A Project Unveiling the Dynamics of the Energy Sector in Africa & Dominant Players in Fossil Energy Sector.

Submitted to the School of Maritime Management, Indian Maritime University in partial fulfilment for the award of degree in

MBA-Port and Shipping Management

Submitted

By

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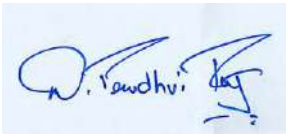
DECLARATION

I, **DANTALA PRUDHVI RAJ (Reg. No. 2203304007)**, student of School of Maritime Management, Indian Maritime University – Chennai Campus, hereby declare that this project report titled **A PROJECT UNVEILING THE DYNAMICS OF THE ENERGY SECTOR IN AFRICA & DOMINANT PLAYERS IN FOSSIL ENERGY SECTOR.** submitted in partial fulfilment of the requirement for the degree of **Master of Business Administration in Port & Shipping Management is** my original work carried under the guidance of my project guide. It has not formed the basis for the award of any Degree/Diploma of any University/Institution. The information submitted is true and original to the best of my knowledge.



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CERTIFICATE

This is to certify that this project reported " A STUDY ON THE FINANCIAL EVALUATION OF MAJOR PORTS IN SOUTH INDIA" is submitted in partial fulfilment for requirement of awarding the degree.

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Abbreviation's

Bpd: barrels per day, Bb: Billion barrels

Mbpd: million barrels per day

Mbpy: million barrels per Year

Bbpd: billion Barrels per day

BOE: barrels of oil Equivalent (oil +Liquid gas (condensed))

MCM: million Cubic meters

MCF: million Cubic feet

BCF: Billion Cubic feet

MT: Metric Ton

MTPA: metric tons per Annum

MMT: Million metric tons

BMT: billion metric tons

1P: Proven Reserves

2p Reserves classifications: proven & Probable Reserves

E&P: Exploration and Production

FLNG (Floating liquid natural gas terminal)

FPSO: Floating Production Storage Offloading Unit

IAEA: International Atomic Energy Agency

O/P: Output

PPP: public private partnership

bbl: barrels of oil

Chapter 1

1.1 Introduction

Africa, with its vast and diverse landscapes, is a continent abundant in natural resources, including oil, gas, and coal. The dynamics of the energy sector in Africa are multifaceted, influenced by geopolitical factors, technological advancements, economic developments, and environmental concerns. Understanding these dynamics and identifying the dominant players in the oil, gas, and coal industries is crucial for comprehending Africa's energy landscape and its implications for global energy markets

Africa is home to several oil-rich nations, with reserves concentrated mainly in North Africa, West Africa, and parts of East Africa. Nigeria, Angola, and Algeria are among the top oil-producing countries on the continent. The exploration, production, and export of oil play a significant role in the economies of these nations, driving economic growth and development.

The dynamics of the African oil sector are shaped by a myriad of factors, including fluctuating oil prices, political stability, regulatory frameworks, and investment climate. Nigeria, as the largest oil producer in Africa, holds considerable influence in the global oil market. However, challenges such as corruption, infrastructure deficiencies, and security concerns have posed obstacles to fully harnessing the potential of the oil sector in many African countries.

The natural gas sector in Africa has witnessed significant growth in recent years, fueled by increasing domestic demand and rising global demand for cleaner energy sources. Countries such as Nigeria, Algeria, Egypt, and Mozambique possess substantial natural gas reserves, positioning them as key players in the African gas industry.

The dynamics of the gas sector are characterized by investments in infrastructure development, liquefied natural gas (LNG) projects, and regional cooperation initiatives. Nigeria's vast gas reserves, for instance, have spurred investments in LNG projects, aiming to monetize gas resources for both domestic consumption and export purposes. Additionally, emerging gas discoveries in East Africa, particularly in Mozambique and Tanzania, have attracted significant attention from international energy companies, reshaping the dynamics of the regional gas market.

Although coal remains a significant energy source in Africa, its role in the continent's energy mix is gradually evolving due to environmental concerns and shifting global energy trends. South Africa stands out as the largest producer and consumer of coal in Africa, with coal-fired power plants accounting for a substantial portion of the country's electricity generation.

The dynamics of the coal sector are influenced by factors such as environmental regulations, technological advancements, and the transition towards cleaner energy alternatives. While coal continues to play a crucial role in meeting energy demands, countries like South Africa are increasingly exploring renewable energy options to diversify their energy mix and mitigate environmental impacts.

In each segment of the energy sector, several dominant players shape the landscape and drive developments. Multinational corporations, national oil companies, and government entities play pivotal roles in exploration, production, and distribution activities. Companies such as Shell, ExxonMobil, TotalEnergies, and Chevron operate extensively across the continent, contributing to the development of Africa's energy resources.

Additionally, national oil companies like Nigeria National Petroleum Corporation (NNPC), Sonatrach (Algeria), and Sonangol (Angola) exert significant influence within their respective countries' energy sectors, often partnering with international firms to leverage expertise and resources.

By understanding the dynamics of the energy sector (Oil, Coal, Natural Gas (Methane), Thermal Energy in Africa requires a comprehensive analysis of the oil, gas, and coal industries, along with identifying the dominant players shaping the landscape. As Africa continues to play a vital role in global energy markets, monitoring these dynamics is essential for policymakers, investors, and stakeholders to navigate the complexities and opportunities within the continent's energy sector.

1.2 Problem Statement

Despite Africa's abundant natural resources, including vast reserves of fossil fuels, the energy sector on the continent faces numerous challenges that hinder its efficient utilization and development. These challenges include inadequate infrastructure, insufficient investment for Addressing the Countries Energy needs, regulatory barriers for having a Private participation in Brode sectors like oil & gas Industry, Minning, and geopolitical tensions going on in the west African nations, among others. Additionally, the dominance of certain players in the fossil energy sector further complicates matters, potentially limiting competition, innovation, and equitable access to their own countries energy resources. Therefore, there is a pressing need for a comprehensive understanding of the dynamics within Africa's energy sector, particularly focusing on the dominant players in the fossil energy sector, to identify barriers to progress and opportunities for respective countries development. This project aims to address these issues by unveiling the complexities of the energy landscape in Africa and examining the roles and influence of key stakeholders in the fossil energy sector and list down some of the Debt traps in the Oil & Gas and Coal mining Industries of African Continent.

1.3 Objectives of Study

The Following are the List of objectives which I gone address in my research.

1. To Understand the dynamics of the energy sector in Africa, focusing on the oil, gas, and coal industries.

2. To analyse the key players in the fossil energy sector and understand the factors influencing the energy landscape in Africa (like Investment, Governance Frame work)

3. To examine the exploration, production, and export activities in the oil sector, with a specific focus on oil-rich nations like Nigeria, Angola, and Algeria.

4. To highlight the rapid growth of the natural gas sector in Africa, emphasizing countries like Nigeria, Algeria, Egypt, and Mozambique with substantial gas reserves.

5. To explore the influence of Multinational Energy giants in gas infrastructure, LNG projects, and regional cooperation initiatives in the natural gas industry and addressing thing supporting Infra (like for oil & gas linked to Oil and gas Run Power plants and also similar way for the Coal Power plant) .

6. To analyse the evolving role of coal in Africa's energy mix, particularly in South Africa, Mozambique and how some of the Entity connected to India, and global energy trends on the coal sector and the strings connecting to India.

7. To understand the Scope of Sources of Energy Procurement for Europe Energy needs and how Europe is using its Countries energy giants have a Holds on African Energy reserves and how the trends are seen in securing those Reserves.

8. To Analysis the impact of Angola Exit from OPEC on Indian Import Price & Quantity.

1.4 Scope of Study

Only 33 countries are taken as inputs starting from the East Cost of African from Gulf of Aden these nation are chosen to do a deeper analysis on what are their Energy asserts capability and how those assets are used (and find who is holding those energy asserts majorly) and find the scope or getting benefited from those reserves is it the local gov or Foreign entity’s and how those entities are feeding these energy’s to their respective origin’s blocks (BRICS, EU …..etc). and the data used is from 2019 – 2024 based Availability with respective to each input.

1.5 Limitations

1. Only 33 Countries are chosen for the Research because of Time Constraint.
2. Most of the Data used is not a single Year Specific as the OIL & Gas & mining industry is a very closed Loop (to get up to date information for free of cost) base of the availability, the data is take which gives a closer understanding (not the pinpointed outcomes but Approx).
3. Most of the Reserves given are Estimation’s are (2p: Proven , Predicted) based on the Reports or news Articles or open Data sets like GEM , GlobalData..etc.
4. All the Data used is secondary data obtained from very vast news network unable to address Each and Every Source of the Data input.

1.6 Abstract

The energy sector in Africa stands at the nexus of economic development, environmental sustainability, and global energy dynamics. This abstract provides a succinct overview of the comprehensive analysis presented in this report, focusing on the dynamics of the oil, gas, and coal industries in Africa, as well as the dominant players shaping these sectors.

The oil sector in Africa is characterized by significant reserves concentrated in nations such as Nigeria, Angola, and Algeria. Despite challenges such as fluctuating oil prices and political instability, these countries play crucial roles in the global oil market. Nigeria, as the largest oil producer in Africa, holds considerable influence, while challenges such as corruption and infrastructure deficiencies hinder the sector's full potential.The gas sector in Africa is witnessing rapid growth, driven by increasing domestic and global demand for cleaner energy sources. Nations like Nigeria, Algeria, and Mozambique possess substantial gas reserves, attracting investments in infrastructure and LNG projects. Emerging gas discoveries in East Africa are reshaping regional dynamics, with Mozambique and Tanzania becoming focal points for international energy investments. Coal, while significant in Africa's energy mix, is undergoing a transition due to environmental concerns and shifting global trends. South Africa leads the continent in coal production and consumption but is exploring renewable alternatives to mitigate environmental impacts.

Throughout these sectors, dominant players such as multinational corporations, national oil companies, and government entities shape the landscape and drive developments. Companies like Shell, ExxonMobil, and TotalEnergies operate extensively across Africa, alongside national oil companies like NNPC and Sonatrach.

This report underscores the importance of understanding the intricate dynamics of Africa's energy sector for policymakers, investors, and stakeholders. As Africa continues to play a vital role in global energy markets, monitoring these dynamics is essential for navigating opportunities and challenges within the continent's energy landscape.

Chapter 2

2.1 Literature Review

The energy sector in Africa is undergoing significant transformations, driven by a complex interplay of challenges, opportunities, and policy imperatives. This literature review synthesizes key findings from relevant studies, shedding light on the dynamics of the energy sector and the role of dominant players in fossil energy exploration and production

1. This article, titled "Marketing Oil and Gas Brands in Africa", discusses the challenges faced by oil and gas companies in Africa due to the environmental impact of their operations. It emphasizes that oil and gas companies need to acknowledge these environmental issues and focus on building a positive brand image through effective marketing strategies(Anon n.d.-e).

2. The challenges and opportunities faced by African oil and gas producers due to the global energy transition away from fossil fuels is addressed in this paper. African countries are highly reliant on oil and gas revenue, but their reserves are expensive to produce and carbon intensive, which means they could become stranded assets if the energy transition accelerates. However, the shift to a low-carbon future also presents opportunities. African countries can improve the competitiveness of their oil and gas production by reducing costs and decarbonizing operations. It specifies the Investment path ways by invest in renewable energy and carbon offset projects to diversify their economies and create new revenue streams(Anon n.d.-f).

3. This paper discusses the challenges faced by the oil and gas industry in Africa. Despite substantial growth and the emergence of East Africa as a new player, the industry also faces numerous challenges including complex bureaucracy, skilled manpower gaps, political risk, security risks, and limited technological innovation. However, the article also highlights that Africa is still seen as a good place for investment, especially for companies that can leverage new technologies(Musisi 2017).

4. It has Discussed the economic and environmental implications of crude oil exploration in Africa. The discovery of crude oil has brought economic benefits to the continent. However, it has also led to social unrest and environmental damage. Unethical practices by oil companies and a lack of regulation have further exacerbated these issues. The authors call for more sustainable practices to ensure that local communities benefit from the resources. This aligns with the findings from the previous article which highlights that environmental management is a key theme in the research on Ghana's oil and gas resources(Adeola et al. 2022).

5. The Brazilian government is about the market study on the oil and gas sector in South Africa. It discusses the growing interest in oil and gas exploration in South Africa, particularly after the Brulpadda gas condensate discovery. This article also details challenges faced by the oil and gas industry, such as the need for a clear regulatory framework. However, the potential economic benefits of the industry are significant, including job creation and a more affordable and reliable energy source. The article concludes by recommending that the Brazilian government and private sector partners engage with South Africa to explore these opportunities(Anon n.d.-a).

6. Geng and Doan (2020) conduct a global review of energy poverty and its implications for environmental sustainability. The study emphasizes the need for targeted interventions to improve energy access while minimizing adverse environmental impacts. Balancing socio-economic development with ecological resilience is essential. This global review of energy poverty and its implications for environmental sustainability provides valuable context for understanding the intersection of socio-economic and environmental factors in Africa's energy sector(Das and Roy 2020).

7. (Azevedo 2014) review energy efficiency measures in developing countries. While efficiency gains are crucial, policymakers must also consider rebound effects—where increased efficiency leads to higher energy consumption. Integrated approaches that address rebound effects are vital for sustainable energy transitions. By reviewing energy efficiency and rebound effects in developing countries, this study offers insights into optimizing energy use in Africa's energy sector, mitigating the dominance of fossil energy players.

8. (Donwa, Mgbame, and Julius 2015) The study investigates corruption and bribery issues within the global oil and gas industry. It analyzes the impact of unethical conduct on industry reputation, regulatory compliance, and stakeholder trust. The findings highlight the prevalence of bribery involving major multinational energy companies. The paper underscores the need for greater transparency and accountability to combat corrupt practices in the sector.
9. (Anon n.d.-c)The study investigates specific bribery allegations and legal issues faced by Chevron in its African oil exploration projects. It emphasizes the legal implications, regulatory responses, and reputational risks associated with Chevron's unethical practices in the region. The paper underscores the need for transparency, compliance, and responsible business conduct.

10. The "Oil, Gas, and Mining in Modern Africa" paper , discusses the paradoxical situation of Sub-Saharan Africa. The region is rich in energy resources, yet many people lack access to electricity. Historically, countries focused on exploiting these resources for economic gain, often leading to underdevelopment, known as the resource curse. A new approach emphasizes developing access to energy for the population, which is seen as crucial for economic growth(Anon n.d.-d).

11. (Damijan and Damijan 2013)The study investigates the impact of bribery on market competition and fair practices within the global oil industry. It finds that bribery negatively affects firm performance, but the relationship is complex. Firms benefit from access to external finance if exposed to bribes and operating under moderate regulation. Export-oriented firms also benefit from higher bribery exposure and regulation. Additionally, market competition increases bribery behavior, while political competition within a country reduces the likelihood of bribing. Understanding these dynamics is crucial for promoting fair practices and maintaining trust in the industry.

12. The research paper by (Daisy 2020) delves into the regulatory responses to bribery allegations within the energy sector, focusing on case studies involving Chevron and Shell. The study evaluates the efficacy of regulatory frameworks, enforcement mechanisms, and compliance measures in tackling bribery practices. As global

regulators intensify their scrutiny, issues like bribery and corruption remain longstanding concerns. Additionally, non-compliance with sanctions has emerged as a recent area of focus. Companies operating in the energy sector face heightened exposure due to their presence in "red flag" jurisdictions, engagement with high-value contracts involving government officials, complex contracting structures, and reliance on third parties. Regulatory enforcement is on the rise, and breach of sanctions is a key target. To maintain compliance, energy companies must navigate the intricate and ever-evolving regulatory landscape

13. "The Debt Trap Dilemma: Chinese Investments in Africa's Oil and Gas Sector" by Smith et al. (2020):
    This paper investigates the debt trap created by Chinese investments in Africa's oil and gas industry. It analyzes how Chinese loans and investments lead to debt accumulation, affecting the financial sustainability of projects. The study highlights the risks faced by resource-rich African nations due to their reliance on Chinese financing(Anon n.d.-b).

14. The potential for increased African involvement in the Petroleum, Gas and Mining sectors within the East African Community (EAC) region. It focuses on the shared historical and geographical similarities among the EAC countries, particularly Kenya, Uganda, Tanzania, Burundi, and Rwanda. These shared features, including past colonial ties and harmonized trade policies, create a potentially attractive investment environment for the entire block as opposed to individual countries. This analysis contributes to the broader study "Africans Investing in Africa" by highlighting the opportunities and challenges associated with increased African investment in the region's resource sectors(Butare 2015).

15. "Debt Traps in Africa's Oil Exploration Projects: Navigating the Risks" by (Zajontz 2022) Specifically addressing oil exploration projects in Africa, this research paper sheds light on the risks associated with debt accumulation. It discusses overleveraging, debt servicing challenges, and their impact on the viability of oil projects in the region.

16. “The paper on topic "Tanzania: From mining to oil and gas" by Alan R. Roe delves into the country's transition from a mining-focused economy to one increasingly reliant on oil and gas. While Tanzania has a long history of mining activity, significant natural gas discoveries offshore in the Indian Ocean have raised expectations of substantial economic growth. The paper explores the potential benefits of this resource wealth, including increased government revenue and improved living standards. However, it also critically examines the challenges associated with managing this new source of income, drawing lessons from the previous mining boom. The author assesses the policy and regulatory decisions taken by the Tanzanian government and suggests that the current approach might not be optimal for maximizing the long-term benefits of the oil and gas resources(Roe 2016).

17. Vast body of research delves into the complexities of the global oil and gas industry, encompassing its historical significance, the distribution and volume of crude oil and natural gas reserves across regions, and the technical and economic aspects of exploration and extraction. Understanding global and regional demand patterns, influenced by population growth, industrial activity, and energy policies, is crucial to analyzing the intricate network of international trade routes and the role of major players in the export and import markets. Price fluctuations are driven by a complex interplay of supply and demand dynamics, geopolitical tensions, and financial market influences, making it essential to analyze long-term trends shaping future prices, considering resource depletion, technological advancements, and the energy transition. While natural gas presents itself as a cleaner alternative fossil fuel, its potential dominance in a future low-carbon energy landscape remains a topic of ongoing investigation. In conclusion, extensive literature paints a comprehensive picture of the oil and gas industry, highlighting the critical challenges and opportunities associated with this vital source of energy in the global landscape(Anyanwu, Abderrahim, and Feidi 2010).

18. Review of The Global Oil And Gas Industry(Hassan 2013): A Concise Journey From Ancient Time to Modern World" by Dr. Aminu Hassan embarks on a historical exploration of petroleum and other hydrocarbon-related energy resources. The paper traces their discovery, development, and utilization from ancient times to the modern oil and gas industry. Based on this global historical review, it concludes that as long as alternative energy sources are not discovered on an economically large scale, hydrocarbons will continue to dominate the world's economy, politics, and social activities for years to come.

19. The role of (multi)national oil and gas companies in leaving fossil fuels underground: It highlights the Energy Transition Participation in Oil and gas companies engage in the energy transition by diversifying their activities, managing their reputation, and lobbying and Diversification involves making modest investments in renewable energy, improving energy efficiency, and expanding into petrochemicals. Along with Technology Preference and provide a detailing of production impact.(Herzog-Hawelka and Gupta 2023)

    The above listed literature provides a multifaceted understanding of the energy sector dynamics in Africa, emphasizing the urgency of transitioning away from fossil fuels towards cleaner energy sources. Key challenges include the influence of dominant players in the fossil energy sector, characterized by multinational corporations and national oil companies. Strategies such as investment in renewable energy infrastructure, decentralized solutions, and policy coherence are crucial for sustainable energy transitions and poverty alleviation. However, issues of corruption and bribery within the global oil and gas industry pose significant obstacles to transparency and accountability. Efforts to mitigate debt risks associated with Chinese investments in Africa's energy projects are imperative for financial sustainability. Despite challenges, there's a growing momentum towards energy diversification and transition, with countries like Kenya and Morocco leading the way. Policymakers must prioritize renewable energy investments and diversify economies to facilitate sustainable energy transitions while addressing socio-economic disparities.

Chapter 3

3.1 Ethiopia (North Africa)

Estimated Basins for Oil &

21 blocks of OGADEN Basin

Source: http://www.mom.gov.et/index.php/petroleum/petroleum-opportunities/

The Ethiopia is a Country located in Horn of Africa which is the newest among the African nations which has started its Gas Production in 2013 by a Chinese Firm POLY-GCL which is a subsidiary of Golden Concord Group Limited a Hongkong Base company followed up with starting of its Oil Production in Ogden Basin in state of Somali, Eastern Ethiopia in HILALA Block 11, KALUB in June 28,2018.

Energy mix:

Hydro power: 95.8%, Wind Power: 3.8%, Bio energy: 0.3%, Solar Energy: 0.1 %

By referring this Energy Mix we can clearly understand how far the Ethiopia dependent of its hydro power by building huge dams on Nile River which is benefiting Ethiopia & Sudan (helping in avoiding floods) but is resulting harm to the Egypt as most of its population is along the Nile River as Ethiopia is building dams which constrains the flow of water to Egypt border.

Oil

Proven Oil Reserves: 0.4 million barrels (as of 2021)[1]

Daily Production: 350 – 450 bpd (mostly meant for domestic use)

Daily consumption: 0.1077 million bpd (as of 2019)

Recent Discovery:

Doha Block 7: 3TCF (Discovered By POLY-GCL from China),

EL KORAN Block 8 (Discovered by New Age Mining from the United Kingdom)

Refinery: No Refinery

Oil Pipelines: nil

Gas

Proven reserves: 24.919 billion Cubic Meters[1]\

(Calub -2.7 TCF, Hilala – 1.3 TCF, El-Kuran – up to 1.5 TCF) …. Earnings Approx $7

Estimates: Approx. 6- 8 Tillion Cubic Feet

Source; Bloomberg & WorldsOMeter

There was a proposal for a gas pipeline of 767 Km which connect the OGADEN Basin Gas Fields and to Port in Djibouti which was also been funded by POLY-GCL Chinese Firm still in progress.

Operator: POLY-GCL (parent: Golden Concord Group Limited (Chinese energy firm) [2])

Connecting gas Fields: Hilala and Calub gas fields-- (FLNG) terminal in Damerjog, Djibouti

Capacity: 12 billion Cubic meters/year (10 billion is meant to reach China)

Year of Starting: 2024

Coast: approx. $4B (built & operated by Chinese's firm)

But recent Updates that the Ethiopia terminated its Contract with Chinese Firm POLY-GCL after unsatisfied Norms put forth by GOV and issues ultimatum on March 2022.

Damerjog Floating LNG Terminal (Djibouti)

Proposed By: Poly-GCL Petroleum Ltd (Owned by: China POLY Group, Golden Concord Group).

Construction Begin: 2016

Capacity: 3 million tons per annum

We can clearly observe how obsess the Chinese firm in getting the gas from Ethiopia to China despite of having 24 billion Cubic Meters gas which was proven they hope to obtain the Estimated of approx. 226 billion cubic meters this estimation is making the Chinese firms interested to get the Ethiopian gas.

Despite the Deal b/w the GCl (Chinese's firm) & Ethiopia is broken by there are chances of Re negotiation as the construction of the Floating LNG terminal not stopped.

The Reason for this proposal of the Floating LNG terminal in Djibouti as the Ethiopia is not having a coastal line and its is land locked and also it will be easy for the Chinese Entity to move the Asset after the completion of its use in that region.

Coal Reserves: 297,000,000 tones (as per Petroleum Operations Department, Ministry of Mines and Energy, P.O. Box 486, Addis Ababa, Ethiopia)

Coal Mines in Ethiopia (Total 3, 2 Operational, 1 Closed)

Kamakshi Coal Mine (o/p : 0.5Million Mt/annum) ,

Delbi Coal Mine (o/p : 0.69 Million Mt/annum)

both are of thermal coal which are Indian Company's which are in operations and One more mine is Yayu Coal field is operated by Chinese firm in been closed due to Eco Damages and main reason is that it go effect its Coffee industry as the Yayu forest is well known for its coffee plantation which accounts approx. 26.4% of Ethiopia Exports .and it is the was a plan to Yayu power station which is of 90MW capacity(built by Chinese firm Shandong Runh Power Plant Engineering Technology with their Chinese personal) is also not Initiated due to the Delays Caused by various Descriptions like Funding Delays followed up with pandemic COVID 19 as of today status is on hold .

Ethiopia mostly relies on the hydro power and in terms of the Oil dependency as it is not having any refinery which makes them to import the refined Petroleum products from middle-Eastern countries approx. 58% of its refined Oil imports from Kuwait,21.1% from UAE,5.9% from China,5.865 from Saudi,1.7 from India …etc as of 2021.

Where its in house small quantities of us been moved/ sold to turkey & Netherlands as per the Data provided by OEC world.

Nuclear Energy: As per IAEA Data no Nuclear power plant was located in Ethiopia.

3.2 Sudan & South Sudan

Sudan is the nation which was boarder with Egypt on the north and Libya is on the north West and Chad on the west and Central African Republic, South Sudan, Ethiopia on south and Eretria on the East having a long coast on the red sea.

before 2011 the Sudan and South Sudan are one but from 2011 the South Sudan Declare independence from then the boarder of the Sudan is been changing that was the reason for just for our assessment, we are gone consider the Sudan and South Sudan as single bit but the differential will be there.

Oil

Sudan & South Sudan

Oil reserves: 5 billion barrels [3](In reality Present Sudan reserves: 1.5 billion barrels after Partition of South Sudan in 2012)

Oil production: 59,000 –66,900 bpd[4](as of 2021)

The oil production has dropped from 4,60,000 bpd (in 2010). 1,30,000 bpd in 2013 to 72,000 bpd in 2019 followed with 66,900 (in 2021)

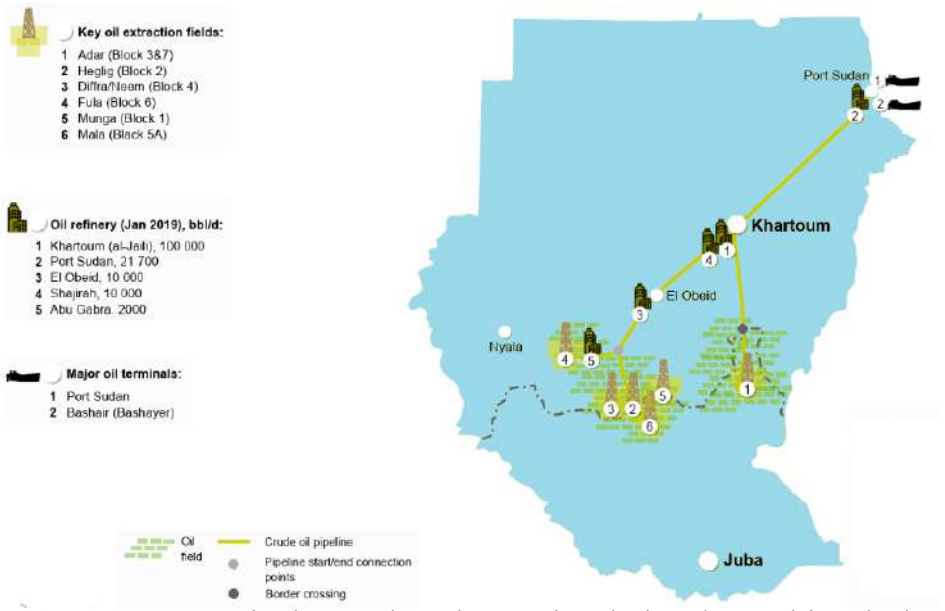
This kind of production has been decreased due to the partition of south Sudan as most of the Oil reserves are been gone to South Sudan territory which was dead low but more than the previous disruption in late 1992 where a civil war broke out which forces the US Private entity Chevron to suspend its Exploration and production and were kicked out of Sudan despite of that entity was the first one which invest in the oil E&P in late 1970's after the American nation Exit the Dragon entered the Sudan Oil market by investing a lot in Construction of infrastructure with a joint venture with different company's[5].

Sudan: Main Oil Companies in Sudan

Consortium/Subsidiary	Shareholders	Share (%)	Country of Origin
Greater Nile Petroleum Operating Company (GNPOC)	CNPC	40	China
	Petronas	30	Malaysia
	ONGC	25	India
	Sudapet	5	Sudan
Petro Energy E&P (PEOC)	CNPC	95	China
	Sudapet	5	Sudan
Petrodar Operating Company	CNPC	41	China
	Petronas	40	Malaysia
	Sudapet	8	Sudan
	SINOPEC	6	China
	Tri-Ocean Energy	5	Egypt
Petrolines for Crude Oil Ltd (PETCO)		100	Sudan

Source: U.S. Energy Information Administration, and company websites.

As of 2020 only CNPC was able to stay in this market rest are left due production constraints in that region and also consideration on conflicts from local revolutionary forces.



Block 1,2,4,5,7 are present in the South Sudan Region during the partition the both nations governments agreed on following agreement foe peace broader shearing

Oil Agreement B/W Sudan 7 South Sudan

There was an agreement between the Sudan and South Sudan nation having a Oil Deal b/w in order to have a peace parturition the south Sudan is gone pay Sudan gov $3.028 billion under the Temporary Financial Arrangement (TFA) over 3.5 years or 15usd/barrel produced in the south Sudan for the Oil and pipeline infrastructure in present and passing through South Sudan there are various charges laid to produce and export the oil from the oil fields[5].

Payment (South Sudan --> Sudan)	
Total payment	$3.028 Billion (3 years) or $15/barrel
Total pending payment	$574 Million (as of 2019)

Royality (South Sudan --> Sudan)	
Block 1,2,4 (production fee)	$11/barrel
Oil Processing fee	$1.6/barrel
Transport fee	$8.4/barrel
Transit fee(for block 1,2,4)	$1/barrel
Transit fee (for block 5 & 7)	$9/barrel

From past few years the tensions b/w the nations gov and the revolutionary forces resultant in the attraction of foreign investments in the both countries even China was decreasing its shareholding and making the Sudan dependent on the Imports of the Crude oil from other nations including 14,500bpd from South Sudan and the hydro

power which accounts for 60 % of the Sudan Energy mix is not able to meet the domestic demand which make the state owned Energy entity to use Crud for the power generation and also they have a deal with Ethiopia by supplying Gasoline to Ethiopia in return of supplying electricity from Ethiopia this might be a bit costly but due to the enough investment they are lagging behind to create their own infra to Handel their energy crisis.

Oil pipeline network

Greater Nile oil pipeline

Operator: China National Petroleum Corporation

Owner: Greater Nile Petroleum Operating Company (GNPOC)

(PipeChina (40%) (Chinese's Sate-owned Entity), Petronas (30%) (Malaysia sate-owned entity), Oil and Natural Gas Corporation Limited (ONGC, 25%) (Indian state-owned entity), Sudapet (5%) (Sudan state-owned Entity)

Capacity: 2,50,000 bpd (Sudan: 70,000bpd, South Sudan: 1,50,000 bpd)

Length: 1,600 km

Operational: since 1999

Oil source: Munga (Block 1); Heglig (Block 2); Adar (Block 3&7); Diffra/Neem (Block 4); Mala (Black 5A); Fula (Block 6)

Among these Block 1,2,4,5,7 are under South Sudan and Only 3,6 blocks are under the Sudan which is why they is a shortage of fuel production in Sudan region despite of getting royalty from the oil Agreement with South Sudan.

India's ONGC, Malaysian petronas and pipechina will exit the ownership as per the agreement to the Sudan State owned Sudapet from 2016.

The above Termination deal is a good thing for Indian ONGC it been a hard time for the ONGC to obtain the profits from 2012 – 2016 due to war and separation of the Sudan and South Sudan which halt the production followed up with the deep plunge in international oil prices make this production in Sudan un economical.

Despite of low production in Sudan but the south Sudan was very productive than their brother Sudan as these production is handled by the foreign nation interest and investments most by Dar Petroleum Operating Co (owned by state-owned Chinese's entity CNPC (41%), Malaysian Petroliam Nasional Bhd (Petronas)(40%) and rest for SINOPEC o (Chinese state-owned subsidiary) and Tri-Ocean Energy. (Egyptian Entity),Nilepet (South state-owned entity)

It seems like ONGC has Exited the Sudan region by selling its shares but most of the oil produced in South Sudan & Sudan reaching India major, Malaysia, Italy (as of 2021)

Oil Refinery

1 Khartoum(al-Jaili),100 000 (suspended due to war 50/50 CNPC (China & Sudan gov)

2 Port Sudan, 21 700 (out of service due to high cost of modification built by China)

3 El Obeid, 10 000 (Active)[5]

4 Shajirah, 10 000 (suspended) [5]

5 Abu Gabra. 2000 (Suspended) [5]

Among these Khartoum (al-jaili) is out of operation due to attacks on the refinery[5].

But in the Khartoum refinery the CNPC decreases it share from 50% to 10% in 2019 that means the Chinese are aware of the conflict going to happen in Sudan in 2020.

Gas

Gas Reserves: 3 trillion Cubic feet (no idea of production) [3]

There are no gas Pipelines as these 2 nations are completely oil or hydro or solar or wind or bio fuel power most among the energy mix oil & hydro take up bigger bite.

Coal Deposits: Nill (as per CIA world fact book & world energy meter)

Nuclear Energy: Nill (as per IAEA)

3.3 Uganda

This was the country which was present in the heart of Africa which is landlocked nation with South Sudan on North, kenya on East, Tanzania & Rwanda on south and DRC (Democratic Republic of Congo) on the Western side.

Energy mix:

fossil fuels: 1.3%, solar: 1.6%, hydroelectricity: 86.4% as of 2020)

Oil

Oil Reserves: 2.5 billion barrels (Economical viable recovery)[6], ~ 6.5 Bb(total)

Oil production: Nill (will be started by 2025-2026) (0.2-0.25 Mbpd O/p)[7].

Oil Consumption: 40,900 bpd (as of 2019) [6]

Oil & Gas Discovery's are in the lake Albert Region (Albert Graben)

In order to recover the potential Oil & Gas Reserves in that region a joint ventured company Uganda National Oil Company was formed in 2012 (shareholders in that Company are[7]

1. Total Energy (56.67%) (French Private Oil giant),
2. China National Oil Offshore Company (28.33%) (Chinese state-owned Entity)
3. Uganda government (15%)

This was the company used to recover the conventional Oil & gas reserves and transport to nearest port in Tanzania/Kenya and sold in the international market by 2025.

Oil Fields

Most of the oil & Gas fields are in Albert Lake region under Lake Albert Development Oil Project the fields under constructions are

1. Tilenga Oil Field

Operator: Total Energy

Owner ship: (Total Energy (56.67%) (French Private Oil giant), China National Oil Offshore Company (28.33%) (Chinese state-owned Entity), Uganda government (15%)

Hear the Total Energy obtain a higher stake after it has acquired Tullow's Oil plc (Ireland Entity) assets in Uganda in November 2020 this is the best example of vertical integration the stake was 66.66 % if the Uganda Government is not opting 15%.

Location of the oil & Gas Fields

Oil reserves: 1.86 billion barrels of oil

Estimated year of completion: 2026

2. Kingfisher South Oil Field

   This was the oil Field Present in the southern part of the lake Albert south of Tilenga oil field

   Operator: CNOOC (Chinese's nation oil offshore Company)

   Oil reserves: 0.24 billion Barrels (or 240 million barrels)

Both these field having a potential of Gas reserves 14.1584 BCBM (billion cubic meters) or (500 billion cubic feet)

The produced content is move to Kasenyi a treatment plant to separate oil, gas & water from the Production material. And then it will be moved to Tanzanian port (tanga via oil pipeline) as stated by total Energies[8]

It seems like 60 % of crude earning are gone be moving towards the Captial cost of the project and then remaining 40% is been shared among the partners (Among total, CNOOC, Uganda gov, hear foreign nations pay taxes and Royality which is a kind of the earnings to the Uganda Government.

