems	Applicable to oil spills in marine environments or oil-soil-water emulsions in onshore environments; and where the logistics cost of treatment offsite is economically feasible; and in terrains where in-situ treatment is technically impractical.	Ineffective real-time monitoring; Cost / budgetary factors; Lack of readily available baseline data; Performance evaluation results to incentivize companies; and Lack of readily available technology for adoption.
	Vacuuming & Centrifugation	Useful in onshore environments where minimal disturbance to the polluted site is desired; and where high degree of separation results are desired.	
	Filtration	Valuable where oil-soil mixtures are involved; and where high degree of separation results are desired.	
	Sorbents	Applicable where coagulation / concentration of low viscous oil spills have been generated; especially in offshore environments.	
	Skimming	Where the viscosity of the oil spill permits containment with booms; and clear aqueous-oil phases can be obtained.	
	Beach-Raking	Useful where the oil spill residue remaining is thick enough to be removed mechanically.	
5	<b>NATURAL WEATHERING</b>		
	Natural degradation	Applicable as a secondary treatment solution, where a primary solution had been utilized prior; and where ambient weather conditions are favourable, especially in the tropics.	Ineffective real-time monitoring; Cost / budgetary factors; and Lack of readily available baseline data.
	Land Spreading	Typically used, ex-situ, where wet, treated polluted soil, needs to be subjected to drying.	
Land Farming	Useful where vegetative species capable of absorbing weathered oil spill is available; albeit, not for consumption.		

Table 3: Remediation and Treatment Techniques and Challenges

on this principle, the petroleum upstream industry in Nigeria can be sustained.

## 7.1 CURRENT SUSTAINABILITY MANAGEMENT PRACTICES

The following are current sustainability management practices adopted in the Nigerian petroleum upstream industry for managing oil spills.

### 7.1.1 Regulatory / Policy Instruments

Several regulations and policy documents / statements have been prepared by the Federal Government, through the Federal Ministries of Petroleum Resources and Environment, and their respective MDAs for managing oil spills. These are periodically reviewed.

This is a commendable effort, albeit, the effective implementation of these policies and regulations need to be improved for improved sustainability performance metrics in the petroleum upstream sector. While this instrument focuses on the 3Ps, based on research / industry publications, the scorecard of the industry, in terms of oil spill management, indicates a significant gap before the Nigerian upstream sector reaches a highly sustainable status.

### 7.1.2 Fiscal Instruments

This tool focuses on the profits component of the 3Ps and based on the current economic climate, may need to be reviewed to incentivize players in the industry towards improved oil spill management practices.

### 7.1.3 Restructuring Nigerian Petroleum Industry

The recent enactment of the Petroleum Industry Act including the creation of Nigerian National Petroleum Company Limited is an attempt to improve the performance of the petroleum industry in terms of the 3Ps See Table 4.. However, outcomes of several fora / platforms deliberating on these indicate that the framework for effective and efficient implementation needs to be worked on especially as it touches on oil spill management.

## 7.2 THE S-P-R-SC MODEL FOR OIL SPILL MANAGEMENT

The “Source-Pathway-Receptor-Sustainable-Conversion” model also known as the S-P-R-SC model is an end-to-end / lifecycle approach employed in conducting oil spill management holistically. It involves searching for the root-cause(s) of the generated oil spill; tracing the path of impact of the oil spill and determining the eventual component(s) of the environmental matrix which is (are) ultimately adversely impacted.

SOURCE	PATHWAY	RECEPTOR	SUSTAINABLE CONVERSION
Identification of the source of an oil spill	Determination of the pathway within the environmental matrix through which the oil spill flows through	Holistic assessment of the components of the environmental matrix that the oil spill ultimately becomes deposited in.	Estimation of the quantity and quality (physicochemical property of the oil spill); followed by determination of an appropriate conversion process for the oil spill into a valuable product.