Oil pipelines

There are 2 oil pipelines proposed from Albert basin one towards Kenya, another towards Tanzania.

1. East African Crude Oil Pipeline (EACOP)

It is also known as Uganda–Tanzania Crude Oil Pipeline or also Hoima–Tanga Port Oil Pipeline which is connecting the Hoima in Uganda and Tanga port in Tanzania.

Operator: TotalEnergies SE (French Private Entity) and CNOOC Ltd (Chinese State-owned)

Owner ship: TotalEnergies SE (French private firm) (62%), Uganda National Oil Corporation (UNOC) (Uganda state-owned entity) (15%), and Tanzania Petroleum Development Corporation (TPDC) (Tanzania state-owned Entity) (15%); CNOOC Limited (Chinese's state-owned entity) (8%)

Length: 1444Km

Capacity: 2,46,000 bpd

Cost: approx. 5Billion USD (3 billion Equity Debt & 2 Billion Share Holders Input)

Estimated construction: 2023; operational: 2025

This was the Pipeline alternative for LAPSSET (Kenya pipeline) major stake was of total energies as it has acquired all the stake of Turmoil Plc a Ireland UK listed firm after it declared force majeure due to the Disruption caused by COVID 19 this created a chance for total to proceed with vertical acquisition, there are many strikes and protests due to ineffective Due diligence in the environmental risk assessment as the pipeline is

underground places for having minimum project cost which pop red flags of Oil & gases sill this was the scenario making insurance firms to skip this project[9].

2. Uganda–Kenya Crude Oil Pipeline (UKCOP) (cancelled project)

   This project which connects the Uganda Oil fields in Albert region to the lamu port in Kenya which planned to carry both Uganda oil and Kenya Oil (in Lokichar) and South Sudan oil, seems to be cancelled due to high cost and security issues the Uganda cancelled this proposal and the Uganda government started concentrated on the East African pipeline connecting Tanga port in Tanzania.

Gas

Gas reserves: 14.158 BCM or (500 billion cubic feet) as of 2021[6].

Gas Production: nil[6]

Gas Consumption: nil[6]

Gas Pipeline

Tanzania Uganda Pipeline was proposed from Dar es Salaam, Tanzania through Tanga port reaching south western part of Uganda announced in 2021 but till today there is no update seems to be on hold.

Coal

Coal Reserves: nil

The coal utilization also nil as there are no coal powered plants in the country as it is heavily dependent on the hydro power where all its hydro plants are situated near the rivers running into Lake Victoria (north east of Capital City).

Nuclear Energy: Nil (as per IAEA data)

3.4 Kenya

This was the nation which is bordered with Ethiopia on the north Somalia on the North East with Indian ocean on the east and Tanzania on the south and Uganda on west with a Nairobi as its capital located on its southern part of the country which was blessed with huge scope of Renewal Energy.

Energy Mix: Geothermal energy (36.2%), hydropower: (35.7%), WindEnergy: (10.3%),Fossil fuels(8%), Solar (6.1), Bio-Energy: (3.7%) as of 2021[10]

Hear Geothermal Energy is a kind producing the stream from the Earth's natural heat and running the generator or turbines and producing the Electricity. Most of the kenya's Energy is relies on this energy.

Oil

The oil deposits are mostly present in the north west region of Kenya in Turkana basin (LokiChar village area) extraction process is not

Oil Reserves: approx. 460-850 million barrels (2P) [11]

Oil Production target: 1,30,000bpd for Export

Oil Extraction units in Kenya

1. South Lokichar Phase 1 Oil and Gas Field (in development)

Operator & owner: Tullow

Oil reserves: 365 million barrels (2P) (as of 2023)

Year of Discovery : 2012 ;Year Of Completion : 2028(Delayed by 5 year Due to Covid and Joint stake breake)

Most of the oil Fields are under Development in lokichar Complex which was presently owned by Tullow (100% stake) is an Ireland nation private owned entity which was has headquarters in UK (as it is having Northern Ireland as its part which means it will be considered as UK based Entity) previously it was holding just 50% stake and rest 25% was owned by Total Energies and rest 25% by Africa oil Corp is a Canadian private Entity.

These 2 entities exited the Kenya market and entered in to other nations for filling their oil portfolio. Total left the project and completely concentrated on Uganda by buying the stake of Tullow in Uganda and became ethe decision maker as it is the highest stakeholder in Uganda followed by CNOOC, whereas Africa Oil crop entered into Namibia orange basin as there is a scope of oil this decision was taken by observing the Achievements of Shell and total Energies Discoveries in the orange basin of Namibia.

2. Turkana Oil Field (Discovery in Tukana basin at Ngamia-1 oil rig)

   This was the discovery just approx. 80 from the lokichar village where the production unit was under development.

Operator & owner: Tullow (UK(Irland) private Entity) (100%)

Oil reserves: 560 million barrels (2P)

Year of Discovery: 2017

By comparing the complete info and also referring the Economic Times Info regarding the oil reserves in Lokichar is around 585 million barrels as of today 01/03/2024 the ownership was 100% with the Tullow Oil but to minimize the risk and maintain a

liquidity the Tullow is willing to sell its 50% stake in the Oil field of Kenya ONGC subsidiary are Quite interested in these sources there are many negotiations are going on either IOCL or OIL will be taking up the Deal mean while Economic Times stated that the Chinese state-owned China Petroleum & Chemical Corporation (Sinopec) is also try to capture that take lets see which Entity is going to add 1,20,000 bpd to their portfolio[12].

Oil infrastructure:

2 pipelines proposed

1. Lamu Port-South Sudan (LAPSSET Corridor.) Pipeline

   The oil pipeline that is connecting juba capital City of South Sudan (South Sudan oil) to lokichar Village in Kenya in Turkana Region.

Operator & owner: Tullow (UK based Ireland Private entity) (100% stake)

Capacity: 65,000 bpd (expandable to 80,000bpd)

Length: 824Km

Year of starting construction :2023

This pipeline is further connected to another pipeline called Lokichar to Lumu port

2. Lokichar–Lamu Oil Pipeline Segment

   Operator & owner: Lullow (UK Entity)

   Capacity: 1,60,000 bpd

   Year of Construction starting: 2023

Due to the material structure of Lokichar crude heating systems is used in order to maintain it viscosity and to easy movements via pipeline which is cost added ones to this project it seems like this project is mainly dependent on the foreign investments as many news articles are stating that this project cost is ¼ th of the present Kenya's GDP.

Total Energies sent a request to use the East African Crude pipeline to secure a cost-effective way of exporting their Crude by Kenyan government was sticked with their own plan.

Ther was another pipeline called Uganda–Kenya Crude Oil Pipeline (UKCOP) which is meant to carry Uganda Alber Basin Crude and lokichar area Crude to the lame port to trade in the international Markets but Uganda dropped this plan and have an agreement with Tanzania for Oil pipeline deal in exchange with having a gas pipeline deal (but he gasses pipeline Deal seems to be cancelled)

Gas

There are Significant natural gas Deposits in the Country that was the reason why it was having talks with the neighbour nation Tanzania (which was rich in gas deposits) for providing gas via pipeline proposed

Tanzania–Kenya Gas Pipeline:

This was the gas pipeline run from Dar es Salaam of Tanzania – Mombasa Kenya.

Owner & operator: Tanzanian & Kenyan Gov (yet to decide who runs which section)

Proposed: 2021

Cost: $1.1 billion

Coal

Coal Reserves: nil (but have a scope from Kitui County's Mui Basin's)

Coal Import Terminals:

The terminal was present in Lamu port which will be constructed by the Chinese firm China Communications Construction Company a state-owned entity

Operator & owner: Kenya Ports Authority (seems on PPP)

Capacity (Tonnes): approx. 23.9 million tonnes by 2030

Cost: $5.5 billion

The source of coal is from south Africa followed with inhouse production from Kitui &Mui basin) this plant is meant to be feeling the Coal powerplant which is also been Constructed by the Chinese Firm but the plan was seems to be kicked off by the Court of Kenya's due to its impacts on the local Community environmental concern[13].

But he lamu port Construction was still going on plan to construct 3 berths at initial stage and reached to 28 berths in future based on the demand and needs and the project is been funded by Chinese banking entities and bit Debt from African bank. There are no operating coal plants in Kenya as per GEM.

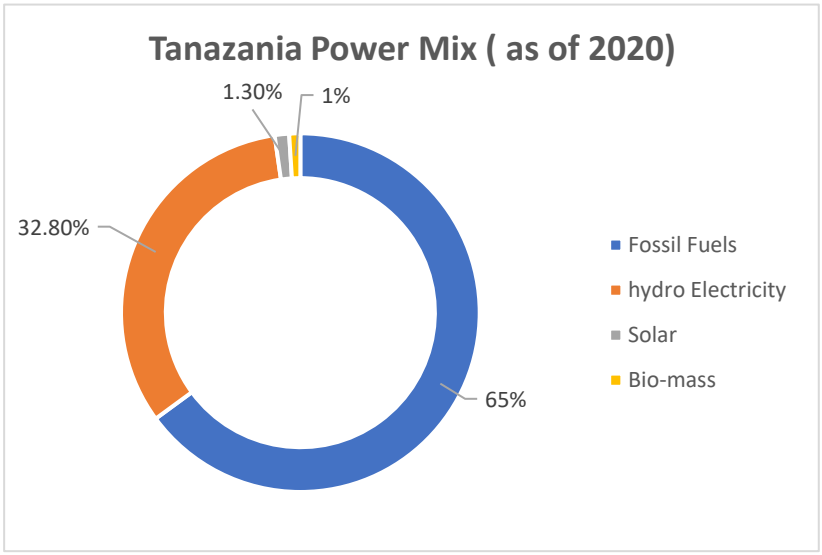
Nuclear power: nil (as per IAEA Data)

By viewing all the Kenyan economy is so much dependent of the foreign investment for their Energy sector needs (entities from China & UK are been highly involved here) which will be Economical risk Kenya need to start minimizing dependency a bit.

3.5 Tanzania

This was the country which was on the Indian ocean Coast on its East , Kenya on its north , Uganda & Rwanda and DRC(Democratic Republic of Congo)on its west, Zambia ,Malavi, Mozambique on its south.

Energy mix:



By observing the mix, the Tanzanian economy is more dependent on its fossil fuels power generation (either from Coal as it has good amount of proven coal reserves at around 269 million metric tons) next followed by the hydro power with 3 operational power plants (Kihansi hydroelectric plant(180Mw), Kidatu hydroelectric plant(200Mw), Mtera hydroelectric plant(80Mw) with a total operational capacity of 460Mw which accounts around 32.80 % in 2020.

Oil

Oil reserves: nil (but equivalent gas reserves are present) [14].

Oil Production: nil

Oil Consumptions: 52,800 bpd (as of 2019) [14].

Gas

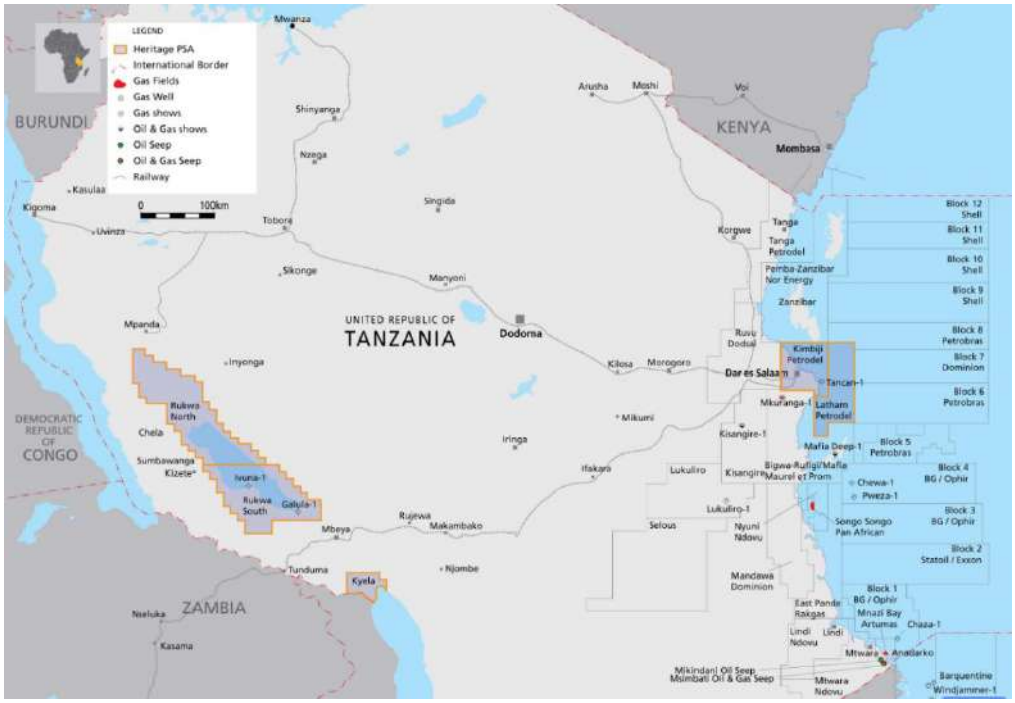
The Tanzania is having a quite good amount of Natural gas reserves and also a gas exporting nation among the African nations.

Gas Reserves: 2.63 trillion Cubic Meters (2P)

Gas Production: 1.378 billion cubic meters/ year

Gas Consumption: 1.378 BCM (means the produced gas is used in house purpose)

Gas block under Licences for E&P:



Gas Fields discovered & Operational

	Unit name	Quantity (2P) (trillion Cubic Meters)	Operator or owner	Country holding majority Stake	2nd Major stake	3rd major stake	Over All portfolio (In TrillionCubicMeters)
On-Shore	Mkuranga	0.0056	Maurel & Prom	Indonasia (g) (60%)	Tanzanian(g)(40%)	-	
	Ntorya	0.0538	Ndovu Resources(Aminex PLC)	United kingdom(p)(100%)		-	
Off-Shore	Block 1 & 4	0.453	Shell	United kingdom(p)(60%)	Singapore(g)(20%)	Indonasia(p)(20%)	0.804
	Taachui	0.02					
	Mzia	0.133					
	Mkizi	0.0169					
	Pweza	0.0481					
	Jodari	0.133					
	Block 2	0.566	Equinor(along with Exxonmobil)	Norway(g)(65%)	USA(p)(35%)	-	1.62017
	Zafarani	0.6					
	Lavani	0.0849					
	Tangawizi	0.1415					
	Mronge	0.0707					
	Piri	0.0849					
	Giligiliani	0.03397					
	Mdalasini	0.0382					
	Mnazi Bay	**0.02**	Maurel & Prom	Indonasia (g) (80%)	Tanzanian(g)(20%)	-	0.1474
	Songo Songo	**0.1274**	PanAfrican Energy Tanzania Limited	United kingdom(p)(100%)	-	-	
		2.57157					

By Observing the above table, we come to know that Equinor (Norway gov entity) and Exxon Mobil (USA private Entity) are the major reserves holder of approx. 1.62 trillion Cubic Meters of gas reserves followed up with Shell (royal Dutch Shell) and Pavilion Energy (Singapore base Gov entity) and MedcoEnergi (Indonesian private Entity) hold the next big chunk of Gas reserves.

The Present operational gas productions is in the hands of Indonesia and UK owned Entities with reserves of 0.14 Trillion in hand Gas reserves ready and presently ongoing with production (most of this gas is seems to be used for Tanzanian In house).

These are the proven and predicted reserves in Tanzania only 2 of those fields are in operational which are the offshore fields of Tanzania.

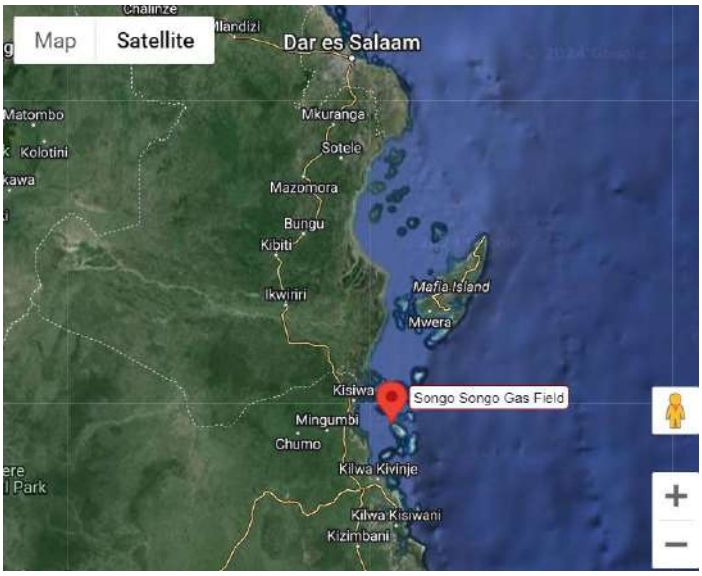
Detail View of the Extraction Fields

Operational Gas Fields: (all most all of the discoveries in Tanzania are of Gas Fields)

There are 2 operational gas fields as of Today (05-03-2024) in Tanzania

1. Songo Songo Gas Field (deep water field)

   This was the off shore Gas field is located to the North of the Song Songo island in Matapatapa region, Tanzania



This gas field is located approx. 15 km from the coast and 200 km from Dar -es-Salaam

Operator & owner: Pan African Energy Tanzania Limited (subsidiary of Orca Exploration Group Inc) which is register entity in Canada major shareholder is a private UK entity Shaymar Ltd.

Discovered year: 1974

Production Start: 2004

Reserves: 5.326 billion Cubic Meters(2P)

Production: 0.631 billion cubic meters /annum (as of 2021) expanded capacity was proposed to 1.7BCM

This means this gas is been produced and profits are been enjoyed by the Canadian and its shareholder Uk entity. There is no stake for Tanzanian government in this project

2. Mnazi Bay Gas Field (On shore but on Coast gas Field & also have Shale Gas)

Operator: Maurel & Prom

Owner: Maurel & Prom (48.06%), Wentworth Resources plc (31.94%) (both are subsidiary of PT Pertamina Internasional Eksplorasi dan Produksi (PIEP) is a Indonesian Private Entity), Tanzania Petroleum Development Corporation (20.0%) Tanzanian state owned.

Discovered: 1982

Production started: 2015

Gas reserves: 9.758 BCM (as of 2021)

Production Rate: 0.843 BCM/year

This field is also seeming to be having shale Deposits around 11.98 BCM(2P) extracted using Fracking technique.

That means in this project the Indonesian Entity was the governing one due to its huge stake in this project and going to obtain an extra benefit due to shale gas also in that region which was under licensed from Tanzanian government.

Total production: 1.47BCM[14]

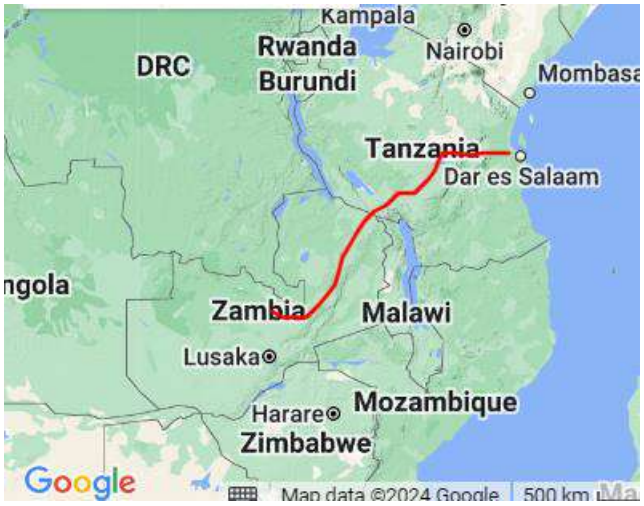
Oil infra

Oil Pipelines (1 Operational oil pipeline,1 Proposed)

1. Tanzanian oil Pipeline (Operational)
2. East African Crude Oil Pipeline (proposed)

The pipeline is mean to supply oil from Dar-es-Salaam port of Tanzanian to Ndola Zambia.

Initially oil from tanker is been unloaded at SBM (Single point mooring) at Kurasini Oil Jetty of Dar-es-salaam port in Tanzania which provides the Crude to Tanzanian & Italian Petroleum Refining Company (TIPER) refinery for storage of the oil (as the refinery is out of service) located in Dar-es-Salaam port it reaches to Indeni refinery in Ndola Zambia(which was a joint venture refinery b/w Zambian Gov & Eni Italian oil giant which further sold to Total SA in 2009 & later the Total energies French entity sold that refinery completely to Zambian Government)



Operator & Owner: Government of Zambia (66.7%) & Government of Tanzania (33.3%)

Capacity: 22,000 bpd

Length: 1710Km (798 (12 in Diameter in Tanzania) +954 (8 inches in Zambia)

Due to its longer transit a huge investment is from Zambia side which make them to obtain a bit more stake in this pipeline.

Commissioned: 1968 (financed by Eni state-owned but privatised, Italian Entity)

Next East African Crude Oil Pipeline is a Oil pipeline meant to transport the Uganda Oil from its albert complex to international market the key funder of this pipeline is Exxon Mobil (USA private entity)

Gas Infrastructure

Total (2 Operational gas pipelines & 2 Proposed)

Operational gas Pipelines

1. Songas Pipeline

This Gas pipeline is starting from Songo Songo Gas Field which was owed by UK entity sending the produced gas to the Power plants in Dar-er-salaam Ubungo power plant(110MW)[15] and TANESCO's generation plants (Kinyerezi II power station(240Mw) which is a thermal power plant which further converted into Gas powered plant.

Operator: songas ltd (Government of tanzania via TANESCO, TPDC, and TDFL (40%) and Globeleq(British International Investment (BII): 70%,Norfund: 30%) owns 54% of the shares and operates the plant.

That means this songo songo gas field major stake under UK and songo pipeline major stake is UK and the power plant major stake is also of UK's.

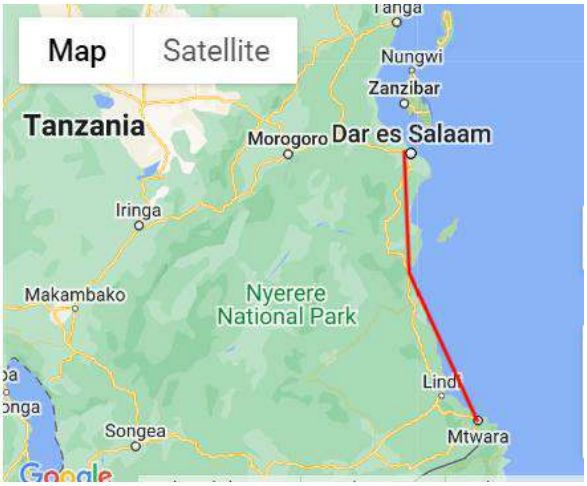
Capacity: 32Million Cubic Meters /day

Length: 225Km

Start year: 2004

2. Mtwara–Dar es Salaam Gas Pipeline

This pipeline was running from Mtwara in south east of Tanzania to Dar-es-salaam



Operator & owner: Gas Supply Company Limited (GASCO) (Tanzanian State-Owned Entity subsidiary of TPDC)

Capacity: 8.1 BCM/year

Length: 533Km

Stated: 2015

This project is Mostly Funded by Chinese Firm Exim bank of China[16] as a loan $1.225B & The Tanzania Petroleum Development Corporation invest $274.4 million [16] and been constructed by a Chinese firm China Petroleum and Technology Development Company (subsidiary of CNPC China State owned entity) with their own labour from China .

Despite of having present production at 1.4 BCM (<12% of its total utility) many citizens are considering it as a dead trap as the pipeline utility will be maximized only when reset of the pipelines are in force but till then the earnings from that asset seems to be less return (approx. 0.3% of its total earnings after excluding the Debt bills and Interests….) if any unforeseen occurred(like spike in interest rates from China) then the Tanzanian gov 0.3% profits won't be sufficient enough need to pay dept bills then the Tanzanian gov has to pay it from its pockets, if time passes the particular gov feels unable to pay which may lead to open this asset for the bid (hear China will be the first entity to grab it) or this assets will become long leasing like Hambantota port in srilanka.

Proposed gas Infrastructure:

2 gas Pipelines are been proposed

1. Tanzania–Kenya Gas Pipeline (Dar-es-salaam(Tanzania) – Mombasa(Kenya))
   Length : 600km,Costs : $1.1B
2. Tanzania Uganda Pipeline (this plan seems to dropped)

LNG proposed Infra

1. Tanzania LNG Terminal (project is proposed in Lindi)
   Operated & owned: Equinor & shell (along with Co E&P entities)
   It seems like this terminal is going to be meeting the international gas hunger in future.

Coal

Coal reserves: 269 million metric tons (as of 2019)[14].

Coal production: 0.75 million tons /annum (Sub-bitumen)

This means these reserves can last for next 360 years due to its boom in natural gas it completely concentrates on the gas production after emptying the gas wells there is a chance of come back to fossil fuels (like Syngas)

Coal Mines: 1(operational mines)

1. Ngaka Coal Mine

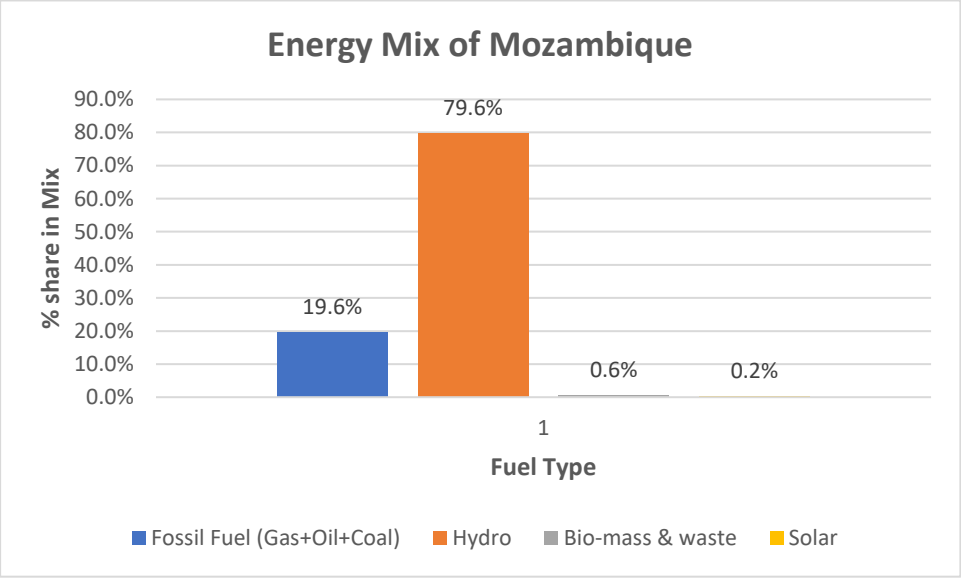
Operated by: Tancoal Energy (It is joint venture of Intra Energy Corporation (Australian Entity), National Development Corporation of Tanzania (NDC)Tanzanian state-owned entity. Which power the Nagaka Coal power station

Nuclear Power: nil (as per IAEA Data)

3.6 Mozambique

This was the nation which present in South east part of African continent bordered with Tanzanian on its north, Malavi in its north east, Zambia and Zimbabwe on its east and Estonia and south African on its south and having a coastal line of approx. 2300 km access to Indian Ocean and a well know transit route call Mozambique channel (between Madagascar and Mozambique) which is the Gas boule foe the east African nations as it was sitting on huge natural gas reserves.

Energy mix[17]:



Oil

Oil reserves: seems to be nil (not notable) as per EIA Data (but has condensate oils)

There are around 5 Oil & gas wells (2 in the North Mozambique & 3 in the Southern part of Mozambique)

Oil reserves as follows:

Oil & Gas in North: (2 Operational in north)

1. Mamba North Oil and Gas Field

   This Oil & gas field also present in the mamba Complex along with the mamba south oil & gas Field with a proven oil & gas reserve.

   Operator : Eni SPA (Italian company)

Reserves: Oil: 17 million bbl , Gas: 209.627 BCM

Ownership: Eni S.P.A. (Italian Privatized State-owned oil giant) (25.0%); ExxonMobil (USA private Entity) (25.0%); Empresa Nacional de Hidrocarbonetos de Mozambique (Mozambique state owned Entity) (20.0%); another stakeholder (seems to depressed) (30.0%)

2. Mamba South Oil and Gas Field

This Oil & gas field is present in the mamba complex present almost to the borders with Tanzanian boarder.

Reserves: Oil: 51Million barrels, 624.465 billion Cubic meters

Operator& owner: Eni (Italy privatized state owned asset) same as that of mamba south Oil & gas fields even ownership also same.

Oil & Gas Fields in South (4 operational (on shore), 1 proposed (off shore)

1. Temane Oil and Gas Field

This Oil & gas field in present in the South East part of the Mozambique.

Operator: Sasol (South African Entity)

Owner: Sasol (South African entity with more Government stake in it) (70.0%); Companhia Mocambicana de Hidrocarbonetos (Mozambique Government) (25.0%); International Finance Corporation (member of world bank) (5.0%)

Year of Discovery: 1967 , Year of production: 2004

Reserves: Oil: 5.6mbbl, Gas: 25.484 BCM

2. Pande Oil and Gas Field

Operator: Sasol (owner ship is same as that of Teman Oil & Gas Field)

Discovered Year: 1961

Production year: 2009

Reserves:

Oil reserves: 1.8 million bbl

Gas Reserves: 31.148 billion cubic meters

3. Mamba North (In Mamba Complex in Noth bordered with Tanzania)

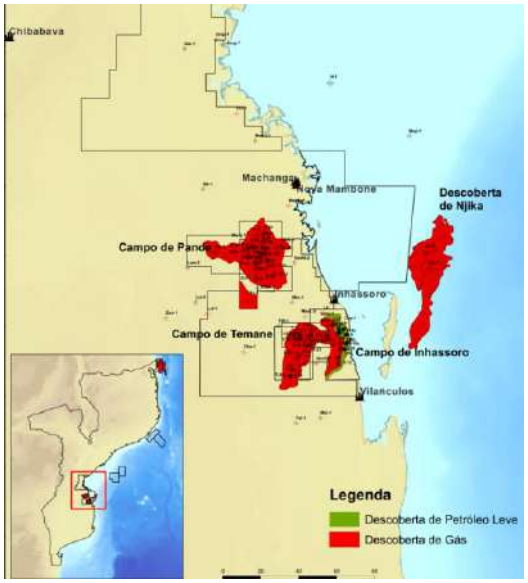
   This was the Oil & gas Field Located in the north eastern most part of the country a offshore Oil & gas Production area along to the one more Oil and gas Extraction point Mamba South as whole present in the Mamba Offshore complex.
4. Inhassoro Oil and Gas Field (Proposed Field)

Operator & owner: Sasol (along with the other Entity's same that of Pande Oil & gas Fields)

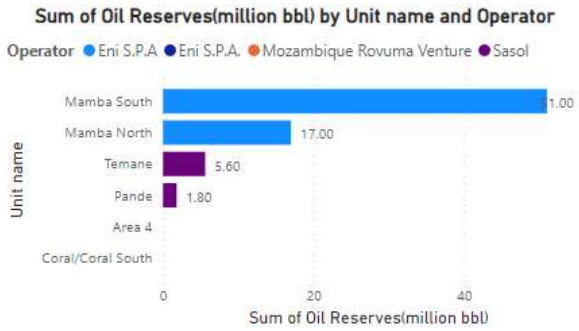
Reserves: Oil: 130 Mbbl (2P),

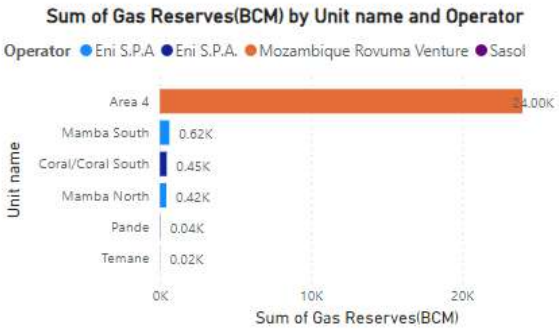
Gas: 13.753 billion Cubic Meters (2p)

Over all briefing of Oil Extraction units and their Capacity and Who are the Operator of these Fields.

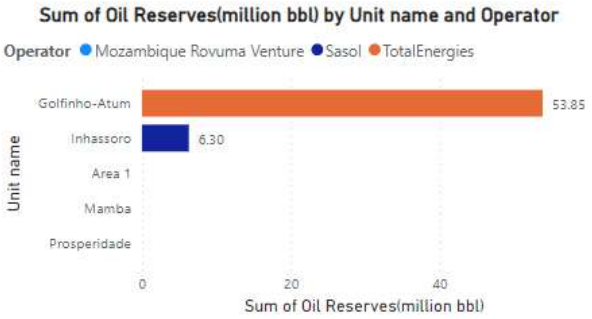


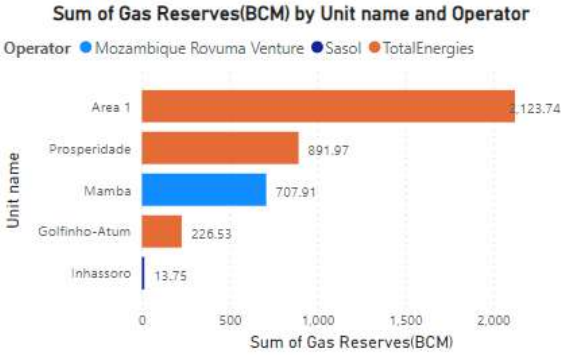
Operational Extraction Units





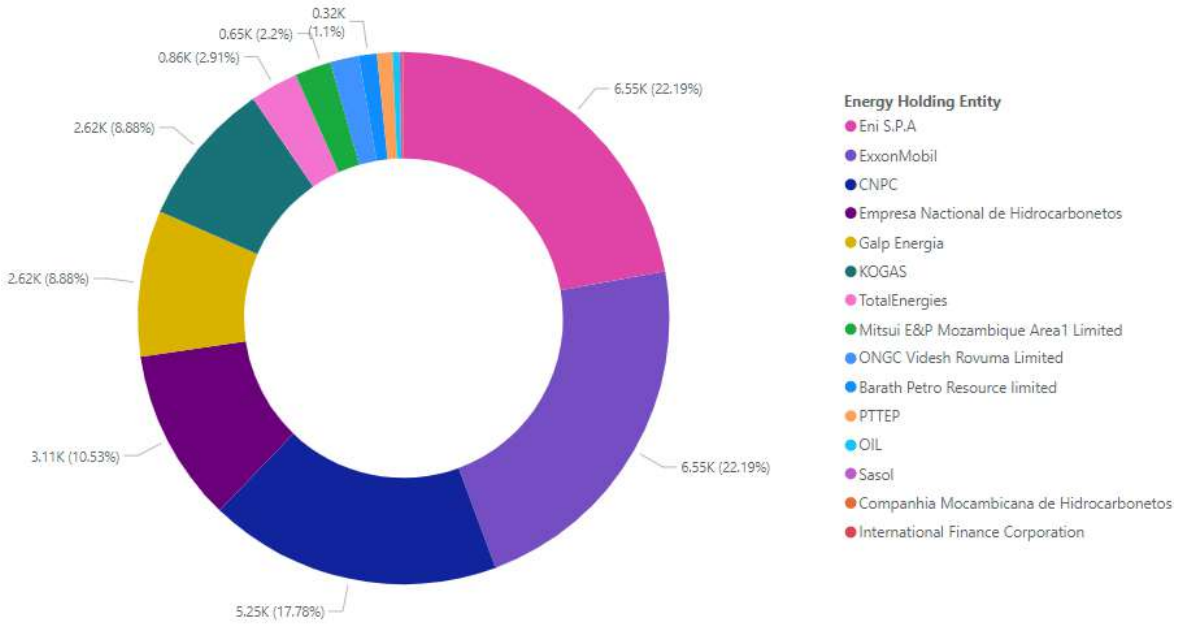
Discovered/In development Extraction units



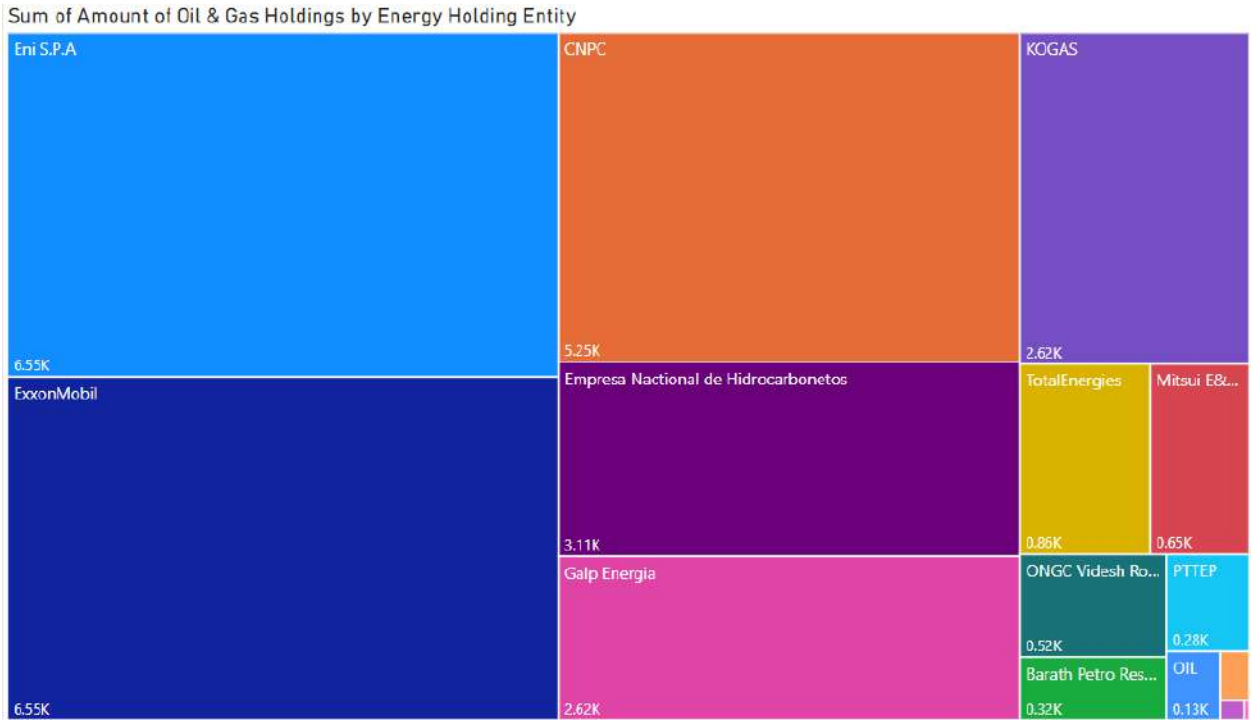


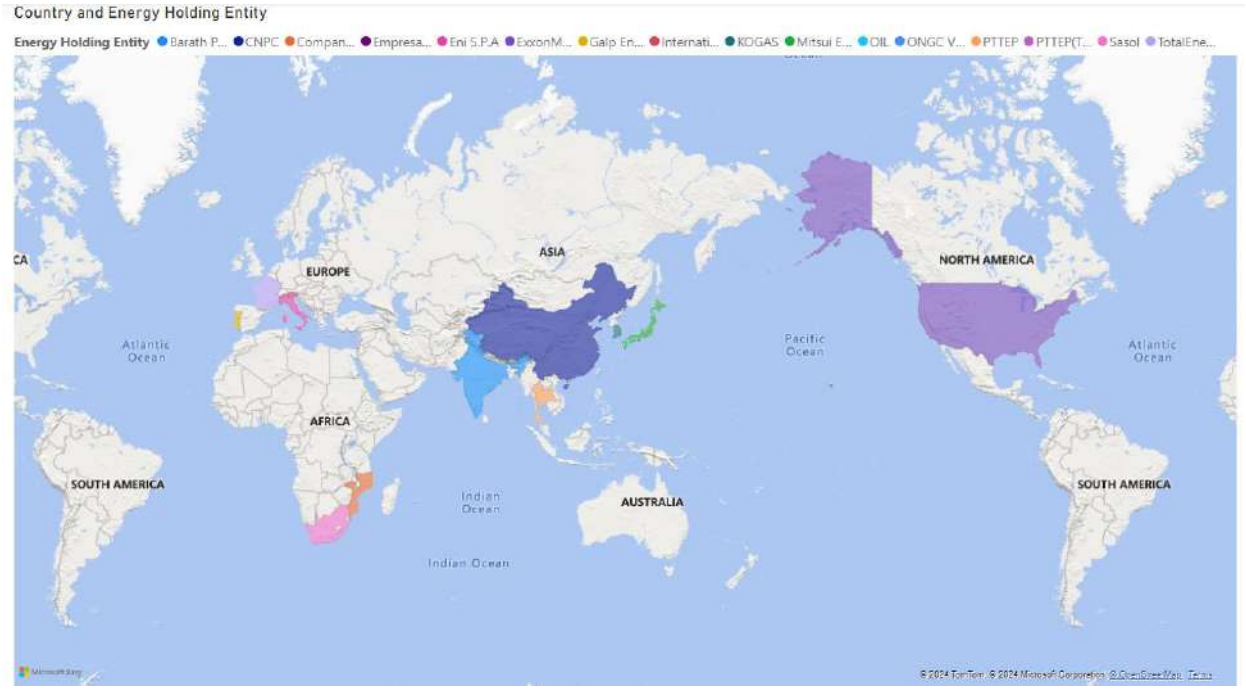
Source: GEM (Raw Data)

Oil reserve Holdings (in Million Barrels) (Light Oil=Low Density-higher API Gravity)



Mozambique Market share of the Gas Reserves holding





These are the Countries market who has the Stake in the Oil & Gas Units in the Mozambique Region .

Raw Data of the info:

Energy Holding Entity	Country Entity	Amount of Gas Holdings (BCM)
Eni S.P.A	Italy	6549.145
ExxonMobil	USA	6549.145
CNPC	China	5246.66
Empresa Nactional de Hidrocarbonetos	Mozambique	3107.05
Galp Energia	Portugal	2620.71
KOGAS	South korea	2620.71
TotalEnergies	India	859.19
Mitsui E&P Mozambique Area1 Limited	India	648.45
ONGC Videsh Rovuma Limited	Thailand	518.77
Barath Petro Resource limited	India	324.22
PTTEP	Thailand	275.6
OIL	India	129.69
Sasol	South Africa	47.2808
Companhia Mocambicana de Hidrocarbonetos	Mozambique	16.886
International Finance Corporation	Japan	3.3772

As per the Observation from the above ones it has given the views that Eni an Italian Entity and Exxon Mobil an USA private entity are the one who is huge gas reserves Holders in the Mozambique with almost 45% combined of both (22.18% each) in Ongoing or Upcoming Production reserves followed up with CNCP (Chinese State-owned Entity) with a overall share of 3rd largest gas holder in Mozambique with a 17% share of total Reserves Discovered or Reserves under Production. Followed up with Mozambique state owned Units followed galp Portugal entity…etc as specified in the Table above which was in Highest to lowest order.

Coal

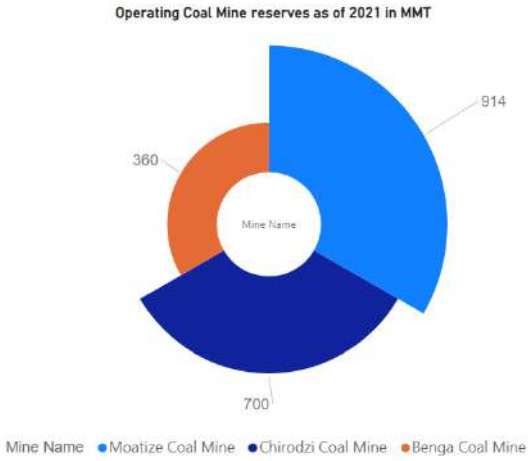
Coal Reserves: 1.792 billion Metric tons (as of 2020)[17]

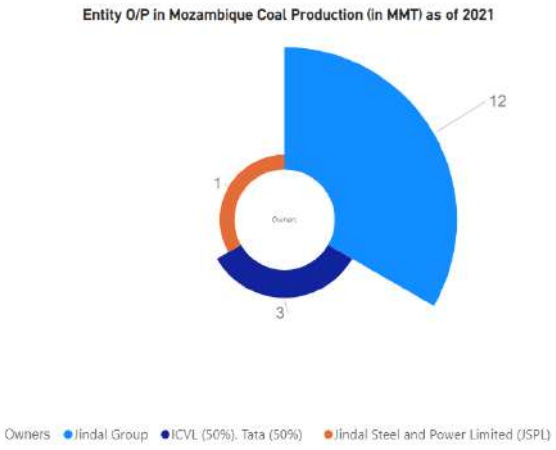
Coal Production: 16.18 MMT/annum

Coal Consumption: 46,000 MT

Coal Export: 9.17 MMT (predominantly to India)

Operational Coal Mines Analysis:





Most of the present proven reserves are present in the Moatize Coal Mine which is owned and operated by Jindal Steel (JSW)which a Indian Private Entity which is having Bituminous Coal (In other words it's a Coking Grade) which is having hight calorific value most used in Steel manufacturing industry's and also in Thermal power plants. And followed up with Chirodzi Coal Mine (bituminous Grade) which is also owned & operated by ICVL & Tata both are Indian Entity's (a joint venture which also includes Steal Authority of india also) next operational Coal mine benga is also operated by Jindal with a o/p of 1MMT as on 2021 which was decreased from 2.4 MMT/annum (in 2020) it seems the present operational Coal reserves are more in hands of Jindal Steel Entity with approx. 13 MMT/annum in hand (12 MMT of Coking & 1 MMT of Thermal Coal)

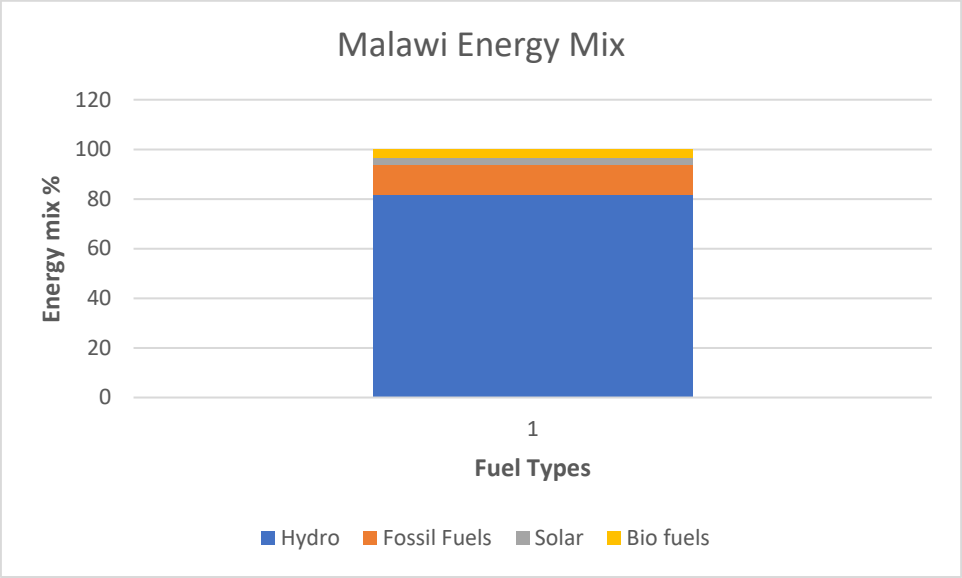
Mine Name	Reserves (MMT)	Production (MMT)	Grade of Coal	Entities involved
Ncondezi Coal Mine	120	1.2	Sub-bituminous	Ncondezi Energy Limited (Mozambique)
Revuboe Coal Mine	1580	7	bituminous	Talbot Group (59%), Nippon Steel & Sumitomo Metal (33%), POSCO (8%) (USA Eneitys)
Zambezi Coal Mine	1700	12	bituminous	Steel Authority of India (SAIL) (49.59%), Rashtriya Ispat Nigam (RINL) (24.8%), NMDC (24.8%), NTPC (0.54%), Coal India (0.27%) (Indian Entities)

It seems Coking (Meta) Coal Production gone Increase in future based on above proposals.

Nuclear Energy: Nill (as per IEA data)

3.7 Malawi

This nation is the one among the African nations which are landlocked broader with 3 nations on the North East Tanzania with 512 Km Bordered line ,Mozambique is on East with a Boarder line of 1498Km and last Zambia is on the west with a capital city Lilongwe which was near to the Mozambique border.



Most it the Malawi's energy mix is from Hydro power and it is having a good water reserves (Fresh water lake "lake Malawi" and salt water lake chilwa ..etc which are helping the Malawi to produce their own Energy instead of depending on the neighbour nations completely most of its hydro projects are been present in the Southern part of the country .

Oil

Oil Reserves: nil

Oil Production: nil

Oil Consumption: approx. 10,000bpd

Refinery: nil (Imports Refined Products)

Oil pipelines: nil (having a Tazama Oil Pipeline passing near to its boarders starting from Dar-es-Salaam to Ndola (Zambia).

Gas

Gas Reserves: nil

Gas production: nil

Gas Consumption: nil (excluding the LPG)

Gas pipeline & Gas fired Plants: nil

Coal

Coal Reserves: 5.5 MMT

Coal Production: 0.34 MMT/annum

Coal consumption: 54,000 tons/annum (as of 2022)[18]

Active Coal mines: only 2

Unit name	Owner	Entity origins	Reserves ProductionO/P (MMT)	Coal Grade
Kasikizi Coal Mine Ltd	Zagaf Cement Sales (35%) Cement Products Limited Minning limited of India Edno Constructions	Malawi Indian	0.24/4	Sub-bituminous
Mchenga Coal Mines	Coal Products Limited	Indian	0.3/1.5(P) or 25 (2P)	Bituminous

By the above Data sourced from Gem shows that Indian Entity are highly involved in the Coal production in Malawi with mainly 2 good Coal grades one is of Thermal Coal (Sub-bituminous) & Coking or meta-Coal (bituminous coal) which helps to fire the inhouse coal mines and also moved some of the Meta Coal to India. And its also helps to minimize the coal imports from neighbour countries like Mozambique & Zambia which helps them to divert their forex spending to import other commodities[19]. Despite of having good coal reserves the Malawi is facing power shortages and the reach is also quite less to many parts of country

Nuclear Power: nil (as per IAEA data)

3.8 Zimbabwe

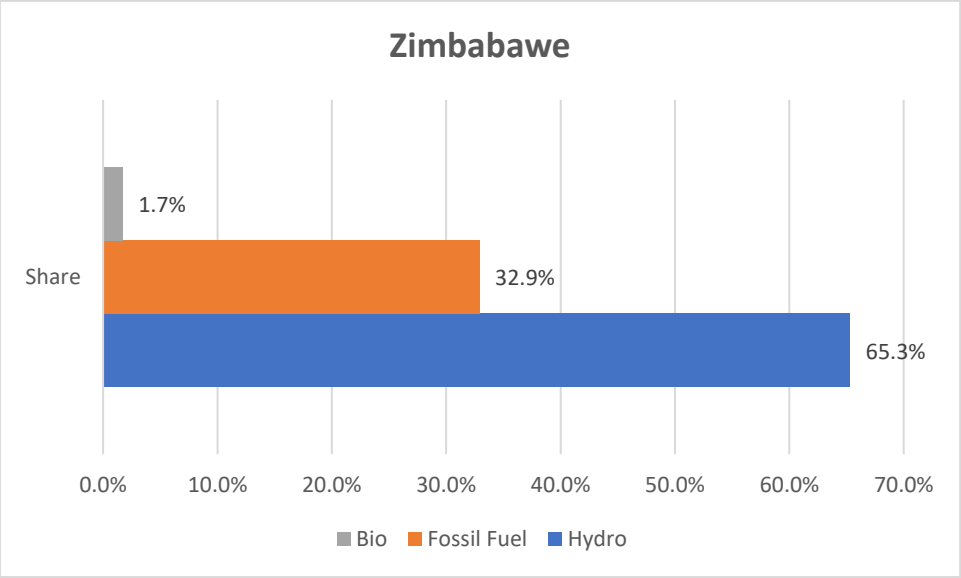
This is the nation which is located in the Southern part of African which is a landlock nation means no sea connectivity but having a good tie with the Easterners borders Countries which are having a coastal line for easy movements of Imports and Export to and from and to the Country.

Geographical overview:

It is bordered with Mozambique in the North and East, South Africa on South, Botswana, Namibia, Zambia in the West

Due to its landlock situation it completely relies on Neighbour nations (Mozambique & South African) for it trade with international markets.

Energy Mix:



Oil

Oil reserves: nil[20]

Oil production: nil[20]

Oil Consumptions: approx. 30,000bpd[20]

Oil refinery's: nil[20]

Gas

Gas reserves: nil[20]

Gas Production: nil[20]

Gas consumption: nil (excluding LPG) [20]

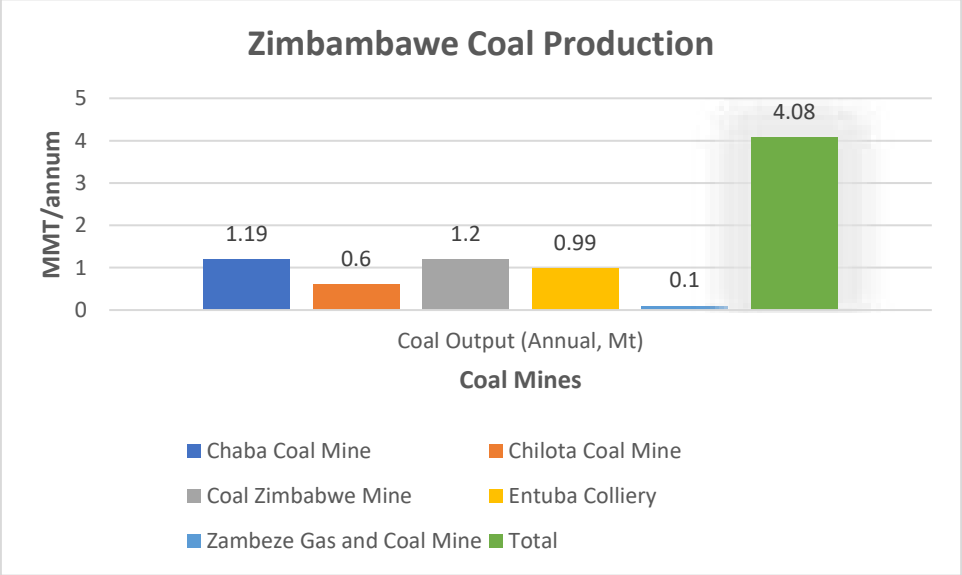
Gas Fired plants: nil (mass consumption) [20]

Coal

Coal reserves: 502 MMT[20]

Coal production: 4.08MMT/annum [GEM]

Coal consumptions: 3.579 MMT/annum[20]



As of 2023 the coal production is around 4.08 million Metric tons most of its production is meant for in house consumption most of the coal grade is Bituminous (thermal & Meta) but mostly this coal is used in the thermal plants and also a for steel manufacturing. & there a 2 Units proposed Dinde Coal Project by Chinese Entity & Sengwa Coal Mine owned by RioZim (Indian Entity).

It good to see Zambian Company's are holding major share in the coal production in Zimbabwe followed up a Indian one and next Chinese Entity.

Nuclear Energy: Nil (as per IAEA)

3.9 South Africa (Southern African nation)

This was the nation which part of African continent boarder with Namibia of the Nort West, Botswana on the North, Zimbabwe, Mozambique, Eswatini in the North East and Lesotho in its heart of Country which is located west of Durban which was well known for its Coal reserves in top 10 of worlds list.

Energy Dependency:

Oil

Oil reserves: 15 million barrels of oil[21]

Oil Production: 1,08,300 barrels/day (include Both Conventional & non-conventional)

Oil imports: 3,97,700 barrels/day[21] (from Nigeria, Saudi Arabia, Ghana, Angola)

Oil consumption: 6,22,500 barrels/day[21]

Shale oil Reserves: 130 million barrels [21]

Oil Extraction Areas:

1. Shale Oil:
   Mostly Done in the southern part of South African region with a proven shale oil reserves of capacity 130 million barrels as of 2021.

2. Crude oil
   Mostly Extracted from Oribi and Oryx oil which is an offshore Oil Well which was approx. 150 km from Mossel Bay.
   Recent Extraction Areas: for both Oil & gas
   1. Luiperd Oil and Gas Field (under development)
   2. Brulpadda Oil and Gas Field (under Development)
   3. Paddavissie Fairway (Discovered)
      These are the present oil Extraction Places and units of the south African offshore Industry.

Location of the offshore Industries

Detail view of these Oil Extraction units under Paddavissie Fairway Oil and Gas Complex

1. Luiperd Oil & Gas

   It was the oil and gas field located at the Sothren most part of the country approx. 100 -150 km radius.

   Operator: Total Energies (French privte Entity)

   Ownership: TotalEnergies (45.0%); QatarEnergy (25.0%) (Qatar state owned Entity); CNR International (Canadian Natural Resources Limited) Canada Entity (20.0%); Main Street (10.0%)

   Oil Reserves: 112 million barrels (2p)

   Gas Reserves: 59.46 billion cubic meters (2p)

   Discovered year: 2019

   Estimated to start Production: 2026(target Production level of Oil: 5.47Mb/year, Gas :2.17billion Cubic meters per year.

2. Brulpadda Oil and Gas Field

   It was also an Oil and gas field near to the Luiperd Oil and Gas Field.

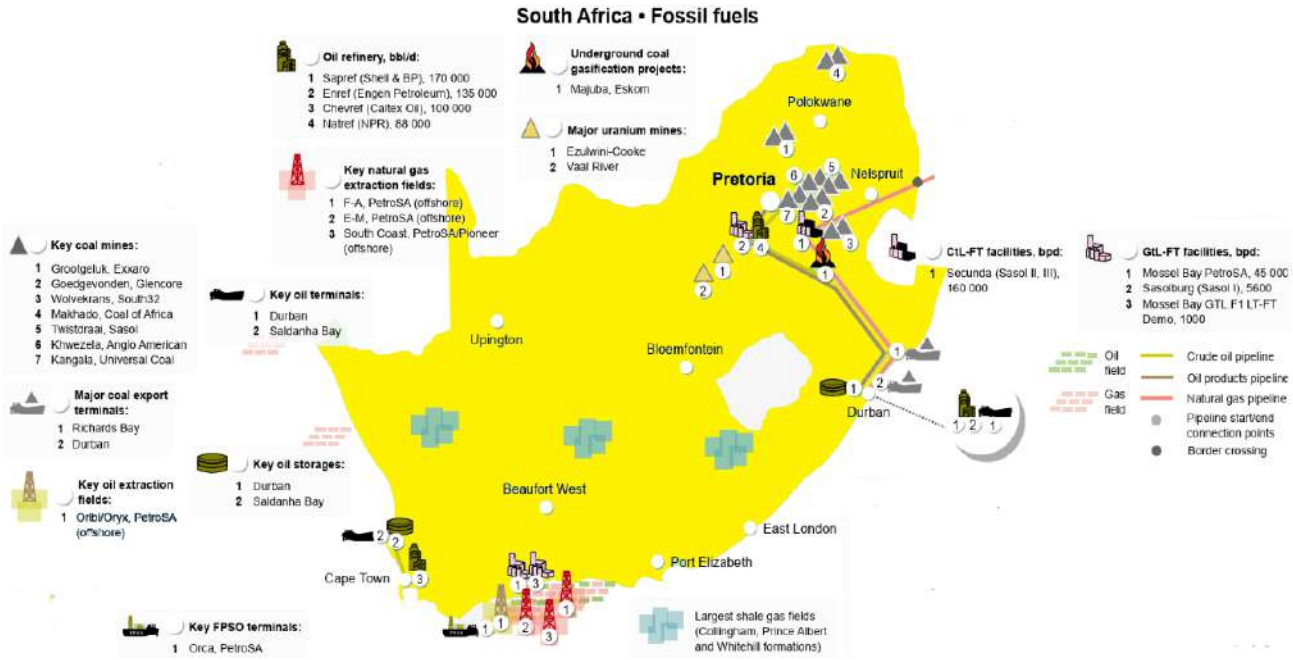
   Operated By: Total Energy (French Private Entity) an Energy giant.

   Owner Ship: same that of Luiperd Oil & gas Field (with same stake)

   Oil Reserves: 80 million barrels (2p)

   Gas Reserves: 36.8 BCM (2p)

Discovered: 2020; Production starts: 2027



Oil terminals

1. Saldanha Bay (north west of cape town) -- Chevref (Caltex Oil) refinery owned by Caltex a subsidiary of Chevron (USA private Entity)
2. Durban -- Sapref (Shell & BP), 170 000 (UK Owned Refinery) -- Enref (Engen Petroleum), 135 000 (Vitol (Dutch), Phembani group (South Africa) both are private.

And FPSO is also locate near Mossel bay connecting to shore to a GTL unit means gas to Liquid unit at

1. Mossel Bay PetroSA, 45 000bpd
2. Sasolburg (Sasol I), 5600bpd
3. Mossel Bay GTL.F1 LT-FT Demo, 1000bpd

These Gas to liquid stations collects the offshore gas and Liquify it mostly bound to Exports as the south African economy is seems to be highly dependent on the Coal reserves for its power generation.

Oil pipelines

1. Durban–Sasolburg Oil Pipeline

   This was the crude pipeline running from Durban to free state for NATREF refinery at Sasolburg, near the capital Pretoria.

Operated by: Transnet SOC. (South African state-owned Entity) this entity also operated all freight movements (via ports, rail, roads) in South Africa.

Length: 580km

Capacity: 1,25,000bpd (operational since 1971 & 7.3 billion Liters per year).

2. Astron refinery- Saldanha Bay crude pipeline

   This was the pipeline connecting SFF oil storage in Saldanha bay Oil terminal providing the crude to the Astron refinery in Milnerton of cape town which was a subsidiary of Chevron.

Oil refinery's: Total 4 Oil refinery's

1. Astron refinery (Caltex Oil) 1,00,000 bpd

(this refinery was out of operation due to a explosion in 2021 but it was restarted in[23] which was owned by Chevron USA private Entity)

2. Engen Petroleum refinery (1,35,000 bpd), owned by Petronas (a Malaysian Entity)

(there is news that this old refinery is going to be converted into crude storage Space)

Located Near to Durban Port.

3. Sapref Refinery (a joint venture of Royal Dutch Shell and BP of UK) (1,70,00bpd)
   Located in and around Durban.
4. Natref Refinery (a joint venture between Sasol (South African state-owned) and Total South Africa (French private entity subsidiary))
   Located in Sasolburg near to Johannesburg (it's in the heart of South Africa)

By Observes all the Refinery capacity and its ownership the South African refinery capacity was in hands of the Foreign entity's like Bp and shell of UK , Chevron of USA ,Total Energies of French Entity a little piece of pie for the south African government that means due to the on going red sea crisis huge chunk of volume and ships are moving via cape of good hope means via south Africa in which the most of the bunker activities are been increased in that area and gulf of Guinee region (at Nigeria) in that scenario these big Oil giant are earing a huge amount of profit out of the Red sea disruption and also gaining profits from Panama Daily transit restrictions also helping these oil giants earning the profits as the Bunker Demand increases in that region.

Gas

Gas reserves:

1. Natural gas: Offshore: - (Total 96.44 billion cubic meters)
   a. Luiperd Oil & Gas (59.64BCM) (2p): Discovered 2019
   b. Brulpadda Oil and Gas Field (36.8 BCM) (2p): Discovered 2020
2. Shale gas: Onshore:-(approx. 390 trillion Cubic feet)
   Due to the infra and technical lag this shale gas is not Effectively produced which make south Africa rely on it neighbour Mozambique for gas.it will be changing when the offshore Fields come to operation by 2028.

   There are few Gas to Liquid convention facility are been present in the country along to liquid to gas Conversion facility are also been present to handle the both the gas form of natural gas and also the liquid form of the gas the main reason for the Gas to liquid Facility is to move the large volume of Gas from one point to another end by converting the gas into liquid under pressure or decreasing the Temperature of it.

Gas pipelines

1. Mozambique-South Africa Gas Pipeline (Operational since 2004)

   This pipeline is also known as Rompco Mozambique to Secunda Pipeline which is running from Pande and Temane gas fields in (Vilankulos), Mozambique to Secunda (Sasol Gas to Liquid Facility), South Africa.

Operated by: Republic of Mozambique Pipeline Company (ROMPCO)

Owners: Sasol Gas Holdings (South African state-owned Entity) (50%), South African Gas Development Limited Company (iGas, 25%) (South African state-owned Entity); Companhia Mocambiçana de Gasoduto (CMG, 25%) (South African state-owned Entity) which is a member of Republic of Mozambique Pipeline Investments Company (ROMPCO) joint venture) the reason for 50% ownership to Sasol is that this pipeline end destination is Sasol's GTL facility in Secunda till 2020 this pipeline was completely owned by Sasol to counter its Debt 50% stake is sold out .

Capacity: 540.3 million Cubic feet (0.54 billion Cubic Feet)

Length: 865km

2. Secunda–Durban Lilly Gas Pipeline

   This pipeline run from Secunda—Durban (which was previously used for oil in 1970's movements from Durban—Richards Bay – Newcastle –Secunda) the previous oil movement was stopped due to underutilization of the asset then that

asset was convert and used for gas Movements in liquid form moving from Secunda (which was connected to Mozambique gas Pipeline to Durban by skipping the Newcastle and Richards Bay links.

Operator & owner: Transnet SA (south African State-owned Entity)

Capacity: 0.61 BCM/annum (billion cubic meters/annum)

Gas Movement operational: since 1995

Proposed gas infrastructure:

Proposed gas Pipelines:

1. African Renaissance Gas Pipeline

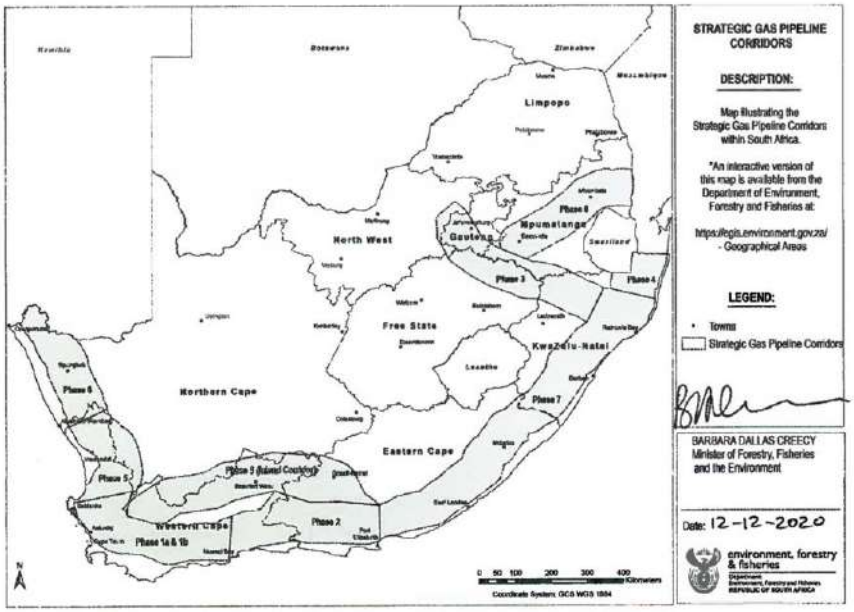
   This pipeline if from Rovuma Basin in northern Mozambique crossing border of south Africa and reaching Gauteng region in South Africa.

Operator: ENH (Empresa Nacional Hydrocarbons is Mozambique state own energy Explorer), Profin Consulting (Mozambique private Entity), China Petroleum Pipeline Bureau a subsidiary of CNPC (China National Petroleum Corporation is Chinese state-owned firm), Progas Investment Group (DCC Energy a German Entity Acquire it in 2023), From this Deal the Sacoil which was partially owned by South African gov considering the viability of the projects start delaying their place is been replace by profin Consulting in this project.

Lenth: 2,600 Km; Estimated Starting year: 2026

There is a clear view that this Project will be completed soon and will be in operational by 2026 as there are having Chinese heads in the investor.

Other Proposed Gas Pipelines



The South African government laid out the following Strategic Gas Pipeline Corridors in 9 phases:

Owned & operated by: Transnet

Phase 1a: Saldanha to Ankerlig

Phase 1b: Saldanha to Mossel Bay

Phase 2: Mossel Bay to Coega

Phase 3: Richards Bay to Gauteng

Phase 4: Mozambique (Southern Border) to Richards Bay

Phase 5: Abraham Villiers Bay (Northern Cape) to Saldanha

Phase 6: Abraham Villiers Bay (Northern Cape) to Oranjemund

Phase 7: Coega to Richards Bay

Phase 8: Rompco Pipeline Corridor

Phase 9: Inland Corridor from Saldanha to Coega

All these Pipelines are owned and operated by Transnet Pipelines (parent: Department of Public Enterprises) state owned Entity.

- Where Phase 1a is gone carry LNG from Saldanha bay LNG terminal to Ankerlig, Cape town.
- Similarly phase 1 b carry LNG from Saldanha bay LNG terminal to terminal at Mossel Bay.
- The Phase 2 of this network gas pipelines will be carried gas Mossel Bay terminal to the port of Coega (and supply to the new gas-fired Dedisa Power Station at Coega)
- The Phase 3 of this Africa's phase gas pipeline network (PGPN) is connecting from Richards Bay to Secunda where it was connected to Mozambique-South Africa gas pipeline and further move towards the free sate (Gauteng).
- Phase 4 connecting Maputo, Mozambique to Richards Bay.
- The phase 5 is connecting new gas discovery in the Abraham Villiers Bay to Saldanha bay gas line which is connecting to Mossel Bay—Coega
- The Phase 6 carry gas from Oranjemund, Namibia (from Kudu offshore gas field), and would connect with Phase 5 of the PGPN.
- Phase 7 run from Coega (Port Elizabeth)—Richards Bay similar phase8,9.

Gas Import terminals proposed

1. Richards Bay Transnet FSRU (Floating storage Regasification unit)

   In KwaZulu-Natal this FSRU will be placed in Richards Bay which will be used to import gas in liquid form and provided it to the inland Phase gas pipeline network where the Transnet will be carrying the gas a provide to the commercial hub Johannesburg or somewhere in land use using the PGPN pipelines.

   Operator: Vopak (Netherlands private Entity)

   Capacity: 0.14 BCF/day (or 1 million tons per annum)

   It seems like this project has been taken by Karpowership a Turkesh owned Entity which will be placing its FSGU produces the power while regasification and supply to the shore but it seems there is delay for this project due to the delays in the environmental concern.
2. Coega FSRU (capacity: 0.6Million tons per annum)
3. Saldanha Bay FSRU

(Karpowership , Turkey's Private Entity seems to be the operator of all the projects where a FSGU floating storage regasification unit was places in the 3 above locations where it gone generate a combine power of 1.2MW of power which will be sold to the Eskom (state owned Electricity Entity).

Coal

Coal Reserves: 9.893 billion metric Tons (as of 2019) [21].

Coal production: 248.3 million metric tons (as of 2020) [21]

Coal consumption: 170.308 million Tons (as of 2020) [21]

Coal Exports: 74.965 million Tons (in 2020) (thermal Coal) but 59-60millions Tons in 2021 as per S&P Global Commodities.

As per the S&P Global the Inhouse thermal power plants are seems to less efficient due to their maintained issue of power plants Eskom. Then export is the only hope for obtaining profits but the Transnet seem to be bit less efficient in the Rail movements which lead to minimizing the Coal Exports for the Richards Bay to it largest destination countries like India and Europe nations.