Table 4: The S-P-R-SC Model of Oil Spill Management

S/N	Focus on People	Focus on Planet	Focus on Profits
1	Covers the entire spectrum of potential impacts / hazards; with human health benefits on the other	Covers the entire spectrum of potential impacts / hazards; the effectiveness of the approach results in significant positive environmental impacts	It has business potential; when significant bulk volumes of oil spill wastes are generated, the conversion of such wastes can provide economic benefits
2	Focus on acquiring and leveraging data to track performance	Focus on acquiring and leveraging data to track performance	Focus on acquiring and leveraging data to track performance
3	Speed of anagement {Response/Containment / Remediation}	Significantly more effective management of the Receptor {Sustainability inclined}	Data acquired helps to generate insight into the operational performance of organizations, which insight can be fed back into the operational system of such organizations for more profitable performance.
4	Provision of such S-P-R-SC based oil spill management services, also have the potential for generating employment, particularly for the local indigenes in the community – a social benefit	Helps with energy and material resource conservation via the provision of substitute materials	Ultimately helps to improve operational efficiency, and thereby cut costs.

Table 5: Benefits of the S-P-R-SC Model of Oil Spill Management

### 7.2.1 Benefits of the S-P-R-SC Model

The S-P-R-SC model for oil spill management was developed with intentional focus on the 3Ps as shown in Tables 4 & 5.

*The “S-P-R-SC” model is an end-to-end / lifecycle approach...It involves searching for the root-cause(s) of the generated oil spill; tracing the path of impact of the oil spill and determining the eventual component(s) of the environmental matrix... ultimately adversely impacted.”*

*“This approach requires a bias for long term visioning by the decision makers in E & P Companies, as opposed to short term drive for profits...”*

## 8.0 CONCLUSION

The author is optimistic that if this model is adopted by oil and gas companies in the petroleum upstream sector in Nigeria, there will be significant improvement in their sustainability performance.

This approach requires a bias for long term visioning by the decision makers in E & P Companies, as opposed to short term drive for profits because initial investments will be required. However, the long term benefits which will accrue for all stakeholders {including superior profits} makes it a winning decision.