Coal Mines infra:

	Mine Name	Coal Output (Annual, Mt)	Mine Type	Coal Type	Coal Grade	Opening Year
1	Dama Coal Mine	26.9	Surface	Bituminous	Thermal & Met	1980
2	Delmas Colliery	18.5	Surface	Bituminous	Thermal	1983
3	Dorstfontein Complex	12	Surface	Bituminous	Thermal	TBD
4	Elandsfontein Colliery	11.3	Surface	Bituminous	Thermal	1982
5	Elandspruit Colliery	9.3	Underground	Bituminous	Thermal	1989
6	Exxaro Coal Central Complex	9.1	Underground & Surface	Bituminous	Thermal	1975
7	Fentonia Coal Mine	8.2	Underground	Bituminous	Thermal	1980
8	Forzando Complex	7.7	Underground & Surface	Bituminous	Thermal	2010
9	Goedehoop Coal Mine	7.4	Underground & Surface	Bituminous	Thermal	2012
10	Goedgevonden Coal Mine	7	Underground	Bituminous	-	2018
11	Greenside Coal Mine	6.5	Underground & Surface	Bituminous	Thermal	2019
12	Grootegeluk Coal Mine	6.4	Surface	Bituminous	Thermal	2004
13	Ikoti Coal Mine	6	Surface	Bituminous	Thermal	
14	Ilima Coal Mine	5.9	Underground	Bituminous	Thermal	1976
15	Impumelelo Coal Mine	5.7	Underground	Bituminous	-	1977
16	Impunzi Complex	5.5	Underground & Surface	Bituminous	Thermal	1984
17	Isibonelo Coal Mine	5.46	Underground & Surface	Bituminous	Thermal	
18	Iyanga Coal Mine Cluster	5.3	Underground	Bituminous	Thermal	2019
19	Kangala Coal Mine	5.2	Surface	Bituminous	Thermal	
20	Kangra Coal Mine	4.5	Surface	Bituminous	Thermal	2005
21	Khanye Coal Mine	4.4	Underground	Bituminous	-	1983
22	Khanyisa Colliery	4.3	Underground & Surface	Subbituminous	Thermal	
23	Khutala Coal Mine	4.2	Underground & Surface	Bituminous	Thermal	
24	Khwezela Coal Mine	4.1	Underground	Bituminous	-	
25	Kiepersol Colliery	3.65	Surface	Bituminous	Thermal & Met	1992
26	Kliprand Colliery	3.6	Surface	Subbituminous	Thermal	
27	Klipspruit Coal Mine	3.5	Surface	Bituminous	Thermal	2016
28	Kriel Coal Mine	3.1	Surface	Bituminous	Thermal	2009
29	Leeuwpan Coal Mine	3	Underground & Surface	Bituminous	Thermal	2015
30	Mafube Colliery	3	Surface	Subbituminous	Thermal	2015
31	Magdalena Colliery	3	Underground	Bituminous	Thermal	1982
32	Manungu Coal Mine	3	Underground & Surface	Subbituminous	Thermal	TBD
33	Matla Coal Mine	2.9	Underground & Surface	Subbituminous	Thermal	
34	Middelburg Complex (MBO)	2.8	Surface	Bituminous	Thermal	2018
35	Middelburg Mining Services (MMS)	2.8	Surface	Subbituminous	Thermal	2012
36	Moabsvelden Coal Mine	2.7	Surface	Subbituminous	Thermal	2020
37	Mooiplaats Coal Mine	2.7	Surface	Bituminous	Thermal	
38	New Clydesdale Colliery	2.4	Underground	Bituminous	Thermal	2009
39	New Denmark Coal Mine	2.4	Surface	Bituminous	Thermal	1986
40	New Largo Coal Mine	2.2	Surface	Bituminous	Thermal	2019
41	New Vaal Coal Mine	2	Underground	Bituminous	Thermal	1964
42	Nkomati Anthracite Mine	2	Underground & Surface	Subbituminous	Thermal	1957
43	Nndanganeni Coal Mine	2	Surface	Bituminous	Thermal	2021
44	North Block Complex	2	Underground & Surface	Subbituminous	Thermal	1957
45	Overlooked Mine	1.5	Underground & Surface	Bituminous	Thermal	
46	Palesa Coal Mine	1.5	Surface	Bituminous	Thermal	
47	Phalanndwa Colliery	1.5	Surface	Bituminous	Thermal	2020
48	Rietvlei Colliery	1.44	Surface	Bituminous	Thermal	2013
49	Savmore-Maquasa Coal Mine	1.38	Surface	Bituminous	-	
50	Savmore-Maquasa Coal Mine	1.32	Surface	Bituminous	Thermal	2010

	Mine Name	Coal Output (Annual, Mt)	Mine Type	Coal Type	Coal Grade	Opening Year
51	Shondoni Coal Mine	1.2	Underground	Bituminous	Thermal	1954
52	Sigma Mooikraal Operations	1.2	Surface	Anthracite	Met	2006
53	Somkhele Coal Mine	1.2	Underground & Surface	Bituminous	Thermal	2015
54	Syferfontein Coal Mine	1.15	Surface	Bituminous	Thermal	
55	Tweefontein Coal Mine	1.15	Underground & Surface	Bituminous	Thermal	
56	Twistdraai Thubelisha Coal Mine	1.1	Surface	Bituminous	Thermal	2017
57	Ubuntu Colliery	1.04	Underground	Bituminous	Thermal	
58	Uitkomst Colliery	1	Surface	Subbituminous	Thermal	2019
59	Ukufisa Colliery	1	Surface	Bituminous	Thermal	2011
60	Vaalbank Coal Mine	0.9	Underground & Surface	Anthracite	Met	1985
61	Vanggatfontein Coal Mine	0.9	Surface	Subbituminous	Thermal	
62	Verkeerdepan Coal Mine	0.87	Underground	Bituminous	-	2017
63	Vlakfontein Coal Mine	0.7	Underground	Anthracite	Thermal	1987
64	Vlakvarkfontein Coal Mine	0.6	Underground & Surface	Bituminous	Thermal	
65	Welgemeend Coal Mine	0.51	Surface	Subbituminous	Thermal	2018
66	Welstand Coal Mine	0.48	Underground & Surface	Bituminous	-	
67	Woestalleen Colliery	0.407	Underground	Anthracite	Met	2008
68	Wonderfontein Coal Mine	0.4	Underground	Anthracite	Met	
69	Zibulo Coal Mine	0.4	Underground	Bituminous	Thermal & Met	
70	Zonnebloem Coal Mine	0.36	Surface	Bituminous	Thermal	
71	Zululand Anthracite Colliery	0.096	Surface	Bituminous	Thermal	
72	Arnot Coal Mine	*	Underground & Surface	Bituminous	Thermal	1971
73	Aviemore Colliery	*	Underground & Surface	Bituminous	Thermal	
74	Belfast Coal Mine	*	Underground	Bituminous	-	1994
75	Black Wattle Coal Mine	*	Surface	Bituminous	Thermal	
76	Bosjesspruit Coal Mine	*	Underground & Surface	Subbituminous	Thermal	2022
77	Bultfontein Colliery	*	Surface	Bituminous	Thermal	2018
78	Chelmsford Colliery	*	Surface	Bituminous	-	

Source of the Data: Gem Wiki

Coal Types:

1. Peat (Starting stage of coal Formation): less energy from its burning.
2. Lignite (Brown Coal/soft Coal/young Coal)
3. Sub-Bituminous (Black lignite) this grade lies b/w Lignite & bituminous -used in Thermal powerplants
4. Bituminous (high calorific coal) (metallurgic coal or Coking Coal)
5. Anthracite (ultra-high Calorific coal)-(low sulphur ,low smoke coal)

   From 1 to 5 the quality of coal increases similar was the moisture decreases and also from 1-5 the carbon content increases and its Energy generation increases when ignited and also its Cost also quite increase as quality of coal increases.

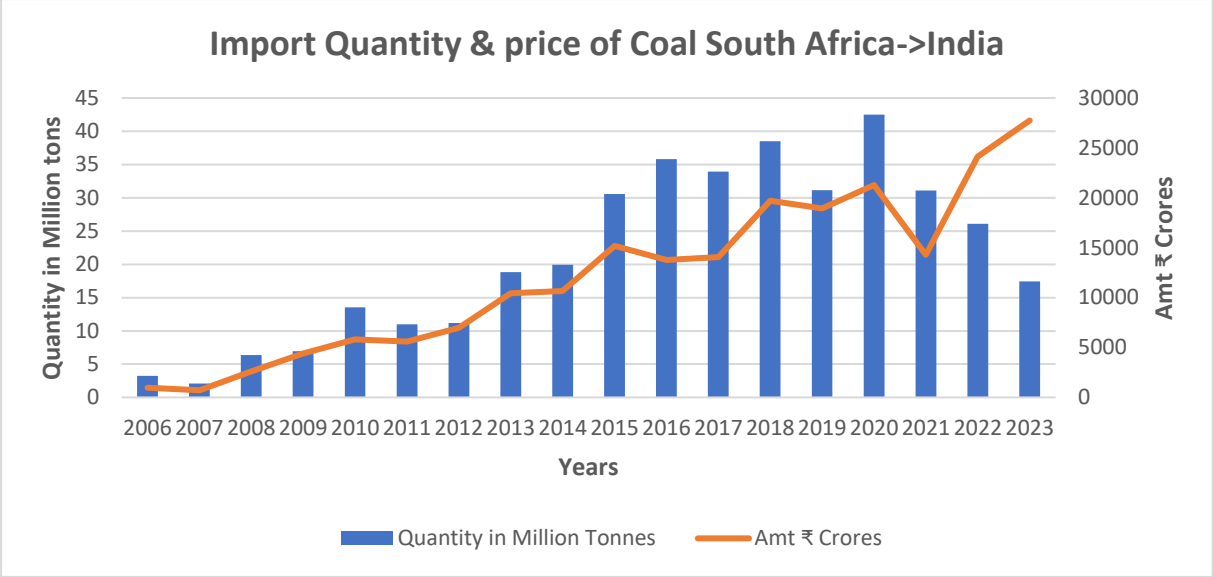
Propose Coal mines:

	Mine Name	Operators	Coal Output (Annual, Mt)	Mine Type	Coal Type	Coal Grade	Opening Year
1	Greater Soutpansberg Coal Project	MC Mining	16.4	Surface	Bituminous	Thermal & Met	TBD
2	Berenice-Cygnus Coal Mine	TerraCom	10	Surface	Bituminous	Thermal & Met	TBD
3	Dalyshope Coal Project	Thungela Resources Limited	10	Surface	Bituminous	Thermal	TBD
4	Zibulo Coal Mine	Anglo American Inyosi Coal Proprietary Limited	8.4	Underground	Bituminous	Thermal	2026
5	Alexander Coal Project	Sasol Mining	8	Surface	Bituminous		2025
6	Weltevreden Project	Thabong Coal (Pty) Limited	8	Underground & Surface	Bituminous	Thermal	TBD
7	Ukufisa Colliery	Canyon Coal	7.2	Surface	Bituminous	Thermal	TBD
8	Sukuma Coal Mine	Canyon Coal	7	Surface	Subbituminous	Thermal	TBD
9	Khwezela Coal Mine	Thungela Operations Proprietary Limited	4.6	Surface	Bituminous	Thermal	2030
10	Elders Coal Mine	Anglo American Inyosi Coal	4.2	Underground	Bituminous	Thermal	2026
11	Matla Coal Mine	Exxaro Coal	4	Underground	Bituminous	Thermal	2025
12	Gugulethu Coal Project	Canyon Coal	3.6	Underground & Surface	Subbituminous	Thermal	2021
13	Umzila Coal Mine	Canyon Coal	3.6	Underground	Bituminous		2021
14	Lefa Coal Mine	Ergosat Limited	3	Underground	Subbituminous	Thermal	TBD
15	Eloff Coal Project	Eloff Mining Company	2.4	Surface	Bituminous	Thermal	TBD
16	Springboklaagte Coal Mine	Izimbiwa Coal, Umcebo	2.4	Underground & Surface	Subbituminous	Thermal	TBD
17	Kranspan Coal Project	Ilima Coal Company	2.16	Underground & Surface	Subbituminous	Thermal	TBD
18	Wildebeestfontein Colliery	Opsirex	2.1	Surface	Subbituminous	Thermal	TBD
19	Gila Coal Mine	Canyon Coal	1.8	Underground	Bituminous		TBD
20	Makhado Coal Mine	MC Mining	1.6	Surface	Bituminous	Met	2026
21	Sterkfontein Coal Mine	Wescoal Mining	1.57	Underground	Bituminous	Thermal	TBD
22	Ilima Coal Mine	Ilima Coal Company (Pty) Limited	1.5	Underground & Surface	Bituminous	Thermal	TBD
23	Thuso Coal Project	Littlesnipe	1.2	Underground & Surface	Subbituminous	Thermal	2021
24	Makhado Coal Mine	MC Mining	1.1	Surface	Bituminous	Thermal & Met	2022
25	Ukwenama Coal Mine	Canyon Coal	0.6	Surface	Subbituminous	Thermal	TBD
26	Magdalena Colliery	Zinoju Coal	0.516	Surface	Bituminous	Thermal	2024
27	Magdalena Colliery	Zinoju Coal	0.24	Surface	Bituminous	Thermal	2022
28	Somkhele Coal Mine	Tendele Coal Mining	0	Surface	Anthracite	Met	TBD
29	Somkhele Coal Mine	Tendele Coal Mining	0	Surface	Anthracite	Met	TBD
30	Arnot South	TerraCom	*	Surface	Subbituminous	Thermal	TBD
31	Aviemore Colliery	Zinoju Coal	*	Underground	Anthracite	Met	2023
32	Aviemore Colliery	Zinoju Coal	*	Underground	Anthracite	Met	TBD
33	Belfast Coal Mine	Exxaro Coal	*	Underground & Surface	Subbituminous	Thermal	TBD
34	Elandsfontein Colliery	Elandsfontein Colliery Limited	*	Underground & Surface	Bituminous	Thermal	TBD
35	Modderfontein Colliery	Xakwa Coal	*	Surface	Bituminous	Thermal	TBD
36	Vanggatfontein Coal Mine	Wescoal Mining	*	Surface	Subbituminous	Thermal	TBD

Source of the Data: Gem Wiki

The upcoming proposed Coal mines Capacity expansion up to approx. of 117 million tons/annum most of the Coal Grade is bituminous and sub-bituminous.

There are some outputs which are mentioned * seems that they are not available in the sources obtained.



Source: India Climate and Energy Portal [24]

The above data is the main source point through which we come to know that the India's Imports were been Decreasing from past 3 years from approx. 43 million tons in 2020 to approx. 17.5 million tons in 2023 the main reason for this decline is due to 2 reasons first is that Accumulation the Coal from Inland of South Africa is becoming delayed due to the less Productivity of South Africa's state owned Entity Transnet which operated country rail, road , pipeline networks as stated by S&P Global Commodity insight[22].

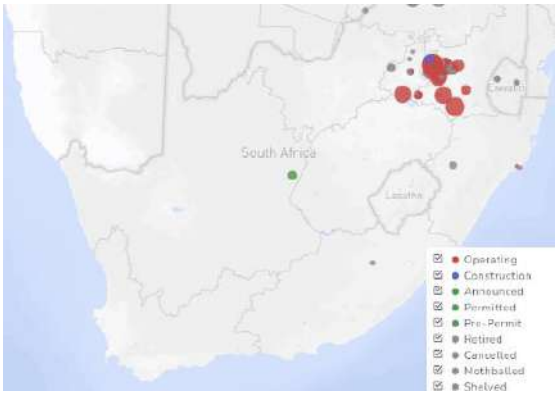
Most of the Coal which India imports is Non- Cocking Coal means It is mostly sub-bituminous or lignite Coal

Nuclear power:

As per World Nuclear Association and IAEA the south Africa is powered with 2 nuclear Reactors which serves around 4% of their total electricity generation.

Energy mix: Coal: 212 TWh (88%); Nuclear 9.9 TWh (4%); Hydro 6.2 TWh (3%); wind 5.9 TWh (3%); solar 5.0 TWh (2%); Biofuels 0.4 TWh; oil 0.3 TWh[21].

By observing the above mix, it was clear how far the South Africa is dependent on Coal for its electric Generation.



The Above image Specifies the most of the coal power Plants are present in the Mpumalanga in the northeast part of the Country which make South African Sate run Electricity production & transmission monopoly Eskom was unable to transmit the power to reach cape town efficiently in order to avoid this draw back a nuclear power plant was installed by a French Company called Framatome (presently called Areva) which was owned by Électricité de France a state owned entity of France with a capacity of 1800Mwe at Koeberg near Cape Town during 1984-1985 which was owned and operated by Eskom .

There was an Expansion plan of the present capacity lifespan for more 40 years which was rejected by France where chines entity Shanghai Electric Nuclear Power Equipment Company (SENPEC) came in picture which is owned by Shanghai municipal government plans to extends its Capacity by 10% and extend the lifeline of the plant for next 20 years this maintenance period along with the Efficient maintenance of the Coal power plant by Eskom causes the Electricity shortages in South Africa during 2022-2023.

Reactors operating in South Africa

Reactor Name	Model	Reactor Type	Net Capacity (MWe)	Construction Start	First Grid Connection
Koeberg 1	CP1	PWR	924	1976-07	1984-04
Koeberg 2	CP1	PWR	930	1976-07	1985-07

Total south African installed capacity was around 51.6 GWe as of 2020 out of which approx. 70% is of the coal run capacity which means 38GWe the south African aim is to increase its nuclear electricity production by at least 9,600 Mwe there are many bids and agreements for the Technical & financial support from entity's from country's like USA, France ,Russia, China , south Korea but the plans are seems to be not working as of today the running capacity was 1,800Mwe which was bit disturbed during march -November 2023 due to the maintain work going followed up with the disruption in three units at the Kusile coal-fired power station which make South African president declare "State of Disaster" lead to Energy crisis[23].

3.10 Botswana

It is a southern African country which is landlocked nation neighbouring with Zimbabwe on east, South African on south and Namibia on West and Zambia on North (along with a long north boarder with Namibia also) which make them bit dependent on the neighbouring nation which have a coastal line (most of the trade movements are from South Africa (approx. 60% via SA) and followed up with Namibia (accounts 9% of imports)[25].

Energy Mix:

99.8% from Fossil Fuels (predominantly from Coal),

0.2% from Solar the one of the reasons for no hydro is that ¾ of the nation is Dry (seems to be desert area).

Oil

Oil reserves: nil[26]

Oil production: nil[26]

Oil Consumptions: approx. 22,000bpd[26]

Oil refinery's: nil[26]

Gas

Gas reserves: nil[26]

Gas Production: nil[26]

Gas consumption: nil (excluding LPG) [26]

Gas Fired plants: nil (mass consumption) [26]

Coal

Coal reserves: 1.66 BMT[26]

Coal production: 4.08MMT/annum [GEM]

Coal consumptions: 1.416 MMT/annum[26]

As pe IEA Data we come to know that Botswana is heavily dependent on Coal Feedstock despite of having pressure from ongoing Climate Crisis from many developed nations setting rule to put down the emissions and become green which is a costly process and un economical for the countries like Botswanan which make the nation think of their own country's Energy. dependency

Operational Mines Info:[as of 2024]

Botswanan			
Mine Name	**Sum of Coal Output (Annual, Mt)**	**Coal Type**	**Owners**
Masama Coal Mine	0.46	Bituminous	Minergy
Morupule Coal Mine	1.67	Subbituminous	Minerals Development Company Botswana
Project Motheo	1.40	Subbituminous	Minerals Development Company Botswana
Total	**3.53**		

Only 3 mines are presently operational with a bituminous grade (Meta Coal-Coking Coal) and Sub-bituminous Grade mainly used for thermal Power generation, Among those 3 mines 1 mine is operated by a local private entity Minnery which is presently seems to be going to halt operations due to low prices in internationally and over Debts which make them approach the State Gov of Botswana for a bail out in 2023 as stated by Reuters[27]. And Remain 2 Operational Mines with a combined o/p of 3.07 million Metric Tons out of its 3.53 MMT/annum output.

Botswanan			
Mine Name	**Sum of Coal Output (Annual, Mt)**	**Coal Type**	**Owners**
Masama Coal Mine	1.90	Bituminous	Minergy
Mmamabula Coal Mine	1.20	Bituminous	Maatla Resources
Total	**3.10**		

Despite of having Debt Minergy proposed a expansion plan for Masama Coal Mine from 0.46 MMT/annum to 1.90MMT/annum this decision has been taken to create a hope to the investors and the Gov of Botswana (previously a fund of 300 M USD : provided to bring this Masama Coal mine online and reach to its proposed targets) and one more new mine Mmamabula Cola mine was Proposed Maatla Resources (a German Firm) along with that the Gov of Botswana is planning for 300MW of Thermal Power Plant a tender is been opened Indian Firm Jindal is also part of that Biding process along with the Australian firm African Energy resources along with Maatla Resources but in 2023 the maatla Firm pulled out of the Bid as stated by Economic Times of India[28] .

Nuclear: Nil as per IEA Data

3.11 Namibia

It is a country located in the south west coast of African continent bordered with Angola & Zambia on north, Botswanan on the east, South Africa on south having a long cost line on the south Atlantic Ocean which is rich in various value added minerals Gold , Diamonds and the most important material is Uranium & thorium which are more valuable than Gold & Dimond's (which eventually landing up in France and USA & Canada) the extraction process outcomes are bit hazard and damage to ecosystem near by if not handled with care.

Energy mix:

Source: https://www.iea.org/countries/namibia

It has been observed that the major chunk of the Electricity is been produced from the Hydro power which accounts ~64 % and followed up with Solar power and wind and surprising thing is that coal contribution is 2.7% which make them bit clean having renewable energies in their Energy mix. But when we compare to the power utility the major share is of Oil & biofuels as of now there is only one Hydro power plant Ruacana hydroelectric plant (332 MW) which is 1978 build and one more new hydro plant (Baynes hydroelectric plant(600MW)) is planned to build both of these plants are located bordered with Angola it seems like new Hydro power plant construction will be start by

2029 which may be speed up due to the Upcoming income obtaining from recently Discovered Oil & gas Fields in orange Basin.

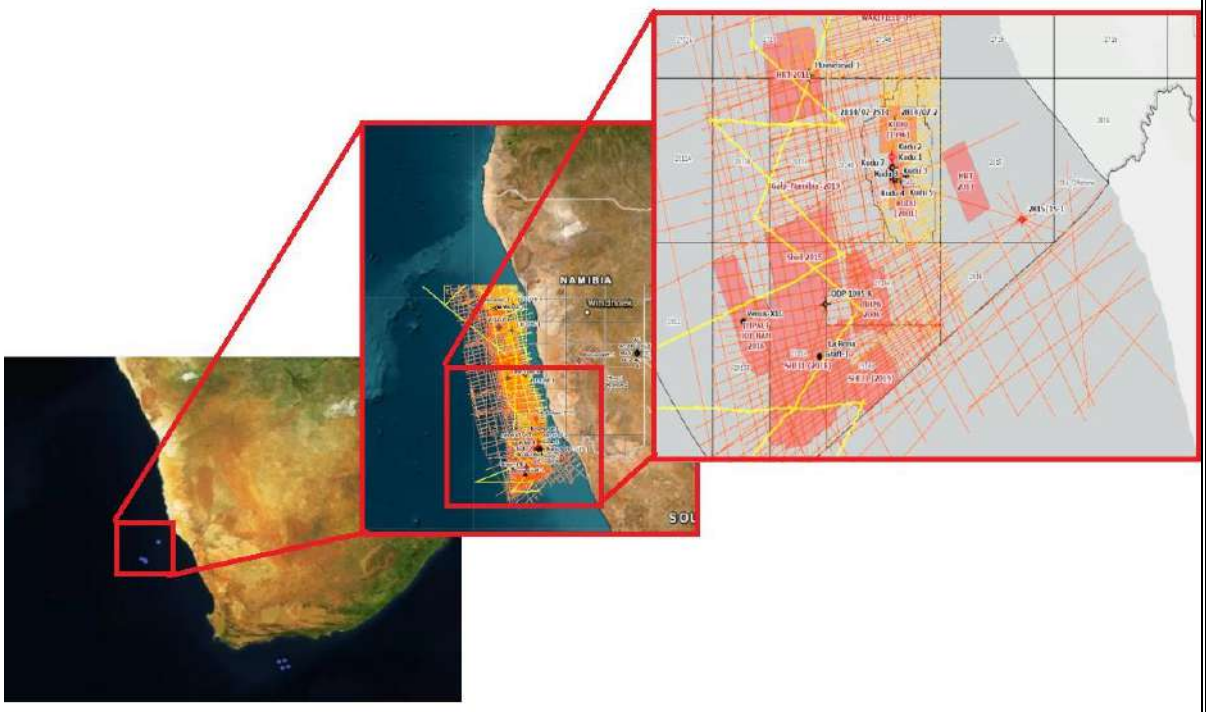
Oil

Oil Reserves:

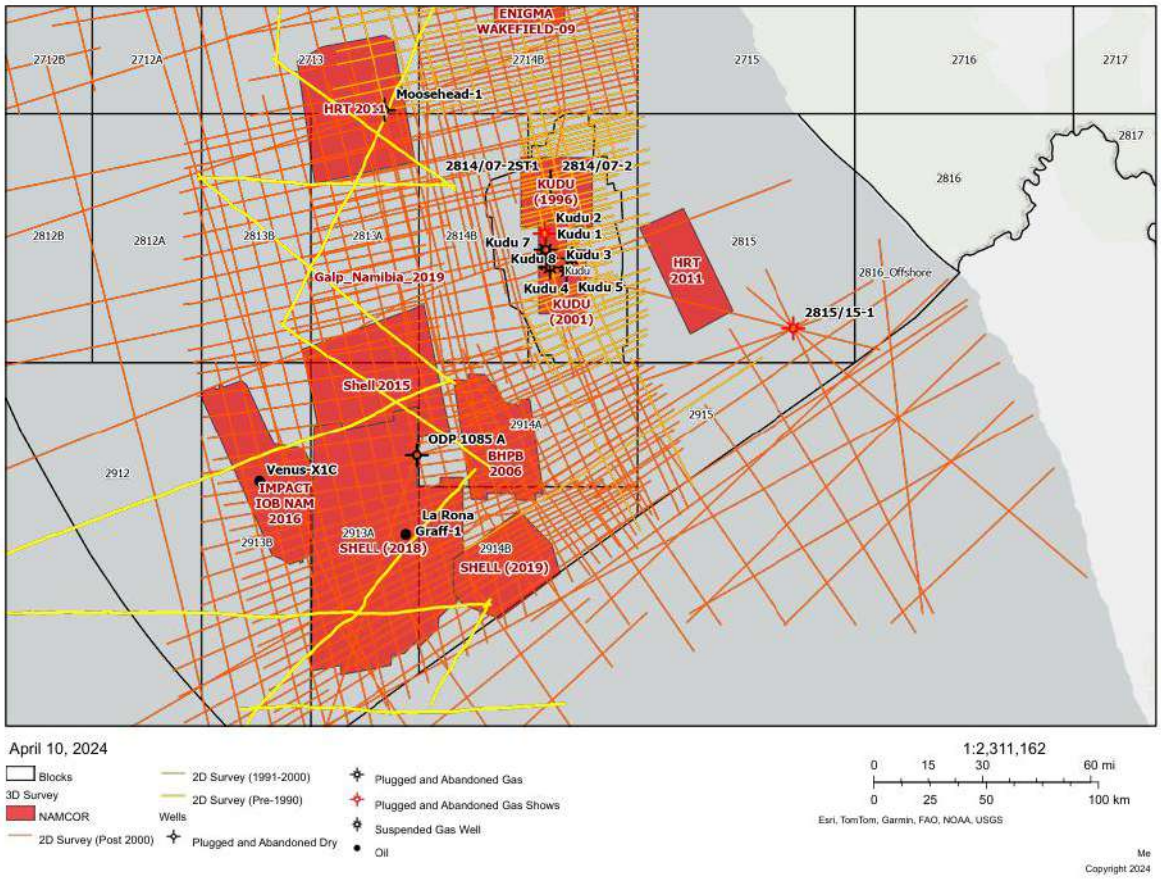
Oil Productions:

In Namibia there are 4 Discoveries of oil reserves

1. Venus Oil Field (in 2022)
2. Graff Oil and Gas Field (in 2022)
3. Lesedi Oil and Gas Field (in 2023)
4. Jonker Oil and Gas Field (in 2023)



This was the Orange Basin Region in the South west part of Namibia which is approx. 150 – 300 km from costal line which are having a recent discovery of Light Oil which is having a good value in the international market but the main challenge is that the Depths of the Discovery & the Weather (is Thought due to Benguela Currents harsh waters and low visibility for Navigation)



Source: Namibia NAMCOR GIS Portal [30]

Explanation of the Above Discovery's

1. Venus Oil Field

   It was the oil Field Discovered by a French Oil giant Total energies in 2022 and expected to start its production by 2029 under Petroleum License 56 which was the largest that a French giant has obtained from past 20 years as per a Upstream news article[29].

   Operator: Total Energies

   Owner: TotalEnergies (40%), Qatar Energy (30.0%), Impact Oil and Gas (20%), National Petroleum Corporation of Namibia (10.0%)[31]

   Oil reserves: 2-3 billion Barrels (with o/p of 0.25 MB/day) vis FPSO

   Gas Reserves: ~14.467 BCM

At initial stage Total Energies intrust was 40 % the spike in the increase of 10.5 % will be happening in future due to plans of Aquation of a part of share of Impact Oil and Gas in 2 blocks by paying a amount of ~99 million USD (a UK based Entity in which African Oil a Canadian Entity is having 25 % Equality) but still the stake was same because this transaction has to be approved by Nambian GOV before the stake is been transferred to Total energies.

This Light Oil Field is West of the Shell Graff which was also a recent Discovery of shell.

Before we dig deep let's get a clarity Shell is carrying Exploration under the Petroleum License 39 (PEL 39) and plans to Dig 3 Wells Graff 1X , Lesedi 1X, Jongker 1X in the Orange Basin which assume that ~700 Million - 1 Billion Barrels of oil is Estimated with a ~ 6 Trillion Cubic Feet of Gas Reserves (~1.8BCM)

2. Graff Oil and Gas Field

This was the Oil and Gas field located in the Exploration Area East of the Total Energies Venus which was operated by Shell PLC a British – Duch Entity based in UK which has its Discovery in 2022 which is expected to start by 2032

Operator: Shell PLC

Owner Ship: Shell plc (45.0%), Qatar Energy (45.0%), National Petroleum Corporation of Namibia (10.0%)

Oil Reserves: 0.2 billion barrels

Gas Reserves: 155.71 BCM

The Reserves are actually estimated 0.5 BB in 2022 but the end of 2023 shell under written those reserves to be ~0.2 BB[32].

3. Jonker Oil and Gas Field

   This oil & Gas Field Comes under Graff Complex which was around 18Km North west of Graff well and 260 Km away from the Namibian Coast which is part of 3 well program which composes Graff 1X, Lesedi 1X, Jongker 1X as per the info popping up in market that the Well is having a Light Oil similar to that of oil found in Venus (Total Energies')

   Oil reserves: 300 million (2P)

   Owner: Same owner ships that of Graff O&G Field.

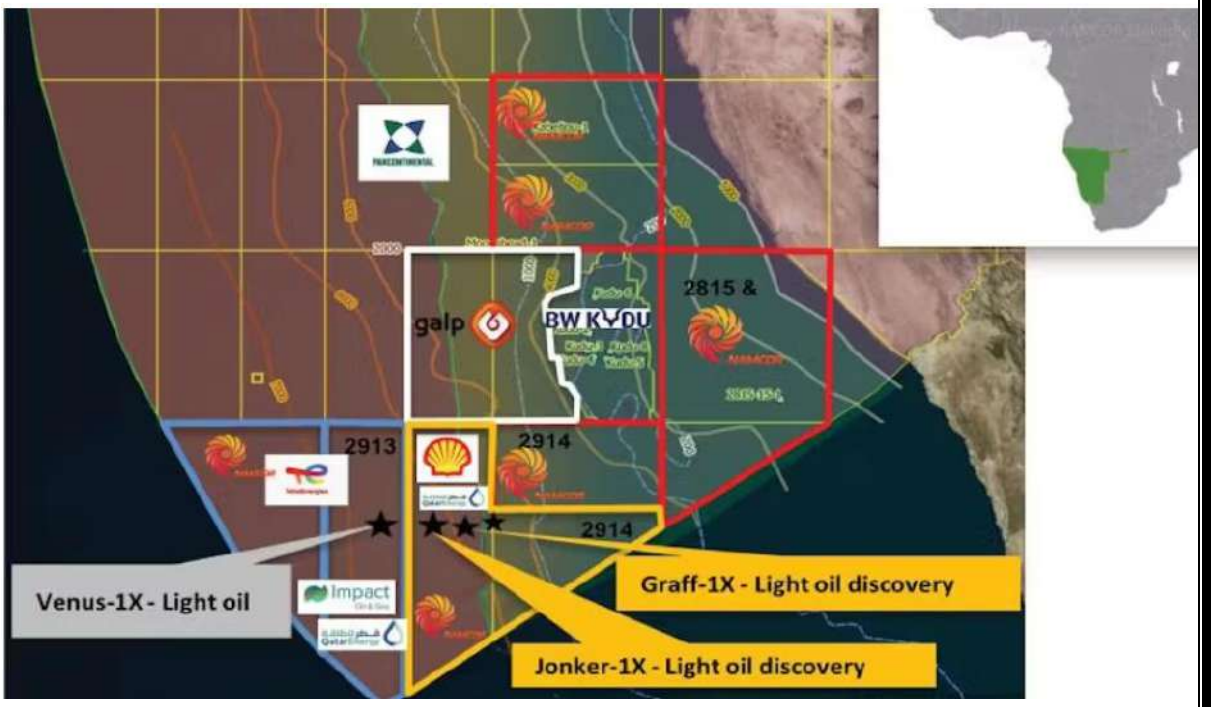
   There are Controversies that Shell is Devaluing the reserves and make others uncomfortable in investing in orange basin to tap more Licenses in that region and become more profitable

4. Lesedi Oil and Gas Field

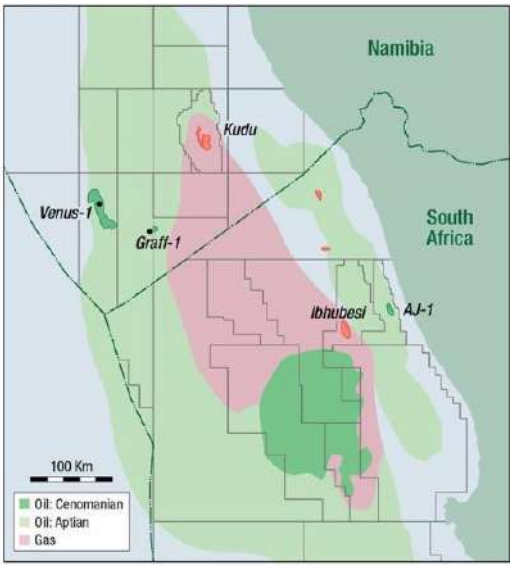
This Oil & Gas Field present 8 Km far away from which is a seems to be the one more discovery in the Shells PEL 39 (petroleum License 39) with one more Light oil Discovery.

Oil Reserves: 130 million Barrels (2P)

Owner Ship: The Same as of Graff, Jonker 1X[33]



And the Estimation Oil and Gas Info Graph



Gas

Gas Reserves: 8.7 trillion Cubic Feet (2.65 trillion Cubic meters)[34]

Gas Production: Nill

Production Units:

Kudu Gas Field is the Only gas Field which is specifically for Gas Production the above listed Oil Fields are have estimated gas reserves as

1. Venus (14.467 BCM)
2. Graff (155.71 BCM) (includes Jonker 1X & Lesedi)

The Reserves of Kudu Gas field Complex is 36.811 BCM but estimated 1.3 TCF (0.40 BCM)[35] which was discovered by Chevron (and having a partnership with Shell ..etc) and later the Interest was transferred to Tullow's a Irland based Entity it was changing hands and then at present the Owner ship lies with BW Kudu.

BW kudu (56% share is of BW energy a Bermuda Entity & rest lies with National Petroleum Corporation of Namibia (NAMCOR) of 43%)

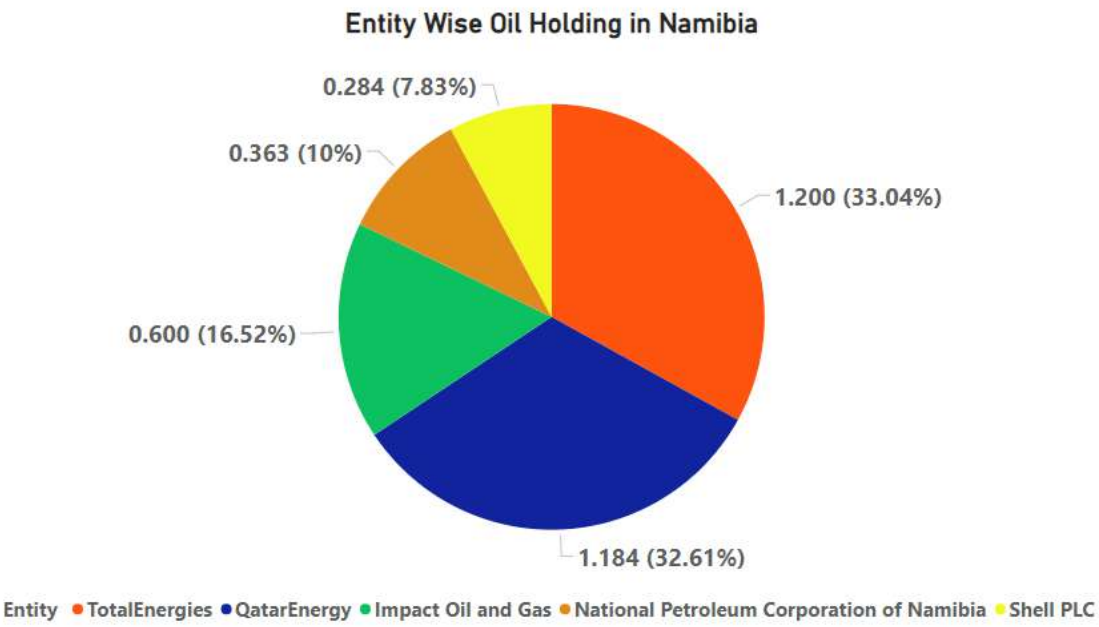
There are Plans going on to connect these gas fields with Shore to supply gas to a power the Gas Run Power Plant in Elizabeth Bay (of 800 MW) by using a Pipeline of length 170 Km from shallow water of the Kudu Gas Field and helps to meet the demand of Namibian energy needs and the Excess will be connected to Abraham Villiers Bay–Oranjemund phase 6 of Soth African Phase 5 of the PGPN (Inter Gas Pipeline Network) it a proposed Pipeline .

The Main Income for Namibia is from following thing

1. Royality: 5%
2. Petroleum Tax: 35 %
3. NAMCOR Working Interest ~10%

As Total Namibia Can hold 50 % of the Oil & Gas sales at end of the Day.

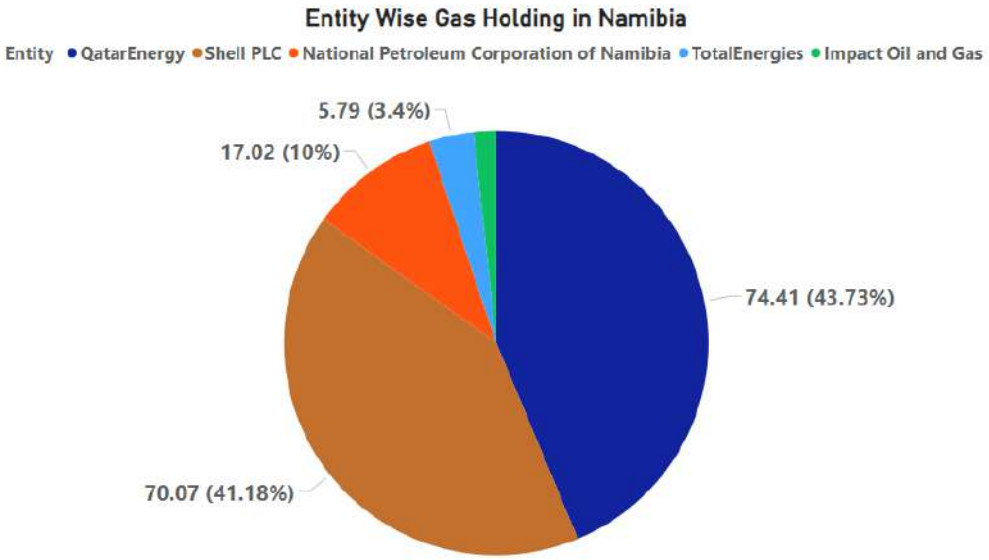
There has been various under writing happening to make others entity's feel to be less attractive to invest in Namibian Oil & Gas Exploration one among the culprit is Shell SLA there are many other entity's do so , Despite of having all these info the Nambian Gov is planning to make their citizens also get involve in the industry and share expertise and which can help other small E&P entity's in Namibia to be a part of this Foreign E&P let's hope that the take by Namibia Gov will be successful and their targets is to not only meet the Basin Energy need of Namibia they are planning to use this Resources to industrialise their nation.



As per the Above Info Graph of Oil holding Total Energies (a French Entity) is the leading reserves holder with a ~33.04 % most of this chunk of Holding is from Venus and 2nd highest holding is Quarter Energies with ~32.61% this is due to its hand in every Investment and Every exploration in present Discovered reserves it is having working interest in Venus ,Graff , Jonker 1X… and maintain a balance relationships the Competitors (Shell & Total Energies) followed up with Impact Oil & gas (which is mostly owned 25% by African oil which is a Canadian Entity) which occupies the ~16.52% of pie the main reason is also Venus (~3B) and followed with Shell9Uk Entity) of 10 % and NAMCOR (Namibian Entity) (~7.8%).

All these info is an estimation the raw data is been taken into consideration from the public news and the Company's portals it is difficult to get the exact Reserves we will be having a estimation of reserves. Below is the Raw Data for the Above Info graph.

Unit Name	Entity	Oil Reserves	Gas Reserves
Venus	TotalEnergies	1.2	5.7852
Venus	QatarEnergy	0.9	4.3389
Venus	Impact Oil and Gas	0.6	2.8926
Venus	National Petroleum Corporation of Namibia	0.3	1.4463
Graffin	Shell PLC	0.09	70.0695
Graffin	QatarEnergy	0.09	70.0695
Graffin	National Petroleum Corporation of Namibia	0.02	15.571
JONKER	Shell PLC	0.135	
JONKER	QatarEnergy	0.135	
JONKER	National Petroleum Corporation of Namibia	0.03	
Lesedi	Shell PLC	0.0594	
Lesedi	QatarEnergy	0.0594	
Lesedi	National Petroleum Corporation of Namibia	0.0132	



The PEL 39 Licence Entities are the One which is Accommodating a huge amount of gas Reserves ~155 billion Cubic Meters of gas there are plans going on to geed this gas to the proposed gas pipeline from kudu gas Field.

Once Again Quatar Energy's is the one which is Holding huge amount of Gas Reserves share as it has 45% Working interest in Graff which holds huge amount of gas reserves followed up with adding of 30% of Venus Gas holdings make the Quarter Energy's a dominant player with approx. 74.41 billion Cubic meters of Gas Holding. Followed up with Shell of ~70% and NAMCOR (Namibia state owned entity) (~17 %) next Total Energies holdings (~5.79%) and at last Impact with just (~3.4%) from Venus.

In Simple Words the Quarter Energy is the Dominant player in Both Oil & gas Holding in Namibia.

Coal

Coal Reserves: Nill [37]

Coal Impots: 59,000 MT[37]

Coal Consumption: 38,000 MT[37]

Most of the Coal Imports are from Botswana.

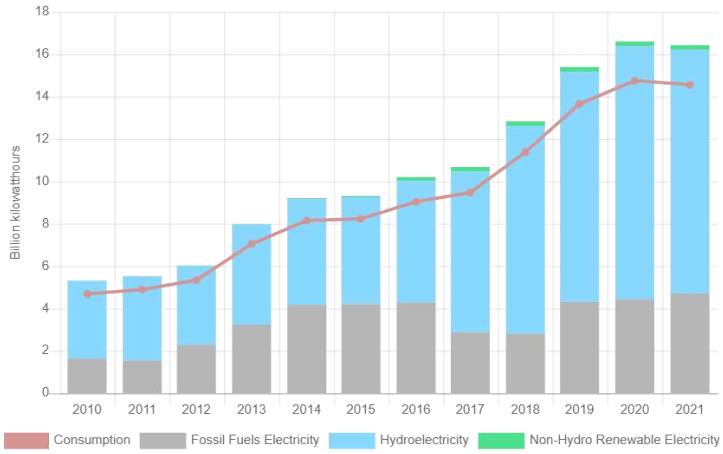
Nuclear Power: nil (as per IAEA)

3.12 Angola

This was the Country which was located in the Southwest part of African Continent having an Atlantic Cost neighbouring Countries DRC on North, Namibia on South, Zambia on East Which is once a Member of OPEC[38] (Organization of Petroleum Exporting Countries) whose is heavily Dependent on its Hydrocarbons Reserves which account for ~70 % of the Country's GDP.

Energy Mix:

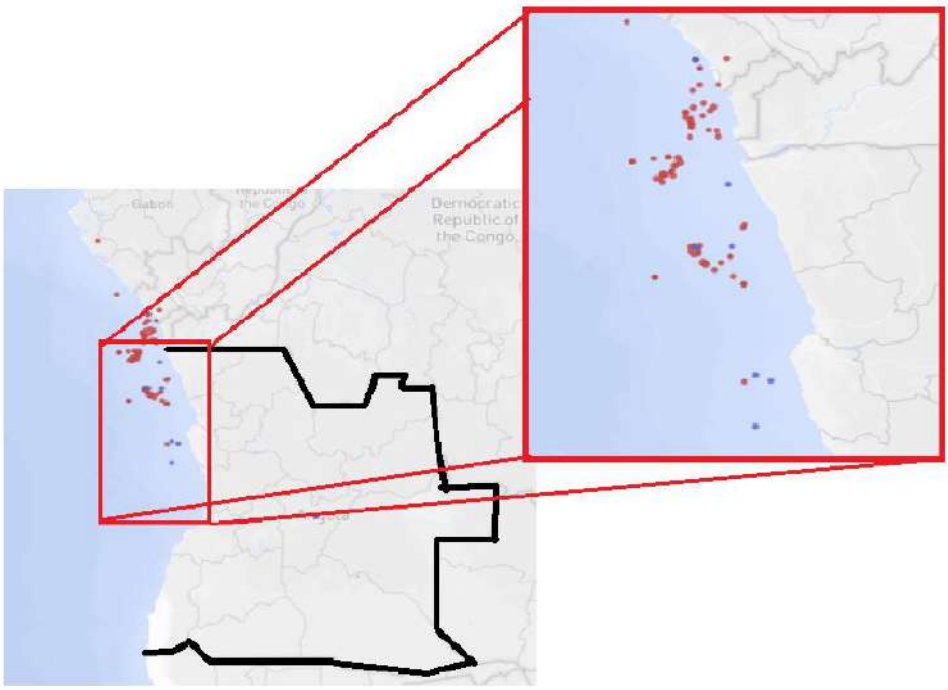
The country's present energy mix consists of 61.8 % hydropower, 37.6 % of fossil fuels and 0.6 % hybrid (solar/fossil fuel). With a 5.7 GW production Capacity which was only 70% utilized as per ITA[39].



Source: Aenert

As per IEA and Aenert Infographic it seems Hydro Power is Filling up the most of the Power Consumption in Angola followed up with Fossil Fuels (either Oil or Gas) as it is having tremendous Oil & Gas Reserves.

Hydro carbon Extraction Unit locations:



Most of the hydro Carbons Extraction units are been located in the North western part of Country most Off shore units which was close to the DRC (Democratic Republic of Congo)

Oil

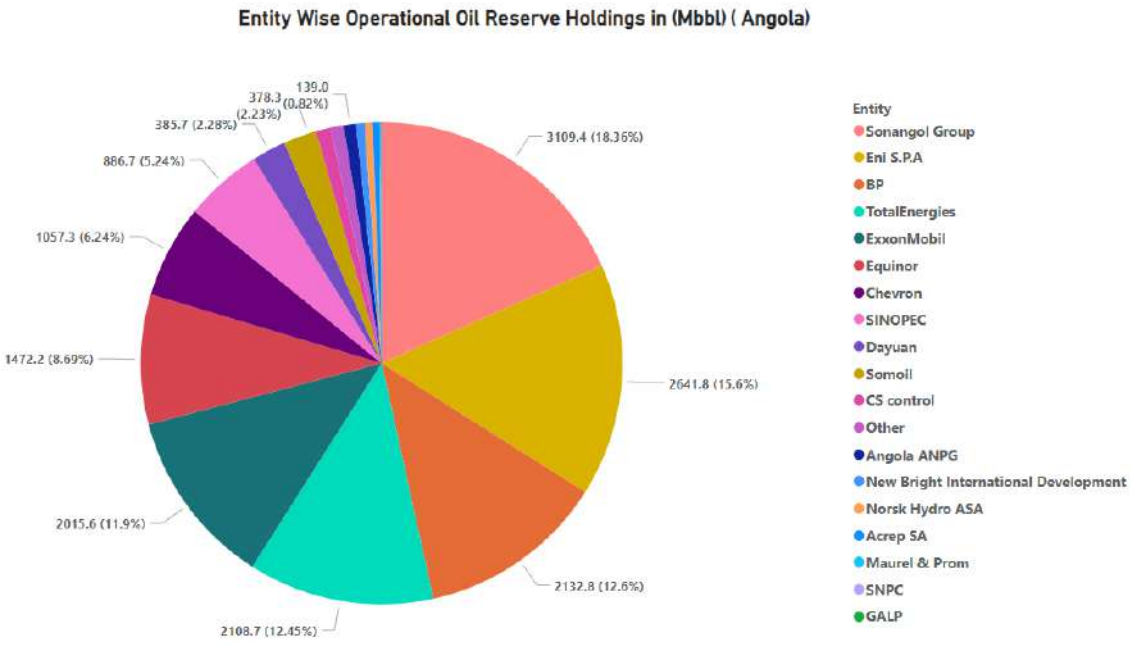
Oil Reserves: 9 billion barrels (Proven)—20.35 billion Barrels of Potential reserves.

Oil Production: 1.1 - 2 million Barrels[40]

Oil Consumption: ~ 1.1-2.2 million petroleum products Consumption /day

As per OEC World Data base in 2022 Angola's major Export Commodities is Crude Oil which accounts ~72% of Overall exports predominately reaching China (54%) followed up to India (9.11%)[41].there is one more trend that has been observed the Petro gas that is produced is been moved towards Europe(Netherlands,France,Uk..etc) as they declare them self's as the Cleanest persons in World by minimizing the Emissions using alternative energy's like Gas , Solar , Wind ..etc which may be a bit clean but the process of preparing those Energy sources which are hight Emission Committers Indirectly.

Approx 77 units are operational as of 2024



From the Detail Analysis of the Units in operational and their Equity Interest holdings it has been found that Sonangol Group Angola state Owned Entity is holding the maximum Reserves followed with Eni SPA a Italian Oil giant is the 2 Nd largest holding of the present Operational reserves with an ~2.4 BOE followed with French Oil giant Total Energies, hear Chinese state owned entity SINOPEC is also having its share and presence in Angola .. as plotted in the Above pie chart but hear there is a limitation there are some other Operational units Reserves are been Excluded as we know that the Oil and gas Industry is a closed loop as the Info of those units is not available in open Public Domine that info are Listed Below.

Unit Name	Fuel type
Acacia	oil and gas
Cabaça South East	oil
Canela	oil and gas
Chocalho	oil and gas
Kakocha	oil and gas
Mafumeira/Mafumeira N	oil and gas
Marte	oil and gas
Mondo South	oil and gas
Mondo	oil
Mostarda	oil and gas
Orquidea	oil and gas
Sangos/Cinguvu	oil
Saturno	oil and gas
Vandumbu	oil
Venus	oil and gas
Violeta	oil and gas
PSVM	oil and gas
Cromio	oil and gas
Clochas	oil and gas
Mavacola	oil and gas

It has been Observes the Present Operational units' reserves are ~16.74 Bbl. (Exclude reserves list of Above).

The Projects that are under Development & Expected of Production.

Unit Name	Fuel type	Operator	Production start year
Quiluma/Maboqueiro	gas	Azule Energy	2026 (expected)
Begonia	oil	TotalEnergies	2024 (expected)
Cameia/Golfinho	oil	TotalEnergies	2027 (expected)
Cameia	oil	Total E&P Angola	2025 (expected)
CLOV Phase 3	oil	TotalEnergies	2025 (expected)
Dalia Phase 3	oil	TotalEnergies	2022 (expected)
PAJ	oil and gas	BP	2025 (expected)

It seem that upcoming Production are been added into Western nations Oil Giants accounts like Total Energies (@france) , BP (@UK) which can boost the Actual Production of 1.1 million Barrels/day as stated by Reuters[40]. There are 2 Discoveries which are not under development by in progress for finical Decisions they are

1. Bicuar (Oil reserve: 290 million) located south of Luanda Capital City
2. Orca (Oil reserve: 100 million potentials of 550 million Barrels of oil

Above 2 are Discovered a Decade back by Total Energies will also a value addition to its Portfolio.

Over all oil reserves that are under development ~2.77 Billion barrels.

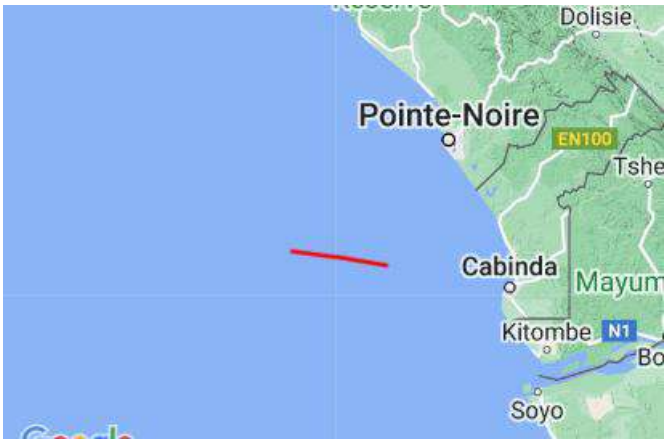
Unit Name	Reserves
Quiluma/Maboqueiro	425
Begonia	10.95
Cameia/Golfinho	420
Cameia	1700
CLOV Phase 3	60
Dalia Phase 3	10.95
PAJ	150
Total Reserves (in Mbbl)	**2776.9**

Oil refinery:

Luanda oil refinery with a capacity of 65,000 bpd processing capacity located near to the capital city of Angola.

Oil Pipelines [source: GEM]:

1. Lianzi-BBLT Oil Pipeline



Operator/Owner: Chevron (USA Oil Giant)

Capacity: 40,000bpd

Length: 69 Km

Operating Since: 2015

It is Connecting an Offshore whell under Republic of Congo to the FPSO unit @ Benguela-Belize-Lobito-Tomboco offshore oilfield, Angola. Which is operated by Chevron.

2. South Nemba-East Kokongo Oil Pipeline

This Pipeline is Connecting South Nemba Oil Field which was operated by Chevron to Kokongo Offshore Platform.

Owner: Chevron

Length: 35 Km

3. Tombua Landana-East Kokongo Oil Pipeline

   This pipeline run from Tombua and Ladana oil Fields which are operated by Chevron connected to East Kokongo Off shore Field.

   Owner: Chevron

   Capacity: 0.13 Mbpd

   Length: 43Km

   Operated Since: 2009

4. East Kokongo-Malongo Oil Pipeline

   Then by combining all the Above Pipelines Oil is Moved from East Kokongo Offshore Field to Malongo Terminal (@port) and One more Oil Pipeline which is running from Numbi Offshore Field to Malongo Terminal with a capacity of 50K bpd which was also owned and operated by Chevron.

   Summarizing the oil pipelines the Angola each and every Pipeline is been owned and operated by oil giant Chevron including the Malonga Oil and LPG export terminal[42].

   Clustered Overall View of the Above Oil Pipeline Network which was owned & Operated by Chevron.

There are 2 Company's which we need to make Note 1. Somoil 2. Acrep SA

Somoil was Founded by a Former Director of State-Owned Energy Entity Sonangal Group and Acrep SA is also been found by a former Executive of Sonangal Group is it coincidence that the Former Employees of state-owned Entity's created their Own Oil Company's and having a Nice Chunk of Oil Reserves in their Hand, Is it Obtained Ethical Way is a Big Question

Chines presence was in Hidden view by having a Holding in some other Entity like Dayuan , SNPC … indirectly having a Chunk of reserves in their A/c.

Gas

Gas Reserves: 11 trillion Cubic feet (~3.2 trillion Cubic Meters)[43].

Gas Production: 6.7 billion Cubic Meters (as of 2019)[44].

Gas Consumption: 860 MCM (as of 2019) [44].

Gas Exports: 5.87 BCM[44].

Dedicated Gas Unit: Only 1 was Present

1. Quiluma/Maboqueiro Gas Field

Gas reserves: 72.242 billion cubic meters

Operator: Azul Energy

Owner: Eni S.P.A. (Italina Entity) (25.6%); Chevron (USA) (31%);Sonangol Group (Angola State-owned)(19.8%); BP P.L.C. (UK)(11.8%);Total Energies(France) (11.8%).

Chevron was the largest shareholder in this gas field.

Note: Other Oil fields also produce huge amount of Gas during the Oil Extraction process.

Coal

Coal reserves: Nil

Coal Production: Nil

Coal Consumption: Nil

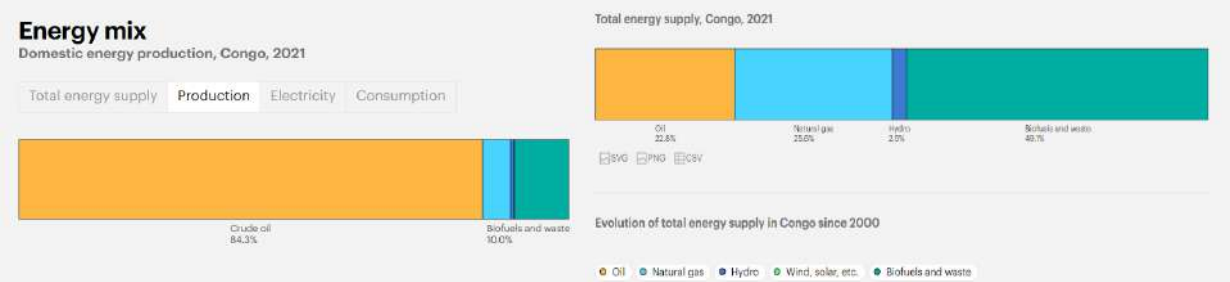
Why would a country with huge number of Oil & Gas reserves could move for Coal exploration even they have sediments of Coal Reserves in their southern part of country near bordered with Namibia.

Nuclear Power: Nil (as per IAEA Info)

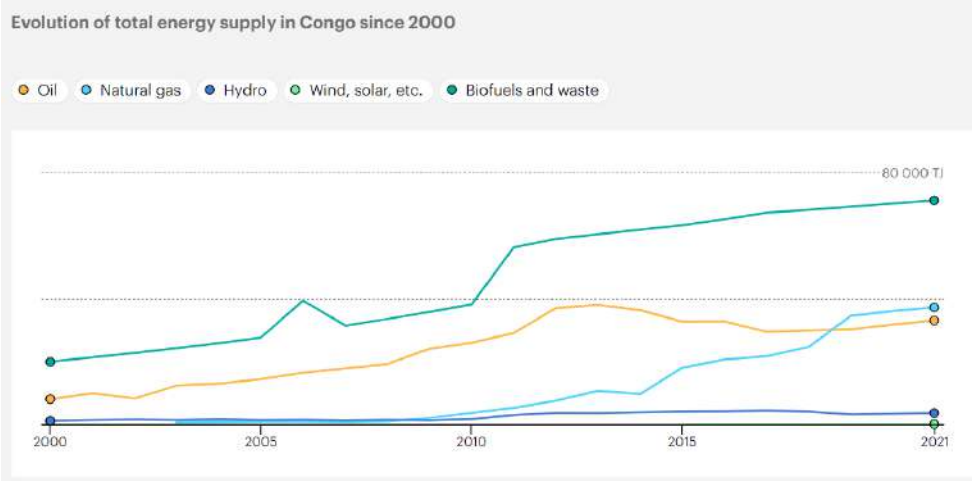
3.13 Republic Of Congo

This is the Country which was Located in the South West of Africa on the Southern Atlantic Ocean Coast boarders with DRC and Angola in the South , Gabon on West and DRC also on East and Central Africa and Cameroon on the North which is a part of OPEC (Organization of the Petroleum Exporting Countries) from hear there is a underlining thing is that the Currency which was used in this Country CFA is the common Currency which will be use in this country (There is a big Info on Western African CFA and Central African CFA in simple words it was a proof of Colonial Influence till after the end of their Era (key player hear is France). This was the same currency followed by North neighbour countries Gabon and Equatorial Guinea (which are also a part of OPEC huge Oil Reserves) but still using the foreign backed Currency in their Market by Pledging their 50% Forex reserves to those foreign nations in terms of Security, where you are unable to use your own currency without their Approvals.

Energy Mix:[45]



It sems that most of the Energy Production is from Crude and Followed up Natural gas and then bio-Fuels but as per supply data Bio Fuels are Adding up a Huge Share.



Oil

Oil Reserves: 1.81 billion barrels (Proven)[46] ,2.882 B bbl (2P)[47]

Crude Oil Production: 0.262 million bbl/day[46]

Crude Oil Exports: 0.243 million bbl/day[46]

Crude Oil Exports value: ~10.80 billion USD

Petroleum Production: 0.17 million bbl/day[46]

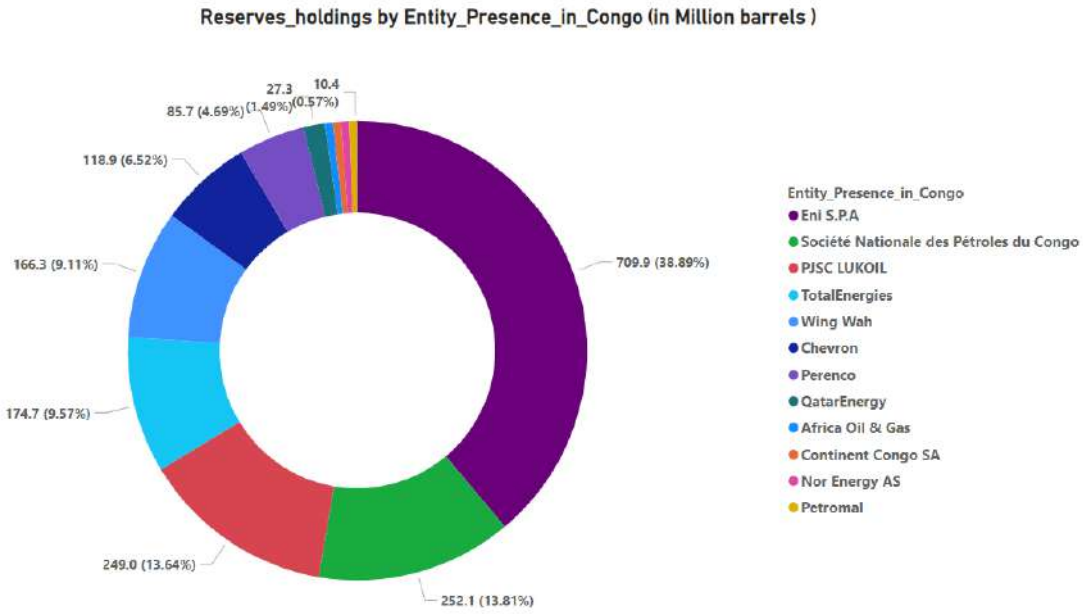
Oil Reserves Briefing

Current Operation Oil Units & their Reserves: [GEM]

Unit Name	Fuel type	Reserves (in Mbbl)
N'Kossa Marine	oil	87.25
Likouala Marine	oil and gas	133.59
Moho-Bilondo	oil and gas	253.8
M'Boundi	oil and gas	18.9
Tchibouela Marine	oil and gas	33.63
Banga Kayo (Phase 1)	oil and gas	195.6
Moho (Phase 1bis - BILDM2,3)	oil and gas	36.5
Nene Marine Field	oil and gas	196.05
Litchendjili	oil and gas	800
Litanzi	oil and gas	70
Total		**1825.32**

Unit Name	Operator	Country Entity Belongs
N'Kossa Marine	Total E&P Congo	France
Likouala Marine	Congorep	Congo
Moho-Bilondo	TotalEnergies E&P Congo	France
M'Boundi	Eni S.P.A.	Italy
Tchibouela Marine	Perenco	France
Banga Kayo (Phase 1)	Wing Wah	Malaysia
Moho (Phase 1bis - BILDM2,3)	TotalEnergies	France
Nene Marine (Phase 2B)	Eni S.P.A.	Italy
Nene Marine (Phase 2A)	Eni S.P.A.	Italy
Nene Marine Field	Eni S.P.A.	Italy
Litchendjili	Eni S.P.A.	Italy
Litanzi	Perenco	France

It has been Observed that the Entity which are operating these units are from European Once Most seen once are Eni SPA an Italian Entity and Total Energy's a French Oil giant.



After analysing the Overall holding an it has been found that Eni SPA an Italian Entity was Holding Huge Amount of Interest and reserves which was approx. 709.9 million barrels ,followed with SNPC a Congo state Owned Entity which is 2nd which holds ~252 million bbl and then followed with Russian 2nd largest oil producer and then followed with French Entity Total Energies with a holding ~174 million bbl and then Malaysian Entity Wing Wah and then Chevron a USA private Entity Holding ~118 Million bbl… continuous as specified in the Above Infographic.

Oil Pipelines: nil ; Oil refinery: Coraf - Pointe-Noire (21,000 bpd)

Gas

Gas reserves: 284 billion cubic meters(p)[46]

Gas Production: 1.4 billion cubic meters /day

Among the Above Units M'Boundi Oil & Gas Field is the Curtail One with a reserves of 61.193 billion cubic meters which majority was Hold in hands of Eni (in gas sector also Eni SPA Italian's are the Dominating Ones)

Gas Infrastructure

There are 2 under construction FPSO are going to be placed near to the Coast just 20 Km away from Eni Marine XII block to liquified the Gas and Export it[48].

1. Eni Congo FLNG II Terminal
2. Congo FLNG Terminal

As Eni an Italian entity was right now acting a largest gate way of Gas network into Europe which is carrying African gas into Europe which is similar to that of Germany carrying huge Russian Gas into Europe now the Dynamics has been changed after Russia stopped exporting gas from Nord Stream 2 due to the Damage to pipeline and some other political tensions the dynamics are changing many countries are moving towards the African energy sector to get cheaper price fuels Eni was catching that scenario using its Working interest and Earning huge.

Coal

Coal reserves: nil[47]

Coal Production: nil[47]

Coal Consumption: nil[47]

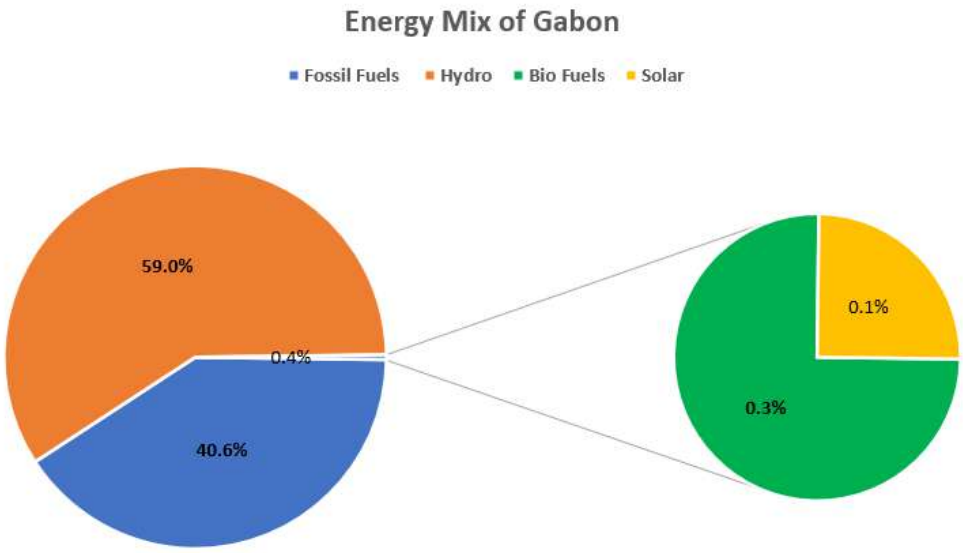
Nuclear Power: nil (as per WNA & IAEA)

3.14 Gabon

This was the Central African nation which is having a coastline of South Atlantic Ocean on its West and having a Neighbour Republic Of Congo on South and East and Equtorial Guinea and Cameroon on North which is also having the CFA franc as its Currency which was backed by Euro with France Guarente in return the Gabon should Padge their 50% Forex Reserves[49]. This country is more reliant on their Oil and Gas Sales which accounts ~51% of their GDP in 2022 which was 38.5% in 2021 [50] seems like they are getting more dependent on Oil money.

There are many factors that are affecting the Gabon Economy (internal or Geopolitical aspects somewhere) Gabon Nation is Feeling the pinch.

Energy Mix[51]:



As a Oil and gas Producing nation the Energy mix was mainly depend on Oil & Gas and also its hydro power (powered by 3 Hydro Projects/dams)

Oil

Oil Reserves: 2 billion Barrels[51][52].

Crude Oil Production: 0.191 – 0.25 million bpd[51] [50]

Crude Oil Exported: 0.185 million bpd[52]

Oil Refinery: Ste. Gabonaise de Raffinage - Port Gentil (21,000 bpd)

Oil & Gas: - E & P Briefing

- Rabi Kounga (On shore) (Reserves of ~60 Mbbl)
  Owner: Maurel & Prom (previous) : French Entity
  But as of 2024 according to Global Data it was transferred to Assala Energy Holdings as subsidiary of Gabon Oil Company (GOC) a state-Owned Entity[55] [56].
  Oil Production: ~0.1 million bpd
  Owner Ship: GoG
- Gamba/Ivinga(On shore)
  It is also Previously Owned by shell but currently Chrysaora E & P entity belongs to UK is Holding that Interest of shell in Gabon[57].
- Onal Field (Operated by Maurel & Prom with a O/p of 10,000 bpd seems like shelved)
- Atora
- Anguille (offshore)
- Etame (offshore)

  Above 3 fields are no operational Oil & gas Fields which are once Owned by Shell but in 2017 shell announced its disinvestment from Gabon by sell its asset s and working interests in the Oil and Gas fields to Chrysaor a Uk Based Company[57].

  All the Oil is Been Moved Via SBM which was Located which was 5 nM offshore to accommodate bigger vessels with draft of 7.25m Max DWT 150,000t Max distance bow to manifold (BCM) 142.43m as stated by Shipnext[58]
  In 2019 Gabon has set its target to increase its oil production to 0.22 million bpd by 2023 by passed a revised Hydrocarbons Code in 2019 as per ITA[50], which triggered the O/p from 0.18 million bpd in 2021 to 0.20 million bpd in 2023 almost close to actual set targets, This is due to 18 exploration and appraisal wells drilled in 2022 and 2023[53].