## REFERENCES

1. “A slick idea” by Cara Murphy Beach Reporter Manhattan Beach section II/14/1992 J.G.Speight, *Handbook of Offshore Oil and Gas Operations* (Elsevier, Waltham/Oxford, 2015) at pp. 257 – 303.
2. “Background on Oil Spills. Cause and Response.” *Congressional Digest*. 89 (6): 165–166. June 2010. ISSN 0010-5899. Bay section page 1 2/24/1994 *If only they'd tried the chilled-soup solution in Alaska*” by John Bogert Daily Breeze (Torrance CA) local section page B1 2/17/1994
3. Burgherr, Peter (2007). “In-depth analysis of accidental oil spills from tankers in the context of global spill trends from all sources”. *Journal of Hazardous Materials*. 140 (1–2): 245–256. doi:10.1016/j.jhazmat.2006.07.030. PMID 16942835.
4. EU Offshore Authorities Group, ‘Landmark Incidents’ available at <http://euoag.jrc.ec.europa.eu/node/41>; accessed 29 June 2018.
5. “How do oil spills happen?”. Office of Response and Restoration. February 5, 2019. Retrieved 2021-05-27.
6. International Legal Regime for the Protection of the Marine Environment Against Operational Pollution from Offshore Petroleum Activities’ in Z Gao (ed), *Environmental Regulation of Oil and Gas* (Kluwer, London, 1998) 93-143.
7. J.Paterson, ‘Health and Safety at Work Offshore’ in G Gordon, J Paterson and E Üşenmez (eds), *Oil and Gas Law: Current Practice and Emerging Trends* (2nd ed, Dundee University Press, Dundee, 2011) 187-230, at p. 204.
8. *Marine Policy* 399 - 404; SV Vinogradov and JP Wagner
9. Michel, Jacqueline; Fingas, Merv (2016). “Chapter 7: Oil spills: Causes, Consequences, Prevention and Countermeasures”. In Crawley, Gerard M (ed.). *10. Fossil Fuels*. Marcus Enterprise LLC, USA & University of South Carolina, USA. p. 160. doi:10.1142/9789814699983\_0007. ISBN 978-981-4699-99-0.
11. M.Knol, ‘The Uncertainties of Precaution: Zero Discharges in the Barents Sea’ (2011) p.35
12. Mu, Lin; Wang, Lizhe; Yan, Jining (2019). “Emergency Response System for Marine Oil Spill Accidents”. *Information Engineering of Emergency Treatment for Marine Oil Spill Accidents*. Taylor & Francis Group: CRC Press. pp. 1–30. ISBN 9780429289101.
13. R.O.Rourke, ‘Changes in the Arctic: Background and Issues for Congress’ (Congressional Research Service 2014) at p. 30; AMAP, ‘Arctic Oil and Gas 2007’ (2007) at pp. 24–25. 23 T Hunter, ‘Offshore Oil Spill Contingency Planning and Response: The International Legal Regime’ (forthcoming, on file with author).
14. “Oil Spill Response - Gulp Oil Skimmers”. *4barges.com.com*. Retrieved 4 November 2020.
15. Sarbatly R.; Kamin, Z. & Krishnaiah D. (2016). “A review of polymer nanofibres by electrospinning and their application in oil-water separation for cleaning up marine oil spills”. *Marine Pollution Bulletin*. 106 (1–2): 8–16. doi:10.1016/j.marpolbul.2016.03.037. PMID 27016959.
16. “Spill Response – Dispersants” International Tanker Operators Pollution Federation Limited. Retrieved 2010-05-03.
17. Reis, J.C. “An Overview of the Environmental Issues Facing the Upstream Petroleum Industry.” Paper presented at the SPE Annual Technical Conference and Exhibition, Houston, Texas, October 1993. Doi.
18. “Zapping Oil Spills with Dry Ice and Ingenuity” by Gordon Dillow Los Angeles Times South.
19. *britannica.com/list/9-of-the-biggest-oil-spills-in-history*
20. *premiumtimesng.com/news/headlines/461635-analysis-77-of-oil-spills-in-nigeria-occurred-in-only-three-states.html*
21. *dtsc.ca.gov/Hazardous Waste/upload/HWMP\_REP\_OilWastes.pdf*
22. *epa.gov/hw/proper-management-oil-and-gas-exploration-and-production-waste*
23. *ohioepa.custhelp.com/app/answers/detail/a\_id/2887/~/-oil-and-gas-exploration-and-production-wastes*
24. *epa.gov/radiation/tenorm-oil-and-gas-production-wastes*
25. *lexisnexis.com/legalnewsroom/environmental/b/oil-gas-energy-law/archive/2013/06/28/disposal-of-hazardous-waste-materials-resulting-from-oil-and-gas-well-drilling-operations-not-a-pollution-event-for-insurance-endorsement.aspx*
26. *researchgate.net/publication/286620089\_Oil\_Gas\_industry\_Waste\_Management*
27. *sciencedirect.com/topics/earth-and-planetary-sciences/spillage*
28. *researchgate.net/publication/283644184\_OIL\_SPILL\_REMEDIATION\_AND\_ITS\_REGULATION*
29. *link.springer.com/article/10.1023/A:1010633903226*
30. *zbw.eu/econis-archiv/bitstream/11159/1936/1/1023180510.pdf*
31. *onepetro.org/SPEATCE/proceedings-abstract/93SPE/All-93SPE/SPE-26366 MS/55119*
32. *sciencedirect.com/science/article/abs/pii/S0360544222020333*
33. *onlinelibrary.wiley.com/doi/abs/10.1002/cbdv.200900203*
34. *repository.elizadeuniversity.edu.ng/handle/20.500.12398/1195*



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# THE ROLE OF IRON AND STEEL INDUSTRY ON INDUSTRIALIZATION OF NIGERIA

## 1.0 INTRODUCTION

No nation has ever transformed into industrial and modern society without the establishment and profitable operation of heavy industries, primarily Iron and Steel Industry. The difference between developed and developing nations or rich and poor nations is their steel technology base. All G20 nations are steel producing nations. In late March 2018, President Donald Trump of United States of America instituted 25% tariff on imported steel and 10% tariff on aluminum because, according to him, 'if there is no steel there is no country' and this was in a bid to give a boost to the American steel industry.