As per Over all view the Dominant player is the GOG and the large section of Disinvestment Occurred from many years and less attractive ecosystem is due to

the Coup in 2023[59]. And Due to lack of foreign investments for new explorations they are building infra of Old Discoveries to meet the Global Needs and Earn Profits in the Prest Volatile Fuel market.

Oil Pipelines Info:

3 Pipeline In Gabon

1. Rabi-Gamba Oil Pipeline (120km'18 inch)

   This Pipeline Connects the on-shore Rabi Oil field to an export terminal in Gamba port (SBM).

   It is Owned and Operated by Assala Energy which was Acquired by GOC from Carlyle Group (UK Entity) which means it was operated and owned by Gabon oil corporation.

2. Rabi-Cap Lopez Oil Pipeline (236Km'18 inch)

   It is Owned by a French entity Perenco which further connect this Rabi to one more Export Terminal Cap Lopez oil export terminal in the North of Gabon. With a Draft of ~20 meters bit deeper draft than gamba Port.

3. Onal-Coucal Oil Pipeline (120 Km'12 Inch)

   This was Owned By Maurel & Prom a French Entity for moving the crude from Onal to Coucal delivery point in Gabon.

   Pipelines Over view flow

Gas

Gas Reserves: 26 BCM[52]

Gas Production: 319.1- 463 million Cubic Metres[51] [52]

Gas Consumption: 319.1 million Cubic Metres[51]

Most of the Gas produced is used in house for the gas-powered Power Plant Owendo

Gas Infra Proposed

Cap Lopez LNG Terminal is proposed by Perenco a French with a cost of 1 billion USD for Exporting the Natural Gas

It seems like all new projects might get affected due to the Coup in 2023 which may have impact on this LNG project also as it was linked to the Previous Colony France.

It has been observing that there is huge colonial influence in the Gabon as we have seen that most of the Projects are been tagged to France /UK/USA hear Franc is the key one which initially owning the Assets and later it either been Moved to a US or UK Entity's.

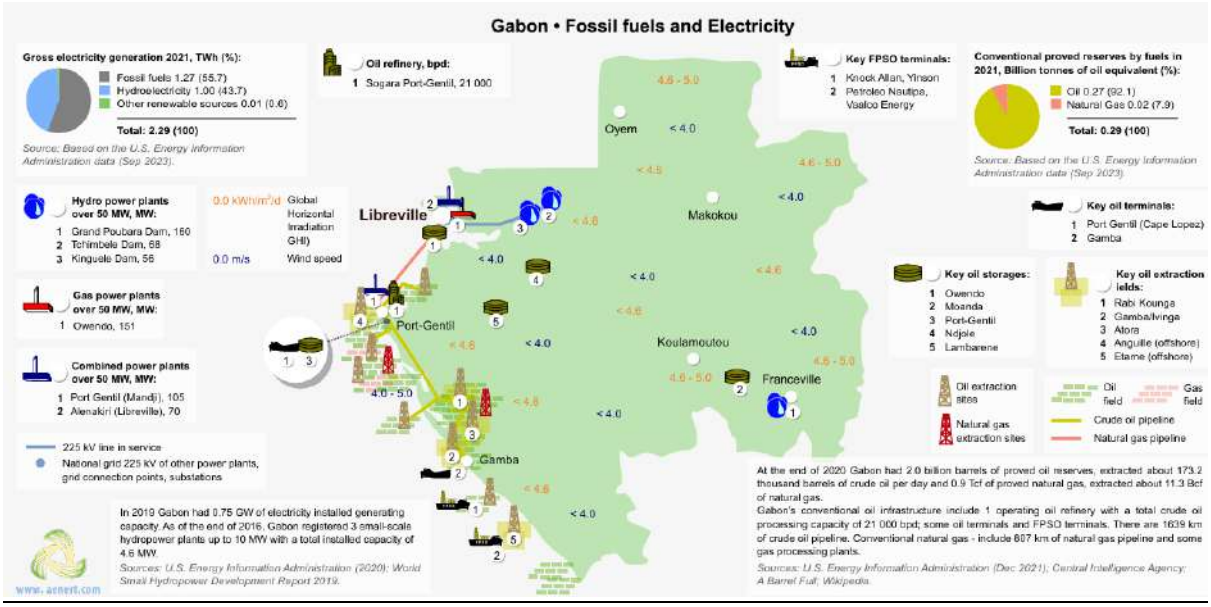
Coal

Coal reserves: nil[51]

Coal Production: nil[51]

Coal Consumption: nil[51]

Nuclear Power: nil (as per WNA & IAEA), below is the Over view of Gabon Energy Drafting



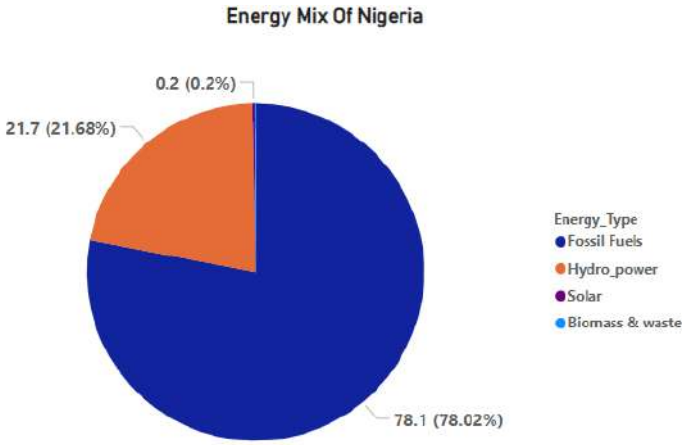
3.15 Nigeria

Nigeria is a Central west African Country Located in Gulf of Guinea Basin which is said to be the Energy Hub of Africa bordering with Niger on North , Cameroon on south and Benin on west and Chad on East which is also well know for it Huge Oil & gas Reserves and also well know for its piracy(it is one of the High risk regions prone to Piracy attacks) which has been controlled by intervene of Foreign Military like Frace , USA …etc (the interesting aspect is that the military presence to safe guards their countries Entity's Energy Assets[60].

Basic Info of Nigeria[61]:

Nigeria / Federal Republic of Nigeriaدولة ليبيا		
Capital: Abuja	Density: 218/km^2	Currency: Naira (₦) (NGN)
Official languages: English	Life expectancy at birth: 52.89 years	GDP (PPP): $1.365 trillion (2023 est.)
National Day: 01 October	Area: 923,769 km^2	GDP - per capita (PPP): $6,147 (2023 est.)
Population: 230,842,743 (2023 est.)	Coastline: 853 km	Internet country code: .ng

Energy Mix[63]:



As we know Nigeria is mainly Dependent on 2 thing one is its Hydrocarbon (includes Oil fired Power plants, Coal Fired Power Plants, Gas Fired power Plants) and 2nd is its Hydro Power with a Overall capacity of 2638 MW (which is Very Huge Production which is result is Exporting power to neighbouring countries like Niger, Benin and Togo[62].

Hydro Infra of Nigeria (Imp)(GEM):

Oil

Oil Reserves: 36.967 -37.50 billion barrels(proven)[64]

Crude Oil Production: 1.138 million barrels/day[64]

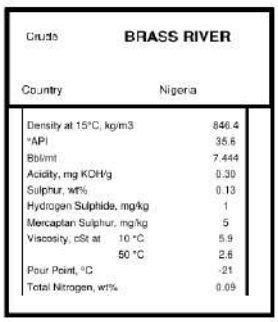
Oil Export: 1.388 million barrels/day[64](including condensed Oil)

Oil Consumption: 0.48 million bpd[63]

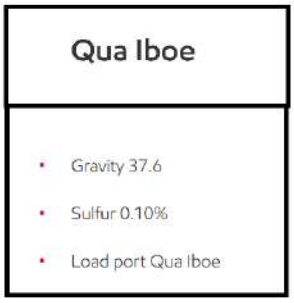
Nigeria's Internation Oil Bench marks

NIGERIA				
Brass River	86.94	-1.60	-1.81%	(1 Day Delay)
Qua Iboe	86.94	-1.60	-1.81%	(1 Day Delay)

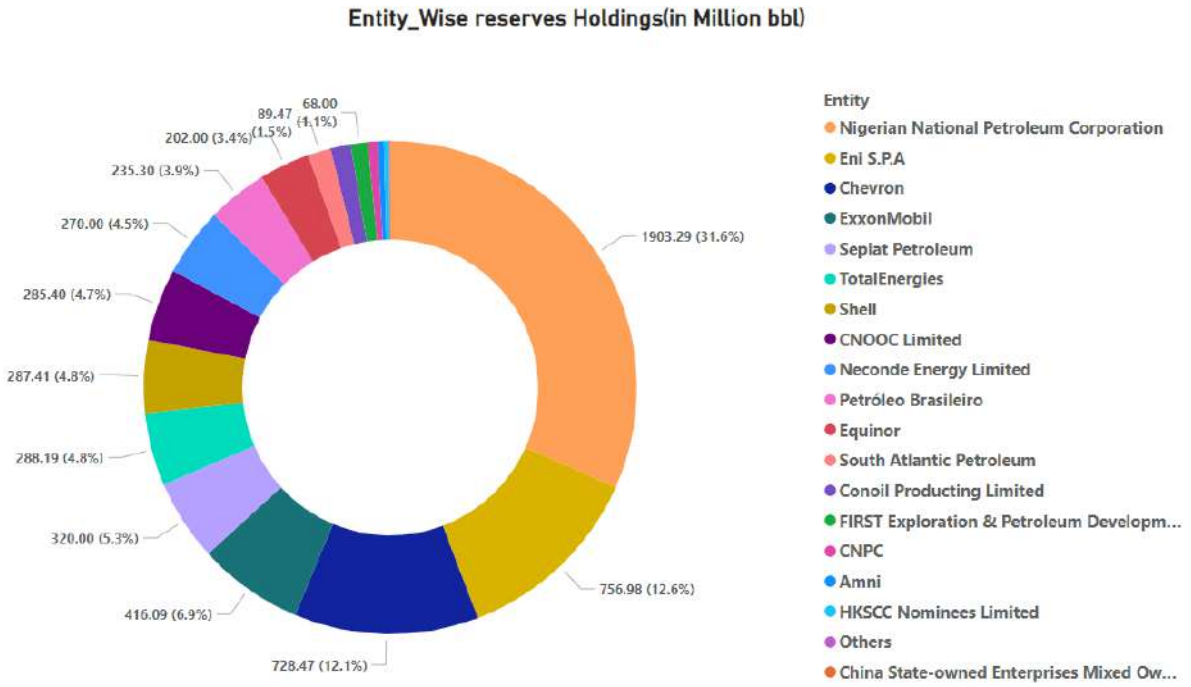
Both the Grades are Light Oil as their API Gravity was near to 38 among those 2 Grades Qual Iboe Grade is the Lightest one with less sulphur content which was found in the wells south part of Nigeria.



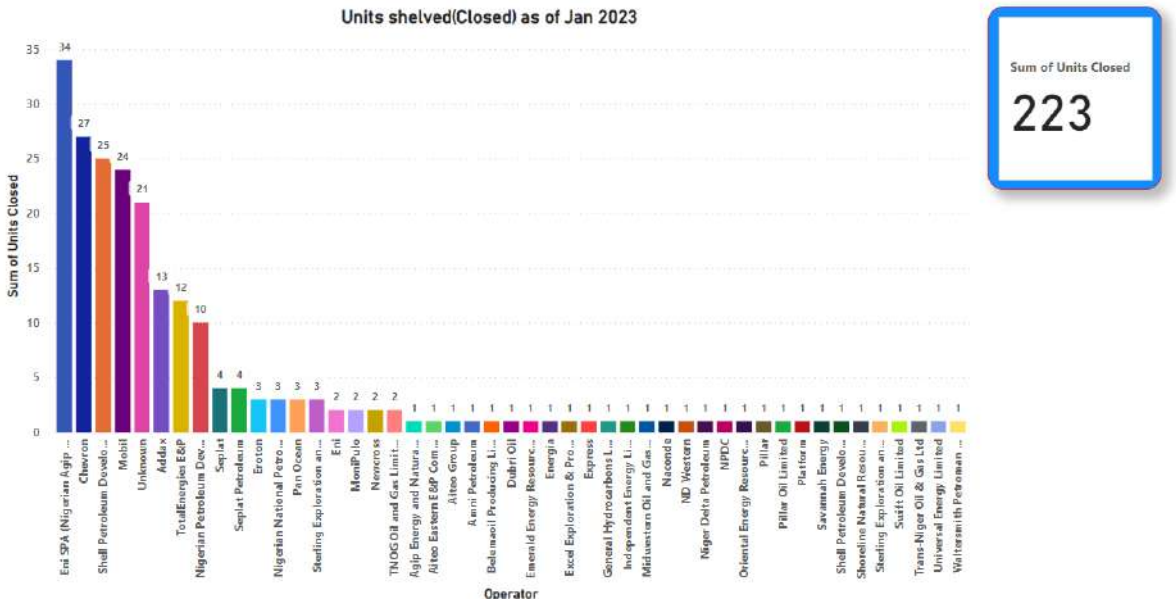
Crude	BRASS RIVER	
Country	Nigeria	
Density at 15°C, kg/m3		846.4
°API		35.6
Bbl/mt		7.444
Acidity, mg KOH/g		0.30
Sulphur, wt%		0.13
Hydrogen Sulphide, mg/kg		1
Mercaptan Sulphur, mg/kg		5
Viscosity, cSt at	10 °C	5.9
	50 °C	2.6
Pour Point, °C		-21
Total Nitrogen, wt%		0.09



Oil Holdings



As per the raw Data Obtained from GEM which was analysis I found that Majority of present operational reserves meant for production Nigeria National Petroleum Corporation a state run Entity with ~31% holdings Followed with Eni SPA a Italian Oil Giant is holding a huge chunk of those reserves ~756.98 million bbl of Oil followed with chevron a USA Private Oil Giant which is holding reserves ~728.47 Million bbl followed with once again an USA Private Entity Exxon Mobil with a holding of 416.09 million bbl next followed with a local Independent Oil Entity Spelate Petroleum with is a Nigerian Entity but also listed in London stock exchange which holds ~320 million bbl and next is Total Energies a French Oil giant with a holding of ~288.89 million bbl and next comes shell a UK based Oil giant which was present holding ~287 million bbl once the shell was the 2 leading Asset holder after the chevron but the scenario changed and closing its Assets ~25 units are shelved and then next comes the Chinese Entity CNOOC limited with a Holding Reserves ~285 million bbl and then next come again a Nigerian private Oil entity Neconde energy limited which holds ~270 million bbl of Oil holdings and then comes a latin American Entity Petrobras a Brazil Oil Giant which has a Holding of ~235 million bbl and then followed up with Equinor a Norway Entity which is having a Holding of 202 million bbl…. The list continuous as displayed in the above info graph.



It was the Info Graph which shows the number of units that are been shelved by the End of 2023 there are many reasons on is found that they are 1960's Discoveries and 2nd is that they are been scenarios where the Reserves in those units are Drained or they might be not economically viable assets due to increase in the Cost of extraction or some time the Licenses for the Units is been Expired or cancelled due to various reasons one of the best example is the Shells Oil Spills and Un professional Practices makes them to start disinvest from the Nigerian Oil and gas Industry and also we can have assumption due to the Local Thefts and Political Pressure are also one of the Reasons for this … etc the reasons list continuous.

Base of the Info graph it been Observed the Eni's subsidiary entity Nigerian Agri Oil company which was a joint venture with Nigerian state Oil Company way back in 1962 was the one of the largest shelved units of 34 and then followed with chevron a USA entity with a count of 27 units closed an then next comes Shell Uk Entity 25 Units Close …etc the list continuous this means that the Foreign Oil giants are having presence in the Nigerian waters since from their independence from British in 1960 it seems like these Oil giants are acting like leach in search of Energy reserves and obtain it at dead cheaper prise by bribing officials in the State owned Entity's and obtaining the Licenses at dead cheap prices and show casing the Wrong reserves holding via under writing and getting approvals from the Bribed official for new licenses and tax aviation benefits which was the money that need to be reaching the Nigerian people was either going into the pockets

of oil giants or the big people of the Nigeria which is resulted in creating chaos in the Local Political stability resulted in creating different rebel groups ,thefts , piracy …etc .

Oil Pipelines:

PipelineName	StartLocation	EndLocation	Sum of LengthKnownKm
Escravos-Warri-Kaduna Oil Pipeline	Escravos	Kaduna	674
Eni Kwale-Brass Oil Pipeline Network	Kwale	Brass	460
Idoho-Qua Iboe Terminal Oil Pipeline	Idoho offshore oilfield	Qua Iboe oil terminal	108
Rumuekpe-Bonny Oil Pipeline	Rumuekpe	Bonny	108
Ogoda-Brass Oil Pipeline	Ogoda	Brass	100
Nembe Creek Trunk Line	Nembe Creek	Bonny Oil Terminal	97
Tebidaba-Brass Oil Pipeline	Tebidaba	Brass	92
Kwale-Ogoda Oil Pipeline	Kwale	Ogoda	80
Bonny-Port Harcourt Refinery Pipeline	Bonny	Port Harcourt Refinery	55
Brass Creek-Forcados Oil Pipeline	Brass	Forcados	55
Clough Creek-Tebidaba Oil Pipeline	Clough Creek	Tebidaba	51
Oso-Qua Iboe Terminal Oil Pipeline	Oso offshore oilfield	Qua Iboe oil terminal	50
Pennington Oilfield-Pennington Export Terminal Oil Pipeline	Pennington offshore oilfield	Pennington offshore oil terminal	50
Rapele-Forcados Oil Pipeline	Rapele oilfield	Forcados	50
Edop-Qua Iboe Terminal Oil Pipeline	Edop offshore oilfield	Qua Iboe oil terminal	48
Nkpoku-Bomu Oil Pipeline	Port Harcourt	Bomu	47
Azuzuama-Tebidaba Oil Pipeline	Azuzuama	Tebidaba	35
Rumuekpe-Nkpoku Oil Pipeline	Rumuekpe	Port Harcourt	32
Trans Niger Pipeline	Nun River	Rumuekpe.	0
Total			2192

Source: GEM and Self Visualized

The Entity owning those Assets

PipelineName	Parent	Sum of LengthKnownKm
Escravos-Warri-Kaduna Oil Pipeline	Nigerian National Petroleum Corporation [100.00%]	674
Eni Kwale-Brass Oil Pipeline Network	Eni S.p.A. [100.00%]	460
Idoho-Qua Iboe Terminal Oil Pipeline	ExxonMobil [100.00%]	108
Rumuekpe-Bonny Oil Pipeline	Shell [100.00%]	108
Ogoda-Brass Oil Pipeline	Eni S.p.A. [100.00%]	100
Nembe Creek Trunk Line	Aiteo Group [45.00%]; Nigerian National Petroleum Corporation [35.00%]; TotalEnergies SE [10.00%]; Eni S.p.A. [5.00%]	97
Tebidaba-Brass Oil Pipeline	Eni S.p.A. [100.00%]	92
Kwale-Ogoda Oil Pipeline	Eni S.p.A. [100.00%]; Nigerian National Petroleum Corporation [unknown %]	80
Bonny-Port Harcourt Refinery Pipeline	Nigerian National Petroleum Corporation [100.00%]	55
Brass Creek-Forcados Oil Pipeline	Shell [100.00%]	55
Clough Creek-Tebidaba Oil Pipeline	Eni S.p.A. [unknown %]; Nigerian National Petroleum Corporation [unknown %]	51
Oso-Qua Iboe Terminal Oil Pipeline	ExxonMobil [100.00%]	50
Pennington Oilfield-Pennington Export Terminal Oil Pipeline	Chevron [100.00%]	50
Rapele-Forcados Oil Pipeline	Shell [100.00%]	50
Edop-Qua Iboe Terminal Oil Pipeline	ExxonMobil [100.00%]	48
Nkpoku-Bomu Oil Pipeline	Shell [100.00%]	47
Azuzuama-Tebidaba Oil Pipeline	Eni S.p.A. [59.18%]; Nigerian National Petroleum Corporation [unknown %]	35
Rumuekpe-Nkpoku Oil Pipeline	Shell [100.00%]	32
Trans Niger Pipeline	Shell [100.00%]	0
Total		2192

As per the above table it has been observed that Nigeria largest Operation pipeline is operated and owned by its state-owned Entity Nigeria National Oil Corporation.

Summary of the Above table

Entity	Sum of No of pipelines Involved	Sum of Km of Pipeline Influence
Nigerian National Petroleum Corporation	6	992
Eni S.p.A	7	915
Shell	6	292
ExxonMobil	3	206
Aiteo Group	1	97
TotalEnergies	1	97
Chevron	1	50
Total	25	2649

Eni was the One Which was Involved and has Ownership in the Majority in the Number of Pipelines in 7 Operational projects and it Is the second largest one Which involves and has ownership in large network of pipelines one of the biggest one is Eni Kwale-Brass Oil Pipeline Network with a length of 460 km it will be in the 2 place if Shell trans Nigerian Pipeline Come Online which boost the Length Coverage from 292 km to 4420 km network which can exceed all the networks others are having by adding a length of 4128 Km to the Existing network holding[65]. And next followed with ExxonMobil involved in 3 Pipelines Projects and have certain owner ship in it which is of around 206 km network and next African Private entity Aiteo Group is owning 1 pipeline of length of 97 Km and then Total Energy a French entity is having ownership in 1 pipeline length of 97 km and last Chevron is a USA oil giant which only holds only one pipeline with a length of 50km.

As a summary the Eni Italian Entity was the Dominant ones in the Nigerian Oil pipeline Infra.

Oil refinery:

Refining Capacity: 0.486 million bpd[64]

Additional Capacity added in 2023: 0.65 million bpd[66]

This additional Capacity was added by starting Dangote Refinery in Lagos a private Refinery where NNPC state-owned entity has a 20% stake which is one of the crude suppliers to this refinery as per Sap Global till 2025 it will be running at 0.37 Mpd capacity[67].which means the present Capacity will be ~1.36 million bpd.

Gas

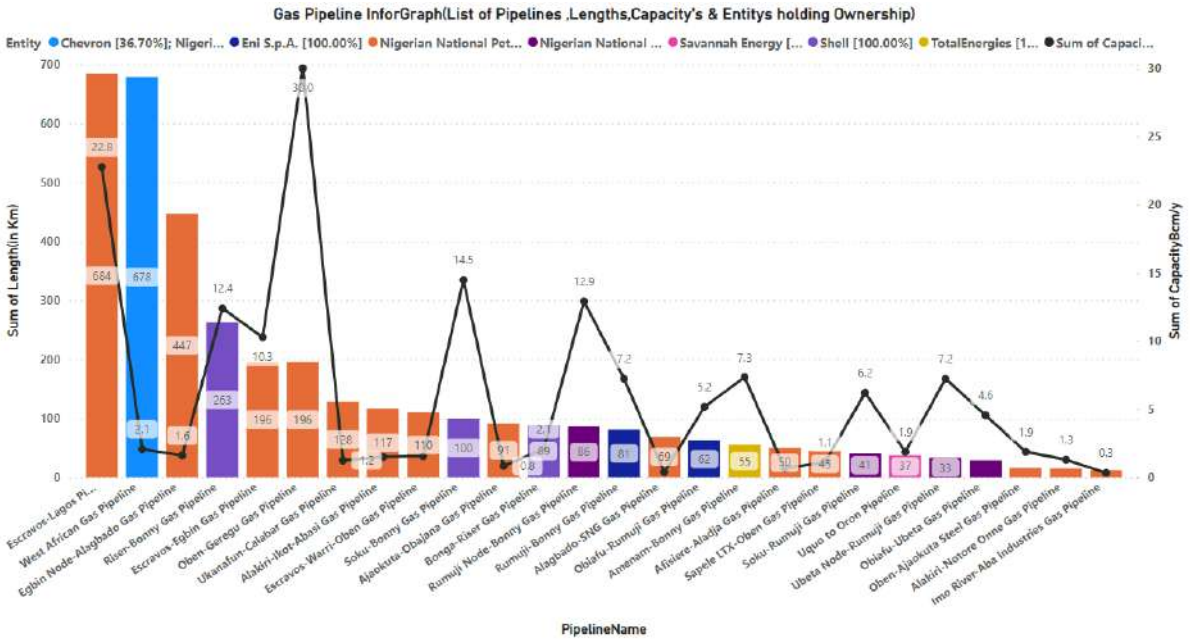
Gas Reserves: 5.9 trillion Cubic Meters[64] & estimates 62.9 trillion Cubic Meters.

Gas Production: 44.306 billion cubic meters[64]

Gas Exports: 32.190 billion cubic meters[64]

Gas Consumption: 18-20 billion cubic meters[63]

Gas Pipeline Infra:



As per the Analysis there are around 27 gas pipelines that are running from Nigeria all the Pipelines are running with in Nigeria except a pipeline that connect its neighbouring countries like Benin , Togo, Ghana with a length of 678 km and capacity of 2.07 BCM/day which was owned by respective countries Entity's with a certain share and 2 outside entities are involved Chevron a USA entity with a share of 36.7% of overall Ownership and next shell a UK based Entity 18% are the 2 Dominant Players in this Pipeline network along with the Nigerian state-owned entity holding a share of 25%.

As per the Observation Nigerian National petroleum corporation was the Leading One In terms of No of Pipelines its holds and Amount of Ownership it has and then followed with shell and Eni(which is having Dominance In Extraction of gas).

In this gas Infra after the Niger state owned entity Shell a UK based Entity is the Dominant Player in this gas Pipeline Network.

There are 2 more Pipelines that are under construction which are completely owned by Nigerian national petroleum Corporation.

PipelineName	Parent	Length(in Km)	CapacityBcm/y
Obiafu-Obrikom-Oben Gas Pipeline	Nigerian National Petroleum Corporation [100.00%]	127	20.69
Trans Nigeria Gas Pipeline	Nigerian National Petroleum Corporation [100.00%]	1300	36.2

Trans Nigerian gas Pipeline was the huge One which also act as part of trans Saharan gas Pipeline which was proposed which completely owned by Nigerian state-owned Entity's.

PipelineName	Countries	Parent
Nigeria-Morocco Gas Pipeline	Nigeria, Benin, Togo, Ghana, Côte d'Ivoire, Liberia, Sierra L	Moroccan National Board of Hydrocarbons and Mines ; Nigerian National Petroleum Corporation
Trans-Sahara Gas Pipeline	Nigeria, Niger, Algeria	Niger Ministry of Petroleum, Energy and Renewable Energies ; Nigerian National Petroleum Corporation ; Sonatrach
Ibadan–Jebba Gas Pipeline	Nigeria	Helios Investment Partners [100.00%]
Trans Nigeria Gas Pipeline	Nigeria	Nigerian National Petroleum Corporation [100.00%]

These are Some of proposed Gas pipelines one of the Biggest one are Nigeria- Morocco gas Pipeline of length of ~5660 Km (30 BCM/day) & 2nd One is the Trans Saharan Gas Pipeline with a length of 4128 km (30 bcm/day)(hear there was a company called Sonatrach a Algerian Sate-owned entity is involved in this Propose Trans Saharan gas pipeline which connect to Algeria gas Network and reaches the Europe via Morocco or Tunisia or direct reaching Spain, Portugal, Italy and further those entity or countries are supplying it to rest of Countries of Europe via pipeline or LNG ..etc

Coal

Coal Reserves: 344 million metric tons[63]

Coal Production: 44,000 metric tons[63]

Coal export: 12,000 metric tons[63]

Coal Consumption: 85,000 metric tons[63]

Coal imports: 77,000 metric tons[63]

Coal Units:

Mine Name	Owners	Production (Mtpa)	Coal Type(Thermal)
Okaba Coal Mine	Government of Nigeria	0.16	Subbituminous
Okpara Coal Mine	Government of Nigeria	0.003	Subbituminous

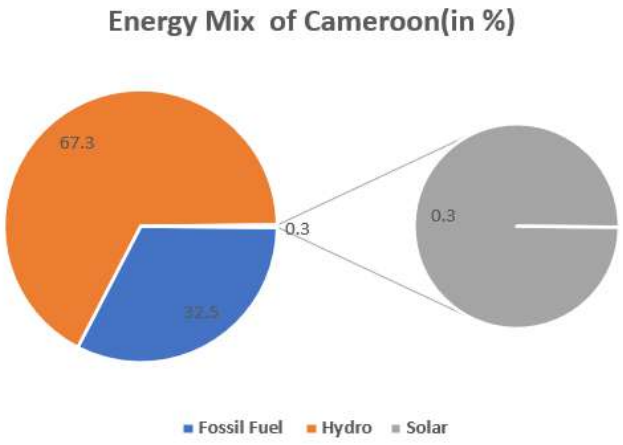
Nigerian Gov put less concentration on its Coal Production as they are mainly focusing on Gas & Oil which result Nigeria importing coal despite of having huge reserves

Nuclear Power: nil (as per IAEA)

3.16 Cameroon

It is the African Nation which was Located in the West Central part of the African Continent which was boarded with Equatorial Guinea On South and Central African Republic on east and Chad and Niger On North which is also well know hot spot for it Hydrocarbon reserves.

Energy Mix:



It has Been Observed that Cameroon is having High hydro power generations which addresses its countries Consumption need and then followed with Fossil fuels (Oil or Gas or Coal)

Oil

Oil reserves: 200 million bbl[68]

Crude Oil production: 20,800 bpd[68]

Product Oil Production: 63,000 bpd[68]

Oil Consumption: 37,000 bpd[68]

Oil imports: 20,200 bpd[68]

Gas

Gas Reserves: 135.07 billion Cubic Metres[68]

Gas Production: 2.67 billion cubic meters[68]

Gas Consumption: 0.986 million Cubic meters[68]

Gas Export: 1.60 billion Cubic meters[68]

Summary Table of Hydro carbons [GEM]

Operational Units				
Unit Name	**Fuel type**	**Operator**	**Oil Reserves (million bbl)**	**Gas reserves (in MCm)**
Logbaba	oil and gas	Gaz du Cameroun	2.8	4757.19
Padouk	oil and gas	Addax Petroleum Corp.	20	5663.2
			22.8	10420.39

Discovered /Under Development				
Unit Name	**Fuel type**	**Parent**	**Oil Reserves (million bbl)**	**Gas reserves (in MCm)**
Etinde	oil and gas	Kerogen Capital (10.9%); Hopu (18.4%);PJSC LUKOIL (37.5%);Bowleven (25%)	7	22936.4
Njonji	oil	Tower Resources	35.4	0
			42.4	22936.4

In operational Units the Gaz du Cameroun is a 60% owned by a UK base Oil entity Victoria Oil & Gas Plc which holds a gas reserve of 4.75 billion cubic meters a next is Padouk is owned by Addax Petroleum Corp which is the Subsidiary of Sinopec Group which is a Chinese state-owned Entity which is also holding huge Chunk of oil and Gas Reserves of ~20 Mbbl of Oil and 5.63 billion cubic meters. These numbers might be small in terms of overall production in the neighbouring Country Nigeria but it is a big thing to Cameroon.

Next the Projects that are discovered Etinde in 2023 which has a huge chunk of Gas ~22.96 billion Cubic Meters and 7 million bbl of oil where Kerogen Capital a London entity, HOPU a Chinese Firm, Lukoil is a Russian Entity and Bowleven is a UK base Entity in this Projects Lukoil a Russian Oil & Gas giant is the Highest share holder. And then next Oil field Njonji is owned by Tower Resources which is a UK Private firm holds ~35.4 million barrels of reserves.

All these finding approx. Numeric as per this the UK base firms and Chinese based Entities are Trying to get involved in the E&P of Cameroon

Oil Pipelines:

1 . Chad–Cameroon Oil Pipeline

Oil source: Doba Oil Field (in Chad)

Owner: Savannah Energy PLC Uk Entity [40%]; Petronas Malaysia state-owned [35%], Government of Chad [25%]

Capacity: 0.225 Mbpd, Length: 1070 Km

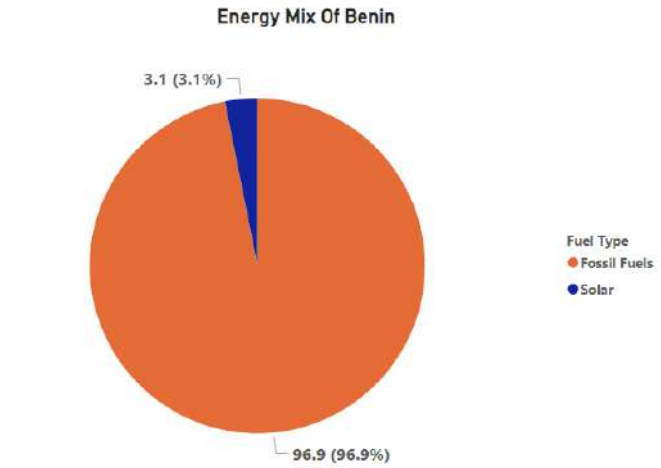
Oil from Doba oil field in Chad is moved to Kribi in Cameroon for export and in returns the Cameroon get Royality /transit fee.

Nuclear Power: Nil (as Per IAEA)

3.17 Benin (West African Nation)

It was a nation which was Located in the western part of Africa in Gulf of Guinea bordered with Niger on the East and Togo on west and Burkina Faso on north and having a south Atlantic coast which is also a part of CFA trap by following West African CFA franc as its currency (it good to hear that they are planning to move away from CFA dominance and moving their assts or forex reserves to Senegal which is a part of ECOWAS)

Energy Mix:



It has been observed that most of the Energy consumption is from fossil fuels either that gas & oil supplied by Nigeria or from some other sources

Oil

Oil Reserves: 80million Barrels (estimated 5 billion barrels)[68] , Source: AFREC.org

Oil production: nil [68]

Oil Consumption: 36,000bpd (129.6 million barrels per year) [68]

As there are active oil production units in large scale in Benin it highly dependent on Nigeria for it energy utilization

Gas

Gas reserves: 1.133 BCM (2p)[69]

Gas Production: nil[69]

Gas Imports: 19.05 million Cubic Meters[69]

Gas Consumption: 19.05 million cubic meters[69]

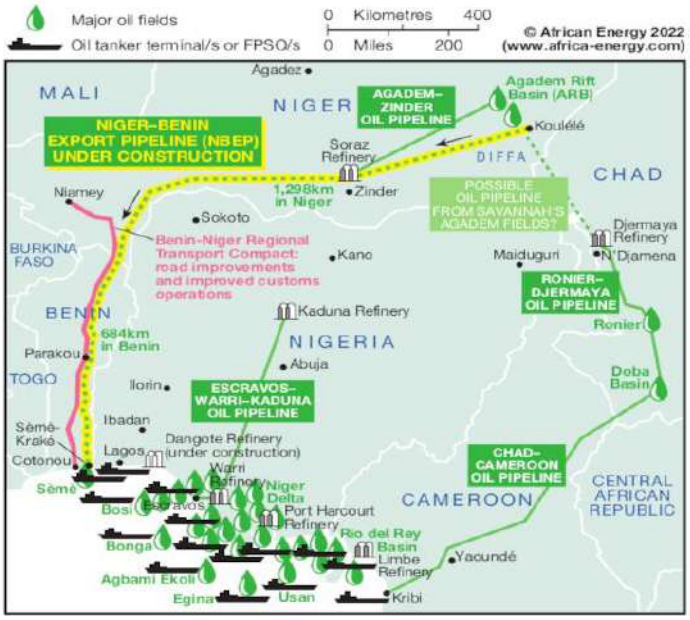
It means the most of the gas imported from Nigeria is used in house there is One more system in the Benin where it is a part of Nigeria Morocco gas Pipeline.

(Despite various multinational Companies like:
Total Energies (France base Company) which is been involved in exploration since 1960 once after the African nation independence.

UK Based Company savannah petroleum (savannah Energy PLC) is also a part of exploration in Benin oil and gas field which Explore and production of south eastern Fields in Niger (R1/R2 and R3/R4) and Nigeria (Exploration interest in Uquo, Accugas) is also a part of Exploration in Beinin.) and one more UK base Company but French owned one is also involved in Exploration Perenco.

Source: https://www.afsic.net/oil-companies-in-benin/

Oil Pipeline: Niger – Benin oil pipeline



The Niger- Benin oil pipeline projects Info:

Owner**: China Petroleum Pipeline Engineering Co**., Ltd along with partner (or mother company) to Chinese National Petroleum Corporation (CNPC).

(It's a Chinese Project Built by Chinese personals) which is a part of dead trap).

Capacity: 90,000 bpd

Distance: 1980km (20-inch Diameter) (In Niger 1275 km + In Benin 675 km)

Cost of project: 7 billion USD

Normally this projects connectivity was first proposed to move from Niger-Chad to Cameroon sea port but due to the Hits by BOKO Haram in and around Chad lake make the Chinese personals to move away from Chad and enter into contract with Benin by connecting Agadem Field in Niger connecting to a Soraz Refinery(20kbpd refining capacity, which produces only petrol , diesel and LPG) in Niger (which is a joint venture b/w Niger Gov and CNPC and build by Chinese) to Benin (port of Seme Terminal) in Cotonou to export Niger oil via SBM (4.5Mt/a) which was 14.5 km from the Port .

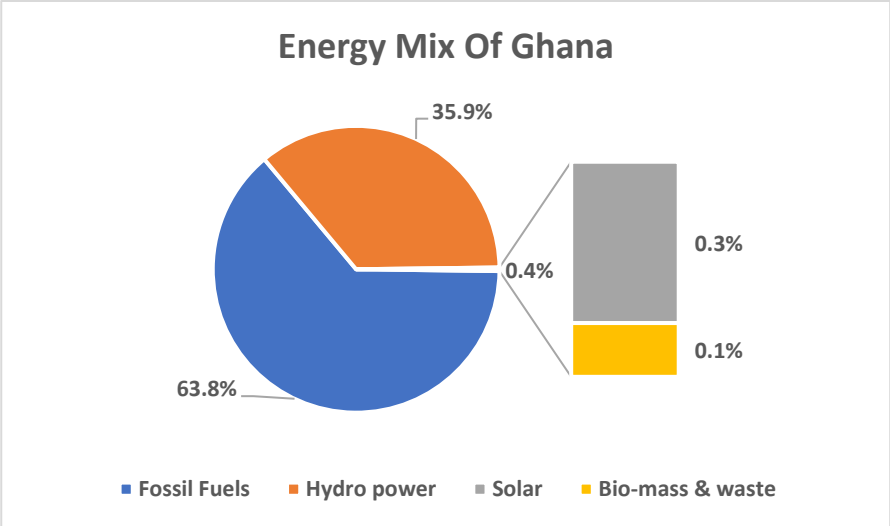
Gas Infra structure: Benin is connected to west African gas Pipeline (678km, capacity 200MCF/day) origin from Nigeria (Itoki Natural Gas Terminal in the Ogun State) passing through Lagos beach compression stations reaching Benin (Cotonou), Togo (Lome), Ghana (Takoradi) move east to via another pipeline Atuabo–Aboadze Gas Pipeline) to -- Tema (this Project main shareholders are Chevon (36.7%), Nigerian national Petroleum Corporation (25%), Shell Overseas Holdings (18%) in operation from 2006.

Refinery's: Nill & Nuclear power plants: Nill (as per IAEA)

3.18 Ghana

This was the one Of the West African Nation Country which was well know for Its Gold reserves in top 10 Gold Exports in the World which is now also a source for Oil & gas Units most of the oil and gas Reserves are been Found in the Recent decade (from 2007.) which was Bordering with countries like Togo on East and Ivory Coast on West, Burkina Faso on north and Gulf of Guinea is on its South with is also coast for South Atlantic Ocean. It is good that Ghana is not following Franc Currency in my opinion that might be the one of the reasons which Ghana is been flexible and is less dependent on other foreign nation approvals and taking decisions according to their Economical needs.

Energy Mix[70]:



It has been Observes that Most of the Hydro Power Plants are units Located on Volta River. Which is full up the majority of Ghana's energy needs, followed up with Fossil Fuels (Mosly gas as there is a Dedicated Pipeline From Nigeria is reaching Ghana).

List of Hydro Units in Ghana (Total: 1584 MW)

1. Kpong hydroelectric plant (160 Mw)
2. Aksombo hydroelectric plant (1020 Mw)
3. Bui hydroelectric plant (404 Mw)

This Capacity is ~60% of Nigerian Hydro Capacity there is one more new capacity coming up juale hydroelectric plant in 2026 adding 90 Mw to the present capacity.

Oil

Oil Reserves: 660 million bbl[70] & estimation 5 billion bbl

Oil Production: 0.13 million bbl/day[71]

Oil Export: 0.176 million bbl/day[70]

Oil Consumption: ~ 0.09 million bbl/day[70]

The exports data is 2019 ones where as the Production is of 2024 data that is the reason why the statistics of Total Production is Not sync with oil Exports & consumptions.

Ghana's Operational oil & Gas Units

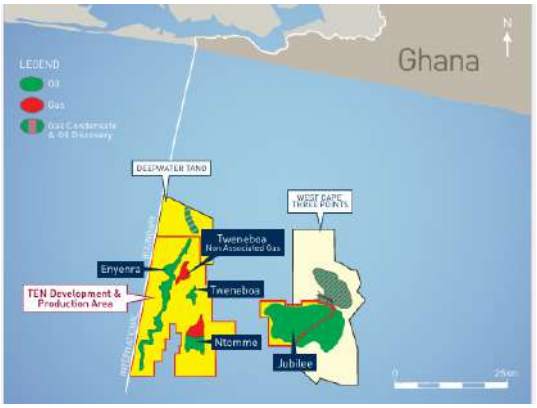
1. Jubilee field
2. TEN field

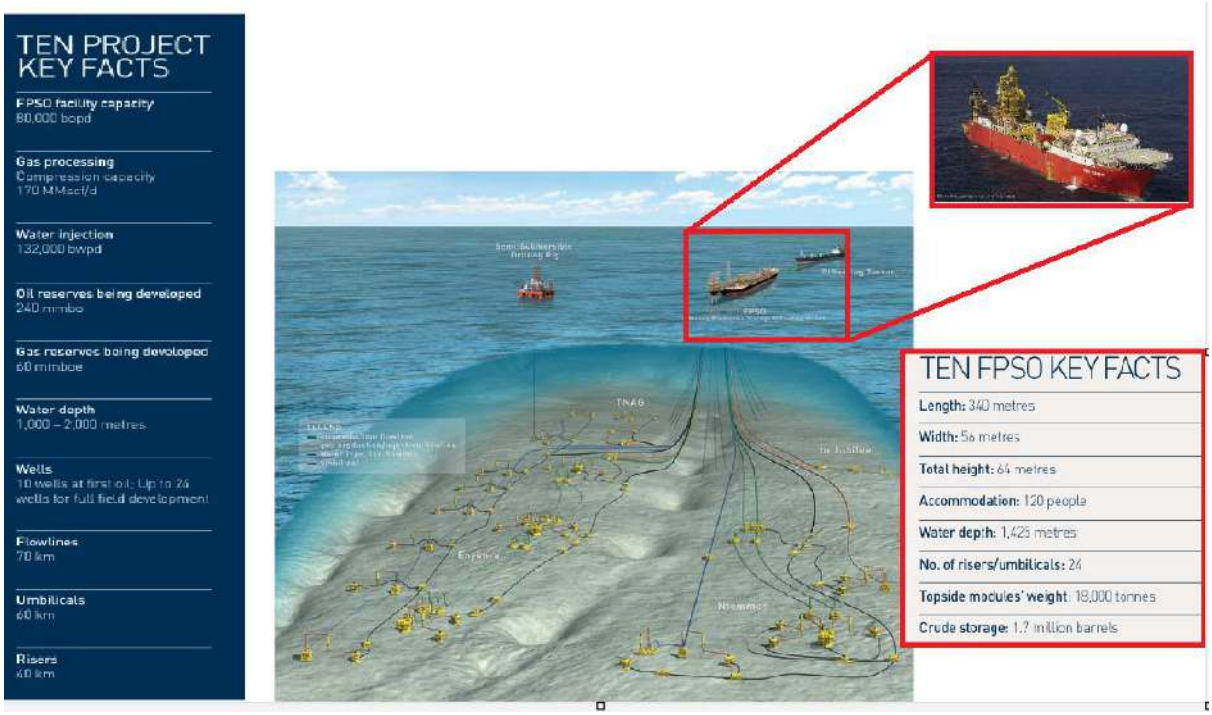
   Both of this are been Operated by Tullow Oil

   Owner ship: Tullow (operator) 47.175%, Kosmos 17%, Anadarko 17%, GNPC 15%, Petro SA 3.825%[72]

   Hear Tullow is a Uk base Entity whose ownership is tagged to Ireland holds majority of share and then followed by Kosmos is an USA private entity and then followed with one more USA energy private entity Anadarko with 17% of working interest and Ghana state-owned entity which is Ghana National petroleum corporation which holds 15% interest and last come a South African state-owned Entity Petro Sa with a working Interest of 3.825 % completely covering ~280 million barrels of Proven reserves[72].

   Location of those Oil & gas Fields





Source: [72]

The is one energy unit Under Development is

1. Eban/Akoma Project

   Which consists of the following units:

   - Eban Oil and Gas Field (Ghana)
   - Akoma Oil and Gas Field (Ghana)

Oil reserves: 104 million

Gas holdings: 11048.78 million Cubic meters (~11 BCM)

Ownership: Eni S.P.A. (Italian Entity) (42.5%); Vitol Holding II S.A. (Swiz entity) (34%); Ghana National Petroleum Corporation (10%); Woodfield's Energy Resources Ltd (UK Entity) (9.6%); Ghana National Petroleum Corporation (4%)

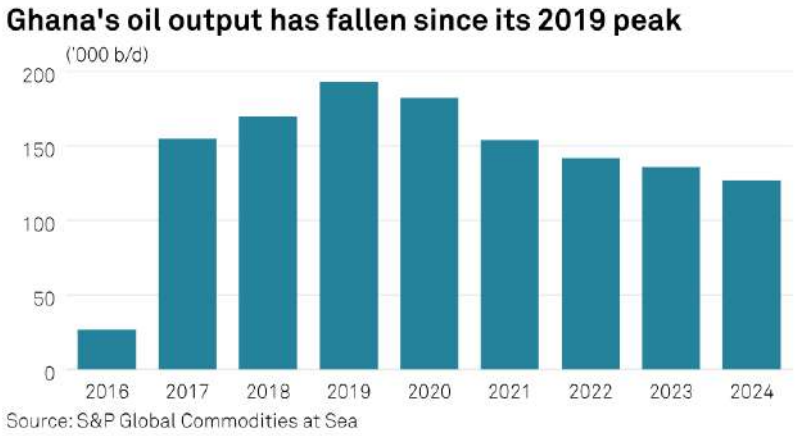
List of projects upcoming in future:

Discovered (Yet to start Development)			
Unit Name	**Fuel type**	**Parent**	**Discovery year**
Afina	oil	Springfield Group (84%); Ghana National Petroleum Corporation (16%)	2019
Pecan	oil and gas	Aker Group (50%); Lukoil (38%);Fueltrade (2%); Ghana National Petroleum Corporation (10%)	2012
Mahogany East and Teak	oil and gas	Tullow	2011

Reserves that are gone be up for production

Unit Name	Fuel type	Parent	Oil Reserves (in million bbl)
Afina	oil	Springfield Group (84%); Ghana National Petroleum Corporation (16%)	100
Pecan	oil and gas	Aker Group (50%); Lukoil (38%);Fueltrade (2%); Ghana National Petroleum Corporation (10%)	300
Mahogany East and Teak	oil and gas	Tullow	70
			470

Hear in the First Oil field Springfield Group is a Local Private Company of Ghana which holds majority of share in Afina oil Field with 100 million bbl of reserves, and next Pecan Aker Group is a Norway investment unit with 50% share and followed with Russian Lukoil entity with 38% shareholding and Fuel trade is the one of the local private entities with a share of 2% and followed with state-owned Oil entity GNPC (10%).



Despite of having huge Reserves the Productivity of Ghana is decreasing the global Inflation caused by Covid 19 and also the wars are influencing the investments flow into Ghana it has been state a small challenge that they need investment for drilling frequently as the geography is quite Different from other felids across world which was dig for once or twice and last for 40-60 years as stated by Ghana Official to S&P Global[73] which is making them to depend on the continuous investment to get their light crude out and export it.

Oil Infra:

Oil Refinery: 2 (1 operational 1 Shut down)

1. Tema Oil Refinery (45,000 bpd) closed due to poor maintenance & upgradation[74]
2. Sentuo Oil Refinery Ltd (1,20,000 -0.5 M bpd) Chines Build Refinery[75]

As per some of the Economists the present Tema oil refinery was using as storage tanks for feeding or get feeded by Chinese build Sentuo oil refinery, It seems like Chinese plans to get they investment in the Ghana Refinery and make them dependent on their Build refinery which is under Debt to China ,and we are hearing many news in retun to this Ghana has allotted some of its E&P blocks on east near the border to Togo for it E&P. there is a chance of upgrading the present refinery up plans are not going to do so they are completely concentrating on Chinese build oil refinery but having a phase 2 expansion plan to increase capacity to 0.5 million bbl/day. It seems like un scene debt trap when Ghana need to pay a huge debt or in return provide the Oil & gas well to clear that debt by which China extract the Oil and refine it in its Build Refinery and Sell it Other nations and Earn more Profits instead of letting those money reaches Ghana Gov.

Gas

Gas Reserves: 22.653 billion cubic meters

Gas Production: 1.59 billion cubic meters

Gas Import: 625 million cubic meters

Consumption: 2.224 billion cubic meters

Hear the huge number of imports are been from Nigeria connecting Benin, Togo and Ghana via Nigeria- Ghana Gas Pipeline which is further has plans to expand till Morocco.

As per the present reserve holders Tullow is the major gas reserve holder followed with Eni a Italian entity are the Dominant player in the Ghana gas market.

Gas Pipelines:

Operational once and the Genser pipelie is having Expansion plans

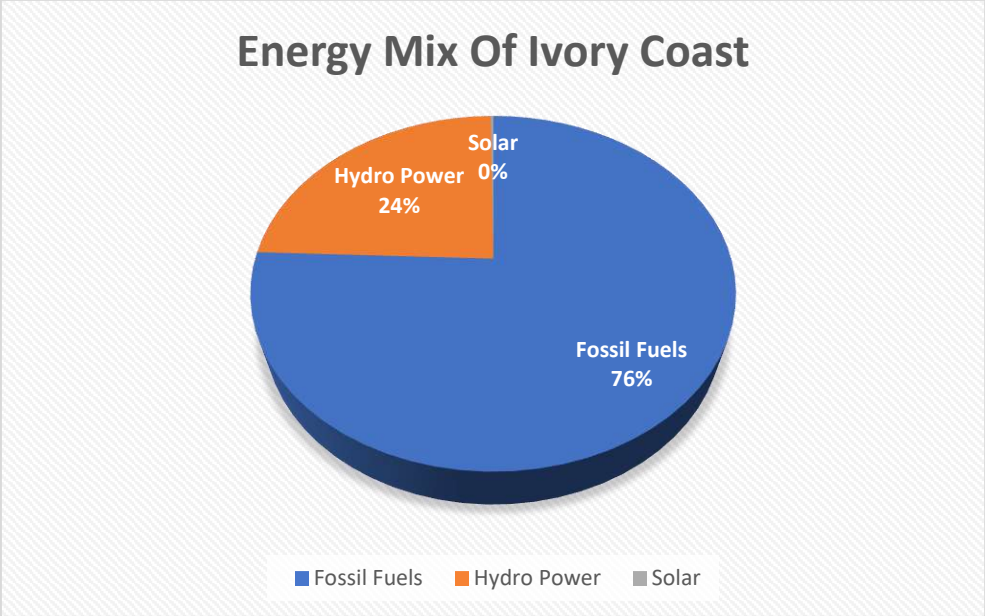
PipelineName	Entiys	Ownership Dominance
Atuabo–Aboadze Gas Pipeline	Ghana National Gas Company	Ghana State-owned
Jubilee–Atuabo Gas Pipeline	Ghana National Gas Company	Ghana State-owned
Genser Natural Gas Pipeline	Genser Power USA, LLC	USA Private Entity
Genser Natural Gas Pipeline	Genser Power USA, LLC	USA Private Entity

Nuclear Power: Nil (as per IAEA)

3.19 Ivory Coast

Ivory Coast is one of the west African nations which was also called as Republic of Côte d'Ivoire which is located in Gulf of Guinea Coast neighbouring countries like Guinea & Sierra Leon on West and Ghana on East and Mali and Burkina Faso on north with a Coast line in its south having a Coast line with South Atlantic Ocean with a coastal line of ~590 Km which is also well know for its Coca products and Gold Exports similar to that of Ghana.

Energy Mix[76]:



Ivory Coast is mostly dependent on the Fossil Fuel for its Energy generation which accounts of 76% off its total energy Production and then followed with the Hydro Power which accounts ~24% and at last solar power account 0.2% of the total production most of its Oil & gas power plants are located on the Coast.

Plant name	Fuel	Capacity (MW)
Agrekko Vridi power station	HFO	100
Agrekko Vridi power station	HFO	100
Azito power plant	NG/FO	253
Azito power plant	NG/FO	460
Ciprel power station	NG/FO	111
Ciprel power station	NG/FO	255

HFO=Heavy Fuel Oil
NG=Natural gas (Methane)
FO=Fuel Oil

Oil

Oil Reserves: 100 million barrels[76]

Oil Production: 33,000 bpd[76]

Oil Imported: 69,200 bpd[76]

Oil Consumption: 56,500 bpd[76]

Unit Name	Fuel type	Parent	Oil resrves (in mbbl)	Gas Reserves (in BCM)
Baleine Phase 1	oil and gas	Eni S.P.A. (90%), National Petroleum Operations Company (10%)	30	Unknown
Foxtrot	gas	Foxtrot International (24.0%), PETROCI (40.0%); SECI (24.0%); ENERCI (12.0%)	Unknown	75
Espoir	oil and gas	PETROCI (20.0%),Tullow (21.33%), Canadian Natural Resources (58.67%)	93	5.096

Source : GEM

Hear Eni is a Italian Entity which is Hold 30 million barrel of Oil reserves with the 90% of share in Baleine Phase 1 and then Foxtrot Gas Field where majority of share is to PETROCI a state-owned entity as there are 4 operational Gas fired power stations to addressed their need and next comes Espoir oil & gas Field which is House for 93 million bbl and ~5.09 BCM of gas this is just an estimation the majority of share is with the Canadian Natural resources which is good at its natural gas handling most having influence in the Western Canada in British Colombia

As summary the Canadian Entity is Holding huge Chunk of Operational Oil holding and For gas the Ivory coast state-owned entity is the Dominant ones .

But as per the Recent Discovery of Eni and expansion of its existing Balenine phase 2 which holds a reserve of 525 million barrel of light oil and 21 bcm of gas which make the Dominant player in Both Oil & gas if it comes on live[77].

Oil Pipeline : nil

Oil Refinery: Societe Ivoirienne de Raffinage – Abidjan (71,000 bpd)

Gas

Gas reserves: 0.589 trillion Cubic meters[78]

Gas production: 2.425 billion cubic meters[76]

Gas Consumption: 2.425 billion cubic meters [76]

Gas Pipelines:

Only one operational gas pipeline was there in Ivory Coast

Petroci Foxtrot Gas Pipeline

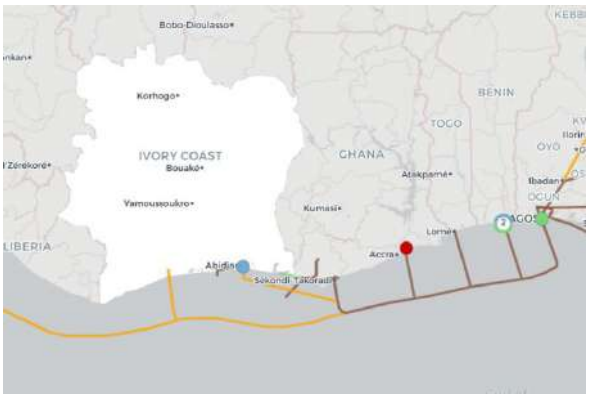
It runs from Foxtrot gas Field to Abidjan carrying the natural Gas (Methane) to its Gas power plants

Operator : Petroci (state-owned entity)

Capacity: 47.53 billion cubic meter per day

Length: 80 Km

Ther are 2 other gas pipelines proposed that are from 1. West African gas pipeline and 2. Nigeria – Morocco gas pipeline to get Nigerian gas via these pipelines as of now the Connection was online till Ghana.

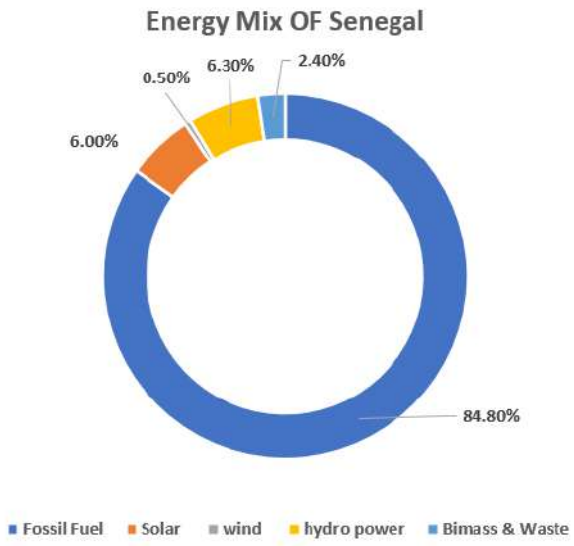


Nuclear Power: nil (as per IAEA Data)

3.20 Senegal

This is West African nation with a Coaster line of 531km on the south Atlantic Oceans boarder with Countries like Mauritania on North and Guinea Bissau on south and Mali a Landlock country on East and Caper Verde on its West in the South Atlantic Ocean and also The Gambia as a mouth to Senegal which also follows CFA currency but as per the recent news the Senegal is moving away from its CFA dependency[79].

Energy Mix[80]



It was Observed that most of the energy that is Produced is from the Fossil Fuels predominately from Crude oil imports from Nigeria which occupies a share of 84 % and then followed with Hydro as this region getting near to the Sahara the Hydro power quite decreases by hear it occupies a share of 6.30 percentage and next followed with its solar power which accounts for ~6%.

It has been found that most of the Solar fields located in the north part of the Country

Oil

Oil reserves: 1.7 billion barrels [81]

Oil production: 0.1 million bbl/day[82]

Oil Imports: ~20,500 bpd[80]

Product Consumption: 57,500 bpd[80]

List of Oil units in Senegal: only 2 Units are present

1. Ahmeyim Oil & gas Field (Bp: 60%, Kosmo:30%, petronas:10%)
2. Sangomar (Woodside Energy Group :82%, Petrosen 18%)
   Hear the Ahmeyim Oil & gas Field Holds ~ 4.6 trillion Cubic Meters of Natural gas which was hold by BP a UK Entity of 60% and Kosmo Energy an US Energy with 30% and petronas Malaysian Entity holds 10%)
   And Second One Sangomar fields is operated by an Austrian Entity Woodside with 82% working interest. Which holds 225 million bbl of oil and 0.862 trillion cubic meters of natural Gas.
   In this oil industry of Senegal Woodside an Austrian entity is the Dominant player.
   Oil Pipeline: nil
   Oil Refinery: Ste. Africaine de Raffinage refinery (27,000 bpd)

Gas

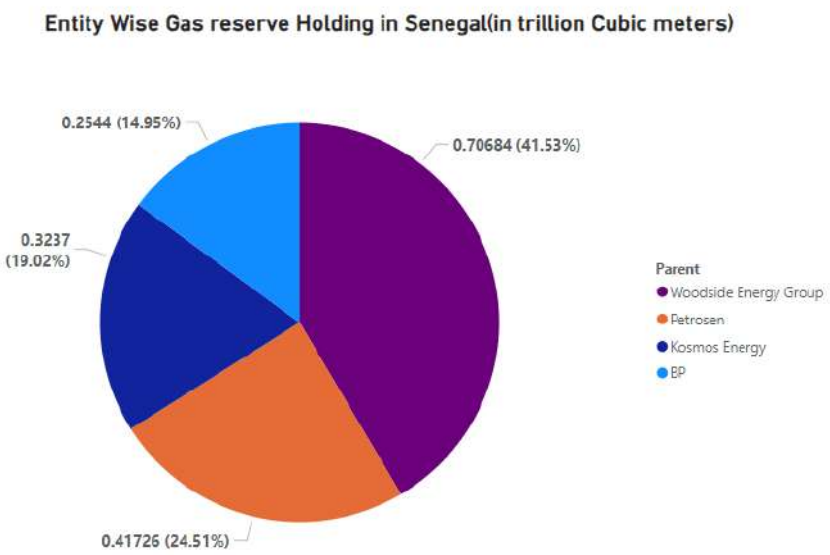
Gas Reserves: 12.34 trillion Cubic Meters[81]

Gas Production: nil/yet to start from offshore[83].

Gas Consumption: 60.003 million cubic meters[80]

List of gas Field in place: as of now the count was 3

1. Sangomar Oil & gas Field (Woodside Energy Group :82%, Petrosen: 18%)
2. Yakaar-Teranga gas Field (Kosmos Energy Ltd: 90%, Petrosen:10%)
3. Greater Tortue Ahmeyim gas Field (BP: 60%, Kosmos Energy Ltd. :30%, Petrosen:10%)
   Hear petrosen is the Senegal state-owned entity in the Greater Tortue Ahmeyim gas field the share of petrosen of 10 % is further divided in 50/50 as it is shared b/w Senegal & Mauritania via a agreement[84].



As the analysis of the Senegal Gas reserve holds it has been found that woodside an Australian Entity was holding huge gas reserves Discovery's and holds a 0.70 trillion cubic meter of Gas reserves which is ~41.53% of total gas discoveries in their portfolio and then followed up with Senegal state owned entity Petrosen which holds 0.417 trillion Cubic meters which account 24.51% of total discoveries and then Kosmos energy a USA private Entity which holds 0.323 trillion cubic meters of gas and last Bp is a UK base Entity which holds 0.254 trillion cubic meters of Gas which accounts 14.95% of total discoveries.

As there are some news popping up that BP is try to get out of Senegal (means it is looking for disinvestment from Senegal by selling its stake)[85]

Coal

Coal Reserves: nil[80]

Coal Imports: 0.894 million metric tons[80]

Coal consumption: 0.894 million metric tons[80]

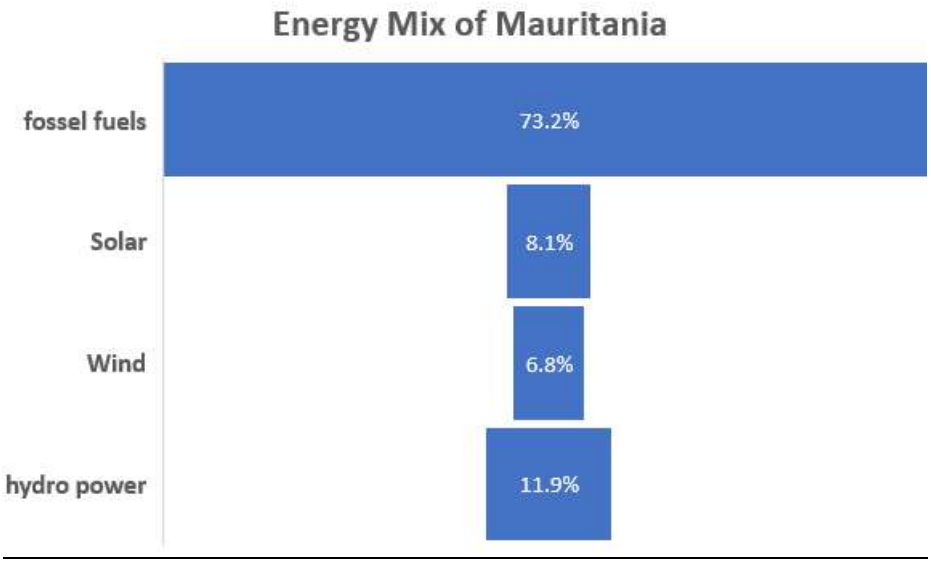
Most of the coal is been imported from south Africa, Mozambique, Tanzania as per OEC data.

Nuclear power: nil (as per IAEA data)

3.21 Mauritania

This is the nation is a part of African Continent which was located in the western side of African continent which is having a portion on world largest hot desert Sahara which is boarder with countries like western Sahara in north , Senegal in south, Mali is on East and having its Coastline on the South Atlantic ocean which is also well know for its Iron ore Exports and also for its huge gold Exports.

Energy mix[86]:



Most of the energy is obtained from the Fossil fuels both gas & Oil powered power plants.

Gas & Powered Plants

1. Banda gas-to-power project (LNG, HFO) 120 MW (in construction)
2. Somolec power plant (Natural gas) (180 Mw) (operational)
3. Tasiast mine power plant (HFO, FO) (60Mw) (Operational): private run
4. Nouadhibou thermal power plant (Crude HFO) (120Mw)

All these combined 480 mw of power is the capacity of the power plants run on fossil fuels. The private entity which was involved in running somolec is a Canadian mining company rest of the plants are been run by state-owned Electric board entity Mauritanian Electricity Co and it seems like there are no Coal fired power plants in the country.

Oil

Oil reserves: 20 million bbl[86],but BOE is ~1.69 billion bbl

Oil imports: 17-20,000 bpd[86]

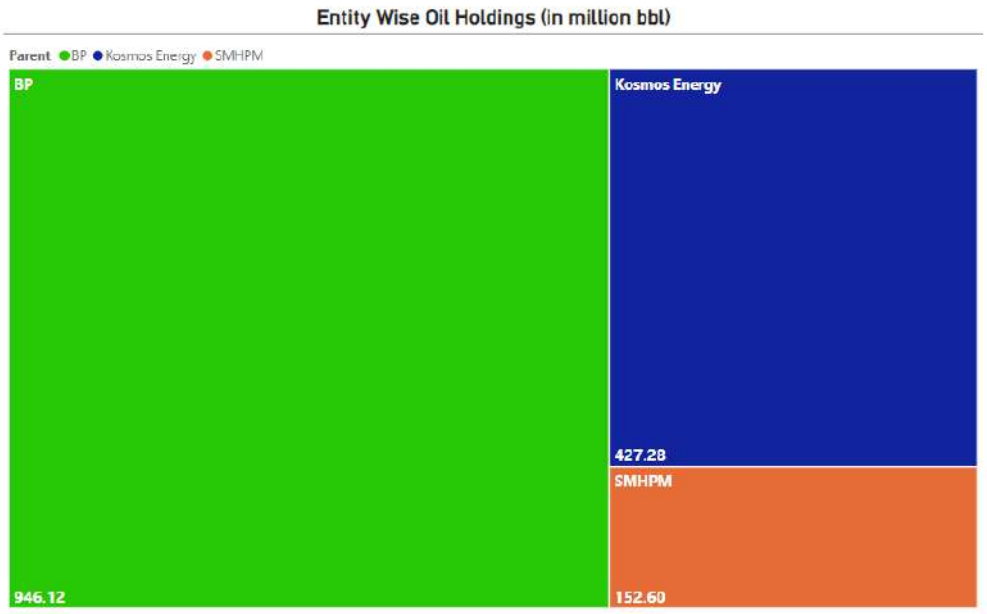
Refined oil Consumption: 27,500 bpd[86]

Oil Extraction info [GEM]

Hydro carbon in Mauritania (Oil & Gas)

Unit Name	Fuel type	Sum of Oil Reserves(in Mbbl)
BirAllah	gas	170.52
Orca	oil and gas	1,300.00
Tortue	oil and gas	226.00
Total		**1,696.52**

The above are the info of the oil reserves which include the Condensed oil reserves (which is also said to be Condensed gas oil).



When we are analysis the Entity's that are involved and having ownership of these unts it has been found that Bp(British petroleum) an Uk base entity is the Dominating one which holds 946.12 million boe/bbl of oil reserves which is 55.7% of total holding in Mauritania followed with Kosma energy an USA Entity who is the 2nd dominant player which holds ~427 million bbl/BOE of oil reserves and then next SMHPM Mauritania sate-owned entity which holds 152.6 million bbl which accounts ~8.9% of their countries oil Discovers is the Dominant player in this oil sector in Mauritania .oil pipeline : nil

Gas

Gas Reserves: 1.4 trillion cubic meters(2P)[87],Prove : 28.317 BCM[86]

Gas Production: yet to start[86]

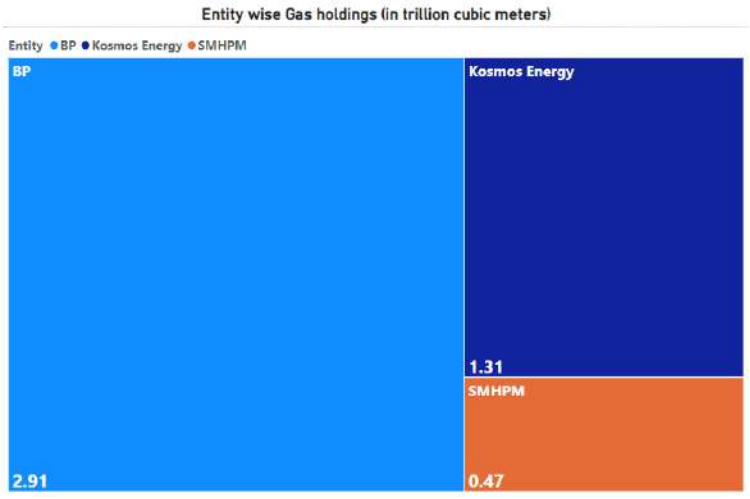
Gas import: 100 kg as per world bank data

Gas Extraction info

Hydro carbon in Mauritania (Gas)

Unit Name	Fuel type	Sum of Gas Reserves (in trillion cubic meters)
BirAllah	gas	0.36
Orca	oil and gas	4.01
Tortue	oil and gas	0.32
Total		**4.69**

As per the above data obtained from Gem it has been observed that Orca Oil 7 gas field is huge amount of gas reserves which is ~4 trillion Cubic Meters of Gas



Base on the ownership or interest shares tagged to those extraction units Bp was once again the Dominant player in the gas sector of Mauritian with 2.91 trillion Cubic meters of Gas Reserves and then followed with Kosmos an USA entity which was holding 1.31 trillion gas reserves and last SMHPM is a Mauritania State-owned Entity holds 0.47 trillion cubic meters of their countries Discovered gas Reserves. And Nigeria-Morocco gas pipeline proposed to connect to this country.BP & Kosmo plans to place FSPO BirAllah LNG Hub at Nouakchott port

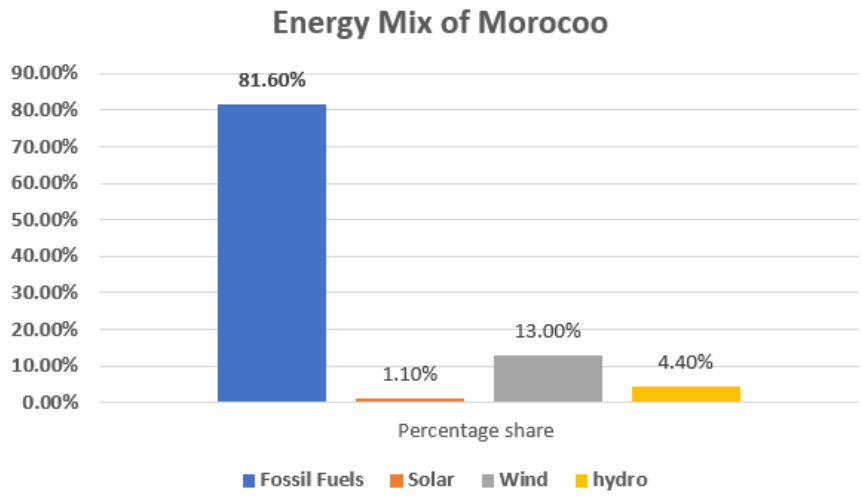
Coal reserves: nil[86]

Nuclear power: Nil (as per IAEA data)

3.22 Morocco (North Africa)

It is a country which is country which was located in the Northern part of African Continent which is also sometimes referees to the western meditation region which has boarders with Spain & Portugal on north Mauritania on south Algeria on the East and Atlantic ocean coast on the West and also having Mediterranean sea on north connecting Both Demitarian sea and Atlantic which is well known for its Chemical and Fertilizer Exports along with Phosphoric Acids (Mostly from its Occupied Western Saharan Region).