Countries like India and Turkey experienced industrial boost through steel development. After the 2nd world war, Japan and Germany rebuilt their economies through massive development of their steel technologies. Other countries like China, Russia and South Korea produced more than their domestic needs and started exporting steel products [1].

Nigeria has the 12th largest iron ore resource in the world and the 2nd largest in Africa yet Nigeria imports more than 90% of its steel needs from China and other countries while it consumes more than 6 million tons of steel per year. It is an undisputable fact that multiple advantages will accrue to the nation if the steel industry is given the attention it deserves.

There are several investment opportunities that create ancillary industries to support the operation of the steel industry which include local manufacture of spare parts, consumables and industrial services, setting up of foundries, machine, forge and fabrication shops, graphite electrode processing plants, processing of waste and by-products etc. [2]

On the 12th of September 2022, Dr. Ayorinde Olabode former Chairman, House Committee on Economic Recession was quoted as saying **“Where is industrialization without Steel?”**

The many areas where steel is used include construction of Bridges, Aircraft, Rigs, Railways, Pipelines, Military hardware, Reactors, Farm Equipment, Columns Tractors, Boilers, Automobiles, Drills, High-Rise Buildings, Home appliances, Electrical equipment, Office appliances etc. The



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*“No nation has ever transformed into industrial and modern society without the establishment and profitable operation of heavy industries, primarily Iron and Steel Industry.”*

stated list gives credence to the need for the steel industry to be given the attention required to place the nation on the path to industrialization.

## 2.0 HISTORY OF NIGERIAN STEEL

In 1958, the idea to establish a government-owned steel company was conceived and in 1967, this matured into a bilateral relationship between Nigeria and the former Union of Soviet Socialist Republics (USSR). Following this, a team of Soviet experts was commissioned to conduct feasibility studies on setting up an integrated steel plant in Nigeria. In 1971, the Nigerian government signed a contract with the Techno-export Company of USSR for studies on raw material requirements for the running of a Steel Industry. This included iron ore, limestone and dolomite. The abundance of these minerals were confirmed and established. The result was the establishment, on 14th April 1971, of Decree No.19 which established the Nigerian Steel Development Authority (NSDA) to identify, locate and procure

S/N	Location	Ore type	% Fe Content	Reserve (Tonnes)
1	Agbaja	Geothite - Hydrothite	45-54	2 billion
2	Itakpe	Magnetite-hematite	36	200 million
3	Ajabanoko	Magnetite-hematite	36.61	62.5 million
4	Chokochoko	Magnetite- hematite	37.43	70 million
5	Agbado-okuku	Magnetite- hematite	37.43	70 million
6	Tajimi	Magnetite- hematite	22.58	20 million

Table 1: Some Iron Ore Deposits in Nigeria

locally available raw materials for the steel industry. Table 1 shows the location of iron ore deposits in Nigeria. The location of some iron ore deposits in Nigeria is shown in Fig. 1.

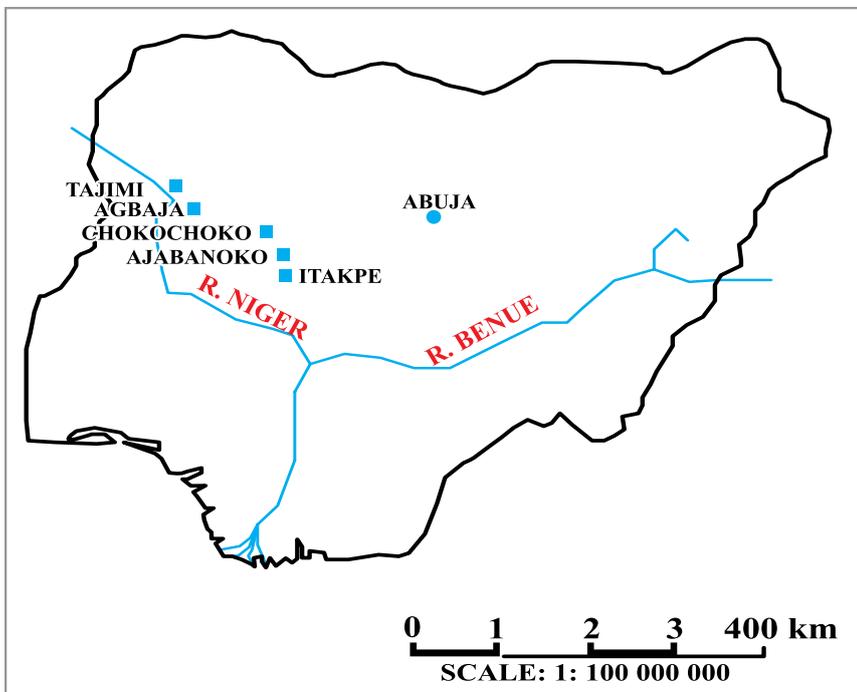


Fig. 1: Location of some iron ore deposits in Nigeria

In 1974, Tiajpromexport (TPE) of the then USSR submitted a preliminary project report (PPR) and in 1975 siting of the company at Ajaokuta to utilize the Itakpe iron ore was agreed upon. The initial capacity of the plant was 1.3 million tons of liquid steel per annum with a projected first phase future expansion to 2.5 million tons per annum and a second phase expansion up to 5.2 million tons per annum.

The initial cost of the first phase was estimated at N2.5 billion. The product mix was to include Rounds, Ribbed bars, Angles, Plates, Strips, Channels, Beams, Tees, Billets (100x100 mm<sup>2</sup>) Slag for road surfacing, etc. In 1991/1992, a 2.5 metric tonne beneficiation plant was installed at NIOMCO, Itakpe which was designed to produce and supply 2.15 million metric tonnes/yr of 63/64% Fe suitable for blast furnace at Ajaokuta Steel Plant.

A standard rail line of 327 km was planned to link NIOMCO to Delta Steel Company for the transportation of iron ore. The rail link was aimed at a capacity of transporting 20 million tonnes of iron ore per year.

In 2002, due to the inability to actualize the production of steel from the Ajaokuta Steel Plant several years after construction started, the government decided to seek private sector participation.

The plant was concessioned to SOLGAS to rehabilitate, complete, operate but SOLGAS could not deliver on the mandate and the contract was discontinued.

By mid 2004, it was concessioned to Global Infrastructure Holdings (GIHL), India. They produced some products using billets imported from Ukraine which, in itself, was an aberration because the original plan was the production of steel from iron ore through the blast furnace route. In 2013, the Federal Government terminated the contract.

*“In 2002, due to the inability to actualize the production of steel from the Ajaokuta Steel Plant several years after construction started...”*

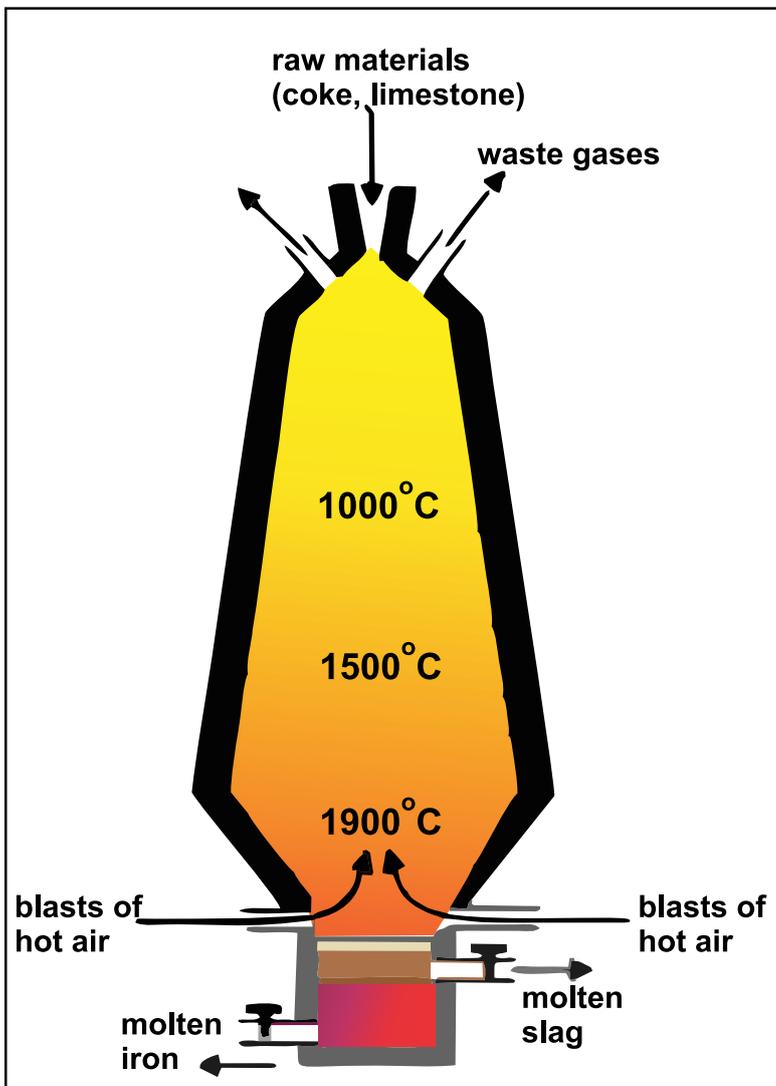


Fig. 2: Blast furnace structure

Although the main contract for the establishment of the conventional Blast Furnace – Basic Oxygen Furnace route to steel production was signed in 1979, global recession, poor funding and the installation of massive infrastructural facilities had stood on the way of the completion and full commissioning of Africa's largest steel making plant.

Due to this delay and convinced by the well-known advantages of the Direct Reduction/ Electric Arc Furnace route to Steel production, the Federal Government of Nigeria signed an agreement with a consortium of 10 Austro-German companies on 3rd October, 1977, to set up a Direct Reduction Electric Arc Furnace Integrated Steel Plant of a capacity of one million tonnes per year of liquid steel with a Captive rolling mill with 320,000 tons per annum at Ovwian-Aladja in Delta State.

The advantages of this manufacturing route include:

- Efficient use of the abundant natural gas in Nigeria
- Independence from coke imports
- Capacity sized to meet needs rather than economy of scale
- Electric arc furnaces can be rapidly started and stopped, allowing the steel mill to vary production according to demand
- Lower capital cost per ton of product
- Shorter construction time (Less than 4 years)

The company was based on the German DIN standard 443 or ASTM A 615. Delta Steel Company was the second IISI (International Iron and Steel Institute) recognized Company in Africa after South Africa. In full operation, it would require about 230 megawatts of energy, enough to power a large city. The product mix included, Direct Reduced Iron (DRI), Billets (120x120) mm<sup>2</sup>, Rounds, Ribbed bars, Angles, Channels.

Delta Steel Company was officially commissioned on the 29th of January 1982 with the highest production of about 25% of installed capacity achieved in 1985. [2] The prospects of the plant were enormous. It also had other ancillary units which included the Lime Calcination plant that was capable of producing high quality lime water treatment, agricultural purposes, paint manufacturing etc, a Foundry capable of producing man hole covers for municipal use, crushers for quarries etc, Central Electrical and Mechanical workshops that could be run commercially, a Training Centre which carried out training for private and public enterprises

*“...steel production was signed in 1979, global recession, poor funding and the installation of massive infrastructural facilities had stood on the way of...”*



*Fig. 3: Direct Reduction Modules after commissioning*

like Guinness Nigeria Plc, Benin, Defence Industries Kaduna among several others. It is on record that DSC produced brake drums for the then Peugeot Assembly Plant in Kaduna.

Engineers in the middle eighties were to modify the Continuous Casting Station to produce blooms for final production of plates towards further industrial applications. Several modifications were made in the Direct Reduction Plant to place it on a pedestal to continuously supply DRI to the electric arc furnaces for production of billets and for export purposes.

In 1982/1983, the Nigerian Government established three (3) Rolling Mills, each of 210,000 tons annual capacity sited in Katsina, Oshogbo and Jos. The Delta Steel Company supplied billets to them.

In 1995, DSC was faced with a dilemma of non-production due to shortage of iron ore supply which at the time was being imported from Liberia and Brazil. This led to a research which resulted in the successful utilization of the enhanced Itakpe ore in DSC. This yielded a good saving for Nigeria. What followed was the export of direct reduced iron (DRI) made from Itakpe ore to Bulgaria and India in 2007.

This created an opportunity for Nigeria to earn foreign exchange.

The potential for export of finished products started in 1992 when direct reduced iron was successfully exported to Spain in the first ever export of the product through containers marking a milestone for the country.

However, the Government, through the Bureau of Public Enterprises (BPE) in 2005, handled the sale of Delta Steel Company, National Iron Ore Mining Company (NIOMCO) and handed them to Indian investors. The three inland rolling mills were sold to Nigerian investors.

The Senate of the Federal Republic of Nigeria constituted an Ad-hoc Committee to investigate the Nigerian Iron Ore Mining Company (NIOMCO) Itakpe over non-performance, despite budget allocations and releases of funds since 2008.

They observed that:

- i. The agency was a major source of wastage of government funds, following its moribund nature since 2008.
- ii. It had been inactive for 14 years despite



Fig. 4: Ajaokuta Steel Plant



Fig. 5: Steel Melting Shop at Delta Steel Company



Fig. 6: Pelletizing Plant at Delta Steel Company



Fig. 7: Direct Reduction Plant at Delta Steel Company

allocations of funds for capital, recurrent, and overheads.

- iii. N1.8 billion was released as capital fund while N2.5 billion had been cumulatively released to the organization as at July 2022.

So privatization that was carried out to supposedly bring life to the steel industry unfortunately turned out to contribute to its eventual collapse and opened up a dark chapter in the history of the Nigerian steel industry.

### 3.0 THE STEEL INDUSTRY TODAY

In 1980, MECON (Metallurgical and Engineering Consultants), India said that the establishment of 1.3 million tonnes based on the Blast Furnace technology at Ajaokuta and the DR-EAF route for 1 million tonnes and the Inland Rolling Mills for 210,000 tonnes at Oshogbo, Katsina and Jos would place Nigeria among the league of steel producing countries.

Unfortunately, this was not to be. The true situation was captured in a In 2014 by Masayoshi Matsu-Shita, UNIDO country representative in Nigeria, in a paper

entitled “Non-oil Sector as the Key Economy Driver” where he said, “The current realities in Nigeria compared to developed countries and developing counties do not leave much to be desired. Non-oil sector especially the manufacturing sub-sector which is the basis for achieving development is almost comatose in Nigeria”. Figs. 4 – 7, showing the idle state of steel plants in Nigeria, tell the unfortunate present day story of the dream of putting Nigeria on the map of steel producing countries.

*“The current realities in Nigeria compared to developed countries and developing counties do not leave much to be desired. Non-oil sector especially the manufacturing...”*

*“The enormous gains in having a vibrant steel industry cannot be over-emphasized. The initial dream was fueled by the abundance of raw materials and utilities for its actualization...and guarantee job opportunities for millions of persons.”*

#### 4.0 CONCLUSION

The enormous gains in having a vibrant steel industry cannot be over-emphasized. The initial dream was fueled by the abundance of raw materials and utilities for its actualization. In addition to the major products from the steel plants, there are numerous potential spin-off industries that would aid industrialization and guarantee job opportunities for millions of persons.

Having successfully entered the export market, there is enormous potential for further expansion particularly into the West African sub- region where Nigeria has the first and only blast furnace and direct reduction based steel plants till date. The completion of the Itakpe - Aladja rail link gives a further impetus. There are four categories of persons.

These include those who:

- i. Do the wrong things because they do not know the right things to do.
- ii. Do the wrong things knowing the right things to do, but lack the will and drive to implement.
- iii. Do the right things without the knowledge of the right but only doing them by accident.
- iv. Know the right things to do and are doing them.

Unfortunately, only a very small percentage of persons fall into the fourth category. If the greater percentage of individuals and corporate entities fall into this category, the failed dream of the steel industry would not have happened and according to the words of a steel industry expert, Engr. Anthony Madagua, taking a queue from other countries that have proven this, Government business with particular reference to the steel industry can be very profitable. What is

required is to pick up the pieces again, learn from the mistakes of the past and put Nigeria again on the path to industrialization by resuscitating the steel industry and taking advantage of the abundant raw materials otherwise industrialization would never be a reality but only remain a dream.

#### REFERENCES

1. Madagua A (2015), *Who Says Government Has No Business In Business*, Bosem Publishers Nigeria Ltd.
2. Madagua A. A (2013), *The Betrayal of The Nigerian Steel Dream*, Delta Steel Co. Saga, Bosem Publishers Nig. Ltd.
3. Olayebi, O. O (2014), *Direct Reduction of the Nigerian local Itakpe iron ore at the Delta Steel Company*, *Journal of Engineering and Energy Research*, Vol. 4. No 1, pp 19-43.
4. Raw Materials Research and Development Council, *STEEL RAW MATERIALS IN NIGERIA*, 2010.
5. Olayebi, O. O (2014), *Steel making experience in the use of Nigerian iron ore at the Delta Steel Company*, *Nigeria, Journal of Chemical Engineering and Material Science*, Vol. 5(5), pp 47-62.
6. Olayebi, O. O (2014), *The Midrex Process and the Nigerian Steel Industry*, *International Journal of Engineering Sciences & Research Technology*, 3(11), pp 344-370.
7. Olayebi, O. O (2014), *Reduction in Power Consumption from Modification in Cooling Water Circuits of the Direct Reduction Plant at Delta Steel Company* *Journal of Engineering and Energy Research*, Vol. 4, No. 2, pp 1-32.
8. Olayebi, O. O. (2014), *Remodification in the Oxide Feed System for Midrex Direct Reduction Shaft Furnace of the Delta Steel Company*, *Global Journal of Engineering Science and Research Management*, 1(7), pp 35-45.
9. Olayebi. O.O and Ogbeide S.E (2021) *Reducibility Tests on Itakpe Iron Ore*, *Iconic Research and Engineering Journals*, Volume 5 Issue 5, pp 86-99
10. Olayebi O.O and Ogbeide S.E (2021), *Modeling of Reduction of Itakpe Oxide Pellets in Furnace Reactor*, *International Journal of Engineering Applied Sciences and Technology*, 2021 Vol. 6, Issue 8, ISSN No. 2455-2143, Pages 200-209
11. Olayebi O (2021) *Shipment of Direct Reduced Iron Made from Nigerian Itakpe Iron Ore*, *Int'l Journal of Engineering Sciences & Research Technology*, 10(11), pp 54-69

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