Energy Mix[88]:



As per the CIA world fact bool data Morocco was hight dependent of Fossil fuels which accounts for ~81% of their energy needs and then followed by Wind power which accounts for 13% and then hydro power at last Solar Power. Source: GEM

Plant name	Fuel	Capacity (MW)
Ain Beni Mathar power plant	LNG	470
Kenitra power plant	HFO/FO	105
Kenitra power plant	HFO/FO	105
Kenitra power plant	HFO/FO	105
Mohammedia 2 Power Plant	HFO	100
Mohammedia 2 Power Plant	HFO	100
Mohammedia 2 Power Plant	HFO	100
Mohammedia power station	CR	150
Mohammedia power station	CR	150
Tahaddart power plant	LNG	400
Tan Tan power plant	Disel	116
Total Capacity		**1901**

LNG =Methane Gas
HFO=Heavy fuel oil
FO=Fuel oil
CR=Crude oil

Oil

Oil reserves conventional: 0.7 million bbl[88]

Un-conventional oil reserves: 53 billion bbl[anet](shale oil)

Oil production: 0.371 million bbl/day[88]

The shale oil which unconventional can be extracted using fracking technique which was used by USA and become a large oil exporter of Light crude in world but hear the Shale oil production statistics are not publicly available may be the production is very small quantity.

Gas

Gas Reserves: 1.54 billion cubic meters[88]

Shale gas reserves: 3.67 trillion Cubic metres[anet]

Gas import: 950 million cubic meters[88]

Gas Consumption : 1.05 billion cubic meters[88]

Gas fields:

1. Anchois Phase 1 Gas Field

Operator: Energean

Ownership: Chariot Energy (USA entity) (30.0%); ONHYM (Morocco state-owned entity) (25.0%); Energean (Israel Entity) (45.0%)

Reserves: 39.388 billion cubic meters(2P)

Production capacity: 413.42 million cubic meters

Gas Infra:

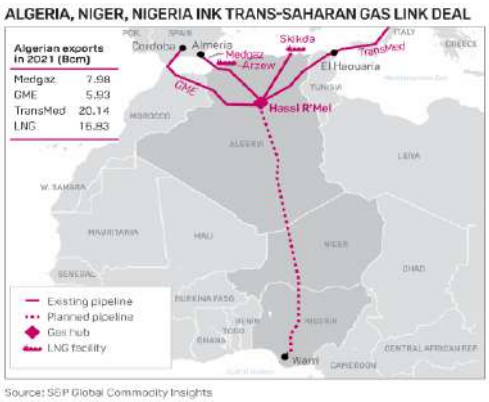
Gas Pipelines Infra:

Maghreb- Europe (LNG Gas line): Present not in operations as its main origin is from Algeria to, Morocco, Spain, Portugal which was halted after the Expiry of Agreement b/w Algeria and Morocco and Due to its political tensions, the agreement was not renewed. This pipeline connected Algerian gas fields with the port of Tarifa in Cadiz, Spain via Morocco, which allows approx. 9Bcm of Gas and brings earning the Moroccan government over 50 million euros annually as a transit fee which was used to power their station this is Due to political stand on Western Saharan Dispute However, Algiers has decided to cut off the supply in 2021, which brought up the energy Deficit in country making them import the Fuel and gas indirectly from north America which reaches Europe and was sent to Morocco, Not Via the Meghred-Europe Pipeline as Sapin stated it consume more time and bit complex to reserve the Fuel movement via the same pipeline.

After the Gas Pipeline Cut from Russia both The Algeria and Morocco are Competing to Tap the European Energy Market planning to export More Natural Gas,.

1) Morocco has Moving steps To Establish Nigeria-Morocco Gas Pipeline (Connecting 13 Countries on the Way) (Budget $19 Billion)

2) Algeria is Planning Signing MOU with Nigeria and Niger (Trans Saharan Gas Link)



The Gas Pipeline is used by Morocco for its in-house Consumption and also most used to connect the existing Maghreb-Europe Pipeline connecting Spain and Portugal via Tangier Port, Morocco. And it is having[89].

Coal

Coal reserves: 14 million metric Tons[88]

Coal production: nil[88]

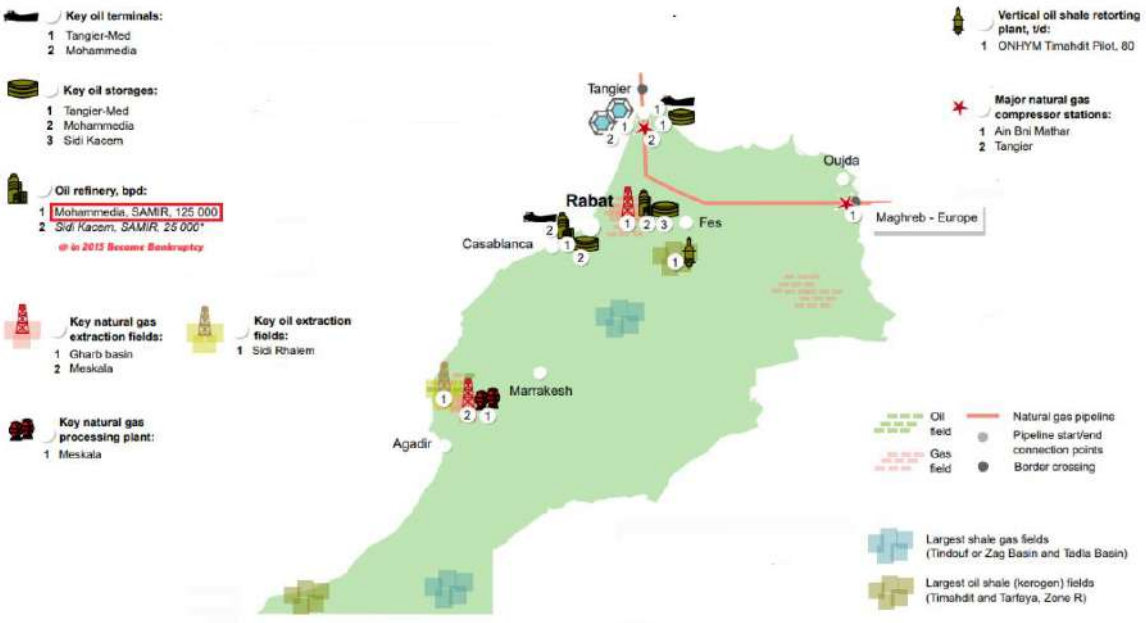
Coal Imports: 9.32 million metric tons[88]

Coal Consumption: 9.32 million metric tons[88]

It is been observes that most of the Coal assets is located towards the north east part of the Country where there are no actives Coal mines.

As a summary in the vast large oil & Gas sector of Morocco the Energean an Isrealy entity is the Dominant player in the Gas energy holding followed with Chariot Energy an USA entity is the 2nd Dominated entity in the Morocco Energy market.

Over view info graph of Morocco Energy assets

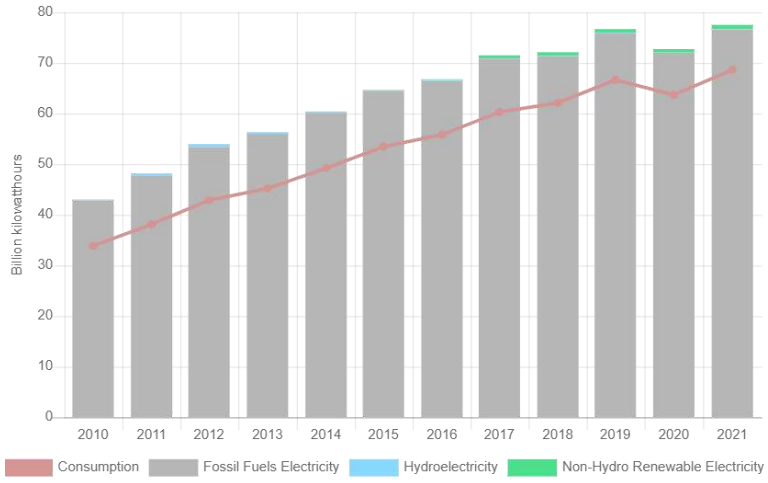


Nuclear power: Nil (as per IAEA Data)

3.33 Algeria

It is a part of African Continent which is located in the North Western part of Africa Located in between Morocco & Libya (lies West and East) and Mauritania, Mali, Niger on South West, South, South East and it is having Tunisia on North east and having balearica Sea which is a part of western mediterranean sea has a costal line of 998Km, and this nation is also a part of Sahara Desert and is a part of Mena Region also and also a member of OPEC.

Energy Mix[90]:



It has been found that most of the Energy production is from Fossil Fuels 98.9% of the energy share. And solar accounts 0.9% of total share. Hydro power accounts 0.1% of the total energy share. Algeria is having a capacity of ~23,254 Mw of Plants which was mostly all of them are power with the Natural gas most of these plants are been run by state-owned entity Sonelgaz SpA

Oil

Oil reserves: 12.2 billion barrels[90][91]

Oil Production: 1.02 million bbl/day [92]

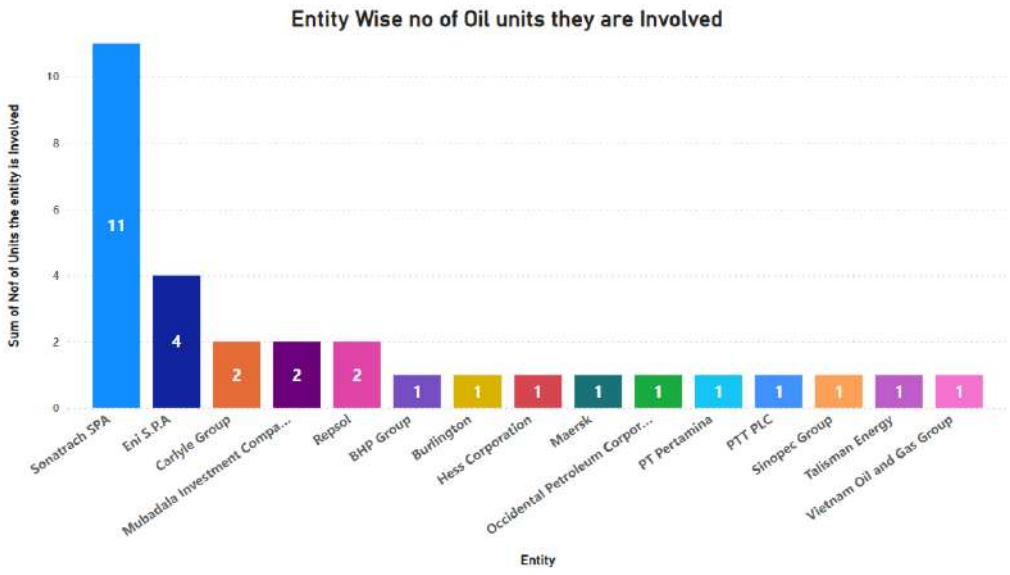
Oil Export: 0.477 million bbl/day[92]

Oil consumption: 0.45 million bbl[90] [91]

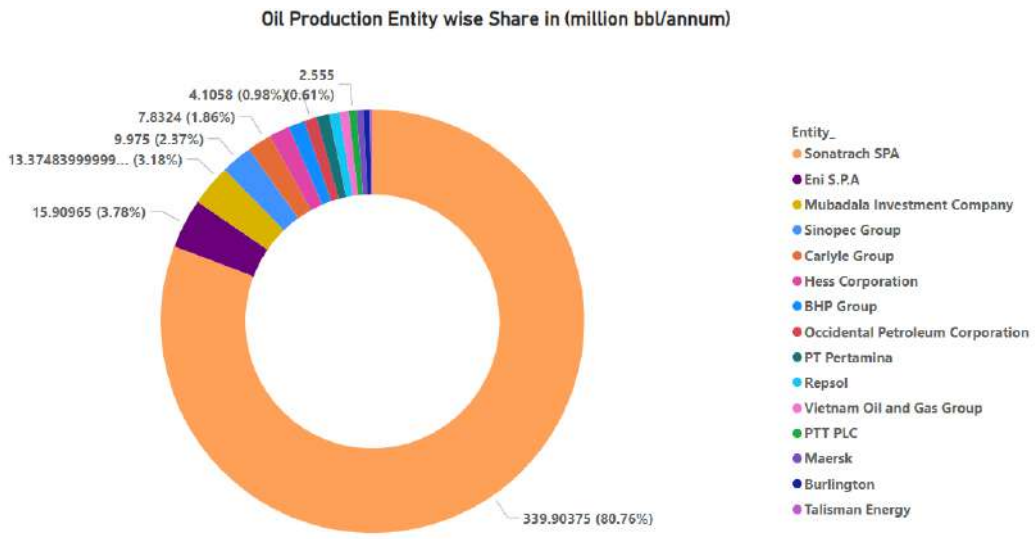
Refined capacity: 0.67 million bbl/day[92]

I have Collected data of operational oil extraction units from which most of the proven reserves data is under hidden (on back of the Pay Wall) but obtained some inputs.and find out that the entity involved in the Ourhoud Oil Field are the one of the largest Dominate entity's in the Oil Reserve holding which is ~1.90 billion bbl of oil the entity's involved are Sonatrach SPA Algeria state owned -Entity (accounts 0.68 billion bbl of Oil (which is 36% of total share),Mubadala Investment Company which is a UAE state-owned Entity holds 0.46 billion bbl of oil (24.6%);Carlyle Group is an American private entity holds 0.27 billion bbl(14.4%);Occidental Petroleum Corporation is also USA entity holds 0.171 billion bbl of oil (9%);Eni S.P.A. (0.095 billion bbl)(5%);Maersk (0.095 billion bbl)(5%), Burlington (0.076 billion bbl)((4%)and Talisman Energy (0.03 billion bbl)((2%).

As a summary Sonatrach Algerian State-owned was the Dominant player in the oil holding followed with UAE entity Mubadala Investment Company is the 2 player who holds huge oil reserves.



I had listed down the Count of the units the individual entity's involved it seems like Sonanatrach SPA a Algerian state-owned entity is the lead involved in 11 operational units and then followed up with Eni an Italian Entity involved in 4 Units and next Carlyle Group a us Entity is the 3 leading entity in terms of count and the list continuous as per the Above info graph, source of raw data is GEM.



The Above Is the info graph of the oil production by entity wise Sonatrach SPA Algerian state-owned entity was in the lead in summing up all of its productivity o/p from the units it has been involved and next comes Eni (Italian entity) was the in the 2 position next Mubadala Investment Company(UAE state-owned entity) was in the 3 position in terms of the Productivity outcome .

Oil pipelines:

PipelineName	Length in Km	StartLocation	EndLocation
Haoudh El Hamra-Arzew Oil Pipeline	821	Haoudh El Hamra	Arzew
Haoudh El Hamra-Skikda Oil Pipeline	646	Haoudh El Hamra	Skikda
Beni Mansour-Algiers Oil Pipeline	145	Beni Mansour	Algiers
El Borma-Mesdar Oil Pipeline	272	El Borma oilfield	Mesdar oilfield
Haoudh El Hamra-Bejaia Oil Pipeline	672	Haoudh El Hamra	Bejaia
Hassi Berkine-Haoudh el Hamra Oil Pipeline	292	Hassi Berkine	Haoudh El Hamra
In Amenas-Haoudh el Hamra Oil Pipeline	630	In Amenas	Haoudh El Hamra
Mesdar-Haoudh el Hamra Oil Pipeline	108	Mesdar oilfield	Haoudh El Hamra
In Amenas-Algerian-Tunisian Border Oil Pipelin	265	In Amenas	Algerian-Tunisian Border
Haoudh El Hamra-Arzew Oil Pipeline	801	Haoudh El Hamra	Arzew
Hassi Berkine-Haoudh el Hamra Oil Pipeline	292	Hassi Berkine	Haoudh El Hamra

The Above list of the oil pipelines are been mostly connect to 4 refinery's or the export terminal's in it Med Coast.

PipelineName	Ownership of the pipeline	Capacity (in mtpa)
Haoudh El Hamra-Arzew Oil Pipeline	Sonatrach [100.00%]	34
Haoudh El Hamra-Skikda Oil Pipeline	Sonatrach [100.00%]	30
Beni Mansour-Algiers Oil Pipeline	Sonatrach [100.00%]	4
El Borma-Mesdar Oil Pipeline	Sonatrach [100.00%]	2
Haoudh El Hamra-Bejaia Oil Pipeline	Sonatrach [100.00%]	11.4
Hassi Berkine-Haoudh el Hamra Oil Pipeline	Sonatrach [100.00%]	15
In Amenas-Haoudh el Hamra Oil Pipeline	Sonatrach [100.00%]	8.9
Mesdar-Haoudh el Hamra Oil Pipeline	Sonatrach [100.00%]	12
In Amenas-Algerian-Tunisian Border Oil Pipelin	Sonatrach [100.00%]	7.8
Haoudh El Hamra-Arzew Oil Pipeline	Sonatrach [100.00%]	11
Hassi Berkine-Haoudh el Hamra Oil Pipeline	Sonatrach [100.00%]	15

It has been found that all the Pipelines are owned and operated by state-owned entity Sonatrach with a over all capacity of 151 mteric tons per annum

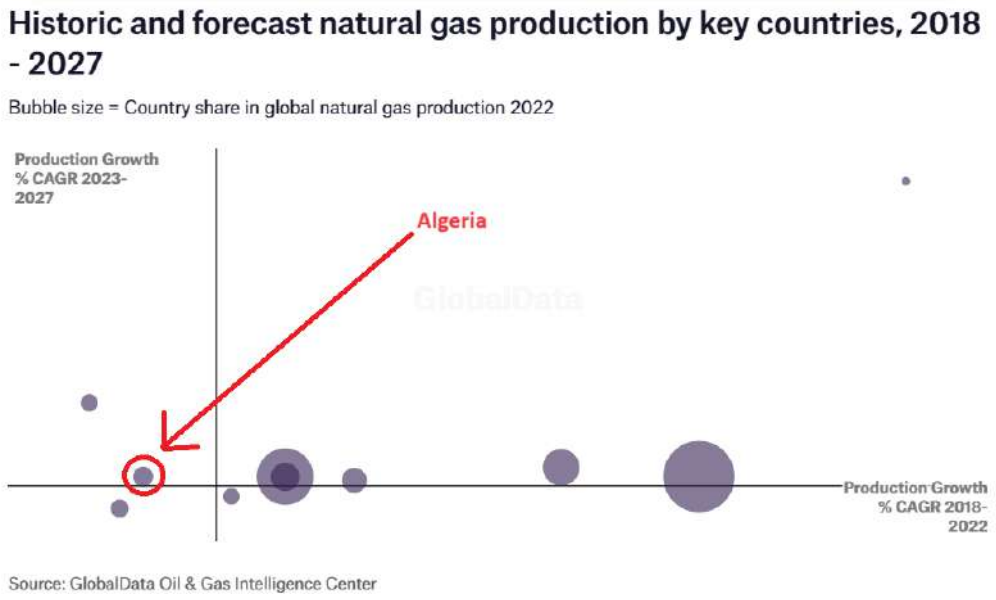
Gas

Gas Reserves: 49.07 trillion cubic meters(2P)[90][91],Proven : 4.5 trillion cubic meters[92]

Gas production: 100.51 billion cubic meters[92]

Gas Export: 48.9 billion Cubic meters[92]

Gas Consumption: 46.945 billion cubic meters[91]



USA, Quatar, Australia are the Leading ones in the Gas exports followed up with Russia Algeria was in the 8th position b/w Indonesia & Trinidad (Carrabin Island Country)

Gas production Over View

Field name	Constituent entity	Production start year	Operator	Participants	Natural gas production in 2022 (mmcfd)
Hassi R'Mel	Laghouat	1961	Sonatrach	Sonatrach	3,015
Rhourde Nouss	Illizi	1978	Sonatrach	Sonatrach	1,081
Alrar	Illizi	1970	Sonatrach	Sonatrach	724
Tinrhert Project	Illizi	2017	Sonatrach	Sonatrach	685
In Salah Complex	Tamanrasset	2004	Groupement In Salah Gas	Sonatrach; Equinor; Eni	576
Gassi Touil	Ouargla	1963	Sonatrach	Sonatrach	413
TFT Wet Gas	Illizi	1999	Groupement TFT	Sonatrach; TotalEnergies; Groupement TFT	362
In Amenas	Illizi	2006	In Amenas Gas Consortium	Sonatrach; Equinor; Eni	322
Reggane North	Adrar	2017	Groupement Reggane	Repsol; Sonatrach; Energean; LetterOne Holdings; BASF	255
Ohanet	Illizi	1961	Sonatrach	Sonatrach	189

Source: GlobalData Oil & Gas Intelligence Center

The Above table are the largest gas Producing Units in Algeria Sonatrach Algerian state-owned one was the Leading one in the most of the top gas producing units one of it is Hassi R Mele which is having 428 billion cubic meters of gas and then followed up with BP and Equinor. when compare to the Sonatrach Bp & Equinor contribution was very small.

Gas Pipeline: [GEM]

Operational Gas Pipelines List (Start & End points)

PipelineName	StartCountry	EndCountry	Sum of LengthKnownKm
Hassi R'Mel-Arzew Gas Pipeline	Algeria	Algeria	2557
Trans-Mediterranean Gas Pipeline	Algeria	Italy	2475
Medgaz Gas Pipeline	Algeria	Spain	1514
In Salah Gas Pipeline	Algeria	Algeria	830
Haoudh El Hamra-Arzew Gas Pipeline	Algeria	Algeria	795
Hassi R'Mel-Skikda-El Kala Gas Pipeline	Algeria	Algeria	784
GR-5 Gas Pipeline	Algeria	Algeria	770
Hassi R'Mel-Skikda Gas Pipeline	Algeria	Algeria	575
Hassi R'Mel-Skikda II Gas Pipeline	Algeria	Algeria	575
Rhourd Ennous-Hassi R'Mel I Gas Pipeline	Algeria	Algeria	535
GR-4 Gas Pipeline	Algeria	Algeria	531
Tidikelt-Tamenrasset Gas Pipeline	Algeria	Algeria	530
Hassi R'Mel-El Aricha Gas Pipeline	Algeria	Algeria	521
Rocade East-West Gas Pipeline	Algeria	Algeria	509
Medjedel-Bordj Ménail Gas Pipeline	Algeria	Algeria	437
Hassi R'Mel-Isser Gas Pipeline	Algeria	Algeria	436
Ilizi-Djanet Gas Pipeline	Algeria	Algeria	379
GR-7 Gas Pipeline	Algeria	Algeria	345
El Borma-Gabes Gas Pipeline	Algeria	Tunisia	294
Sougueur-Hadjret En Nouss Gas Pipeline	Algeria	Algeria	273
Sougueur-Arzew Gas Pipeline	Algeria	Algeria	217
El Aricha-Beni Saf Gas Pipeline	Algeria	Algeria	197
Bir Rebaa Nord–Menzel Ledjmet Est Gas Pipeline	Algeria	Algeria	185
Gassi Touil-Hassi Messaoud Gas Pipeline	Algeria	Algeria	150
Mocta Douz-Beni Saf Gas Pipeline	Algeria	Algeria	122
Total			**16724**

Ther are Around 32 Gas pipeline present or origin from Algeria with a total pipeline network length of 16,724 km of operational pipeline with a over all capacity of which has a capacity of moving 2.03 trillion Cubic Meters of gas.

Pipeline running out of country:

1. Trans-Mediterranean Gas Pipeline (to Italy) (2475 km & 33.5 billion cm/annum)
2. El Borma-Gabes Gas Pipeline (to tunasia)(294 km & 3.244 Bcm/annum)
3. Medgaz Gas Pipeline (to spain) (757Km & 10.7 Bcm/annum)

   Over all gas Exports via Pipeline is ~47.44 billion Cubic meters of gas is moved to Europe via pipeline which means ~47% of Algerian gas which was produced is move to Europe via Italy, Spain, Tunisia.

List of Oil & gas units Under Development/Discovered in Algeria

Unit Name	Fuel type	Owner	Oil Reserves (in mbbl)	Gas reseves (in bCm)
Ahnet	gas	Sonatrach (100%)	8.09	103.026
Gassi Touil Satellite (Phase 1)	gas	Sonatrach		20.397
Hassi Mouina Nord et Sud	gas	Sonatrach	-	-
Tinerkouk	gas	Sonatrach (100%)	-	6.983
Bir Seba Phase 2	oil	Sonatrach (25%);PetroVietnam Exploration Production Corporation (40%);PTT Exploration & Production Algeria (35%)	-	-
Hassi Illatou	oil	Sonatrach	123	-
Adrar	oil and gas	CNPC	151	
Ain Tsila	oil and gas	Sunny Hill Energy (38.3%);Enel (18.4%);Sonatrach (43.4%)	108	101
Bou Goufa	oil and gas	PTT Exploration and Production Public Company Limited (PTTEP) (24.5%);Sonatrach (51%);CNOOC Limited (24.5%)	-	-
Hassi Messaoud Sud (Satellites)	oil and gas	Sonatrach	-	-
Reg Mouaded	oil and gas	BG Group (49%);Sonatrach (51%)	-	-
Rhourde er Rouni II	oil and gas	Cepsa;Sonatrach	-	-
Tihalatine South	oil and gas	Sonatrach (51%);Enel (13.5%);ENGIE sa (9.8%);Repsol (25.7%)	-	-

Coal

Coal reserves: 59 million tons[90][91]

Coal Production: nil[90][91]

Coal Import: 85,000 Metric Tons [90][91]

Coal Consumption: 85,000 Metric Tons[90][91]

Most of its Electricity produced is been exported to Neighbouring Countries like Morocco & Tunisia ~0.6 trillion MW from its excess supply.

At last State-owned Entity Sonatrach is the Dominant player is Every Division of its Energy sector having less dependency on foreign oil giants.

Nuclear power: nil (as per IAEA Data)

Analysis on Price Difference Caused by Decision from One of the Former OPEC Member & their Impact of Indian Oil sector

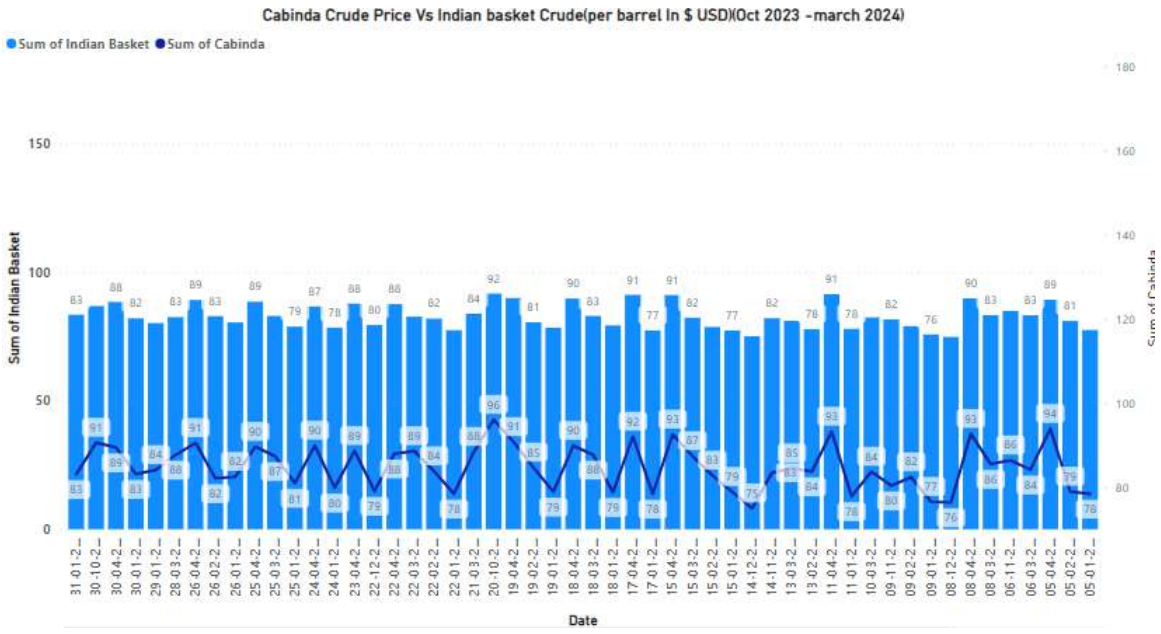
In 2023 Quater 4 there was a news Coming from Fossil fuel sector of Africa

This is where Angola has no restrictions of oil Production Quotas as OPEC set target of 1.11 million bbl of oil o/p per Day which is bit difficult for Angola to achieve as there is slow investment flow into Angola for its investment which is backfired result in reduction of o/p in the same time again there are production cuts from OPEC which make Angola a bit un comfortable and make them exit from OPEC reference Reuters.

This analysis is what impact happened due to exit of Angola from OPEC and their Impact on India basket Crude Price

Angola has 3 types of Grades of oil For my analysis I had Collected data for Cabinda Crude Price from Oct 23- April 24.

ANGOLA				
Cabinda	86.39	-1.70	-1.93%	(5 Days Delay)
Nemba	83.24	-2.40	-2.80%	(5 Days Delay)
Dalia	83.74	-1.70	-1.99%	(5 Days Delay)



Using One Way Anova Test to find the significant Difference b/w the oil Prices of cabinda Crude Oil Price and Indian basket Crude Price

Results of the Anova Test:

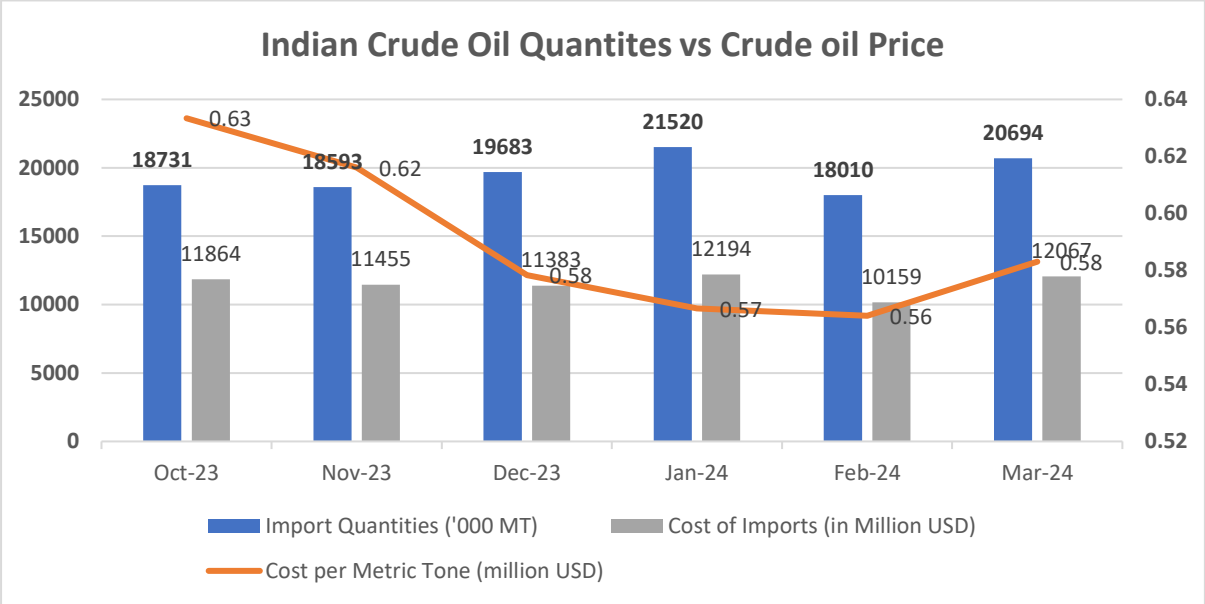
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Cabinda	62	5286.25	85.2621	27.99035127		
Indian Basket	62	5158.83	83.20694	20.52837898		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	130.9343	1	130.9343	5.397269266	0.021824	3.918816
Within Groups	2959.643	122	24.25937			
Total	3090.577	123				

if P is <=0.05	*the alternative hypostasis : there is a Difference b/w the Means of Cabinda Crude Prices & Indian Basket Prises*
if P is >0.05	Null hypostasis there is no difference blw the Prices

It has been Found that we reject the Null hypostasis and Accept the Alternative hypostasis and found out that there is a significant Differences b/w the Price which we need to consider as per the info graph it has been observed the Price of Angola crude and Indian basket crude shots up Due to the Supply constraints in market

And lets see the changes or Indian Crude import Prices and Quantities.

Date	Import Quantities ('000 MT)	Cost of Imports (in Million USD)
Oct-23	18731	11864
Nov-23	18593	11455
Dec-23	19683	11383
Jan-24	21520	12194
Feb-24	18010	10159
Mar-24	20694	12067



It has been found that the India's Number of Imports has been increased as Angola was Out of OPEC and it start adding extra barrels to the Open market India sees this situation and start importing more in December & January which reaches 21520 My of Crude (135.43 million bbl) which has costed 0.57 million USD a price difference for the Dec price is 0.01 million USD/ton which is 1 lakh USD per Tone is been save But in Feb due to the Continuous Extension of OPEC + oil production cuts again increase the Cost of imports per Ton in march 2024[93].

The Exit of Angola has benefited Indian Crude importers but just for a short span of period.

Chapter 4

4.1 Findings

The research project delves into the intricate dynamics of the energy sector in Africa, focusing on oil, gas, and coal industries. It highlights the significant reserves in countries like Nigeria, Angola, and Algeria, shaping the continent's energy landscape.

The study reveals the challenges faced by the oil sector, including fluctuating prices, political instability, and infrastructure deficiencies, hindering its full potential in many African nations.

The rapid growth of the natural gas sector, driven by domestic and global demand for cleaner energy, is evident in countries like Nigeria, Algeria, and Mozambique, with substantial gas reserves attracting investments in infrastructure and LNG projects.

Coal, while significant in Africa's energy mix, is transitioning due to environmental concerns and global energy trends, with South Africa leading in production but exploring renewable alternatives.

It has been found there are many foreign entity which are over investing and creating Debt traps one among them are the Entity belongs China and there are many Western Oil giant under Writing their Actual Reserve holding Which are a bit red flags in the OIL & Gas industry ex: Uk’s Shell ,and there are certain trends found that there are few entity formed as a private Oil company’s which are owned by the Former state-owned oil Company’s government Officials which give us a clear view that how those officials use their previous connections and entered into their our Countries oil network there are certain doubts occurring that these official got bribed during their tenure at their country’s State-owned Energy Company’s. and there are various scenarios found that extraction and movement of energy assets is not insured perfectly and there are certain disasters happening for those un safe methods.

4.2 Suggestions

1. Strengthen governance and transparency in the oil sector: Policymakers should implement robust regulatory frameworks and anti-corruption measures to address the challenges of corruption and mismanagement that have hindered the full potential of the oil sector in many African countries.
2. Invest in oil infrastructure development: Governments and private sector players should prioritize investments in oil exploration, production, refining, and transportation infrastructure to enhance the efficiency and productivity of the oil industry.
3. Diversify the energy mix: While the oil sector remains crucial, African countries should actively promote the development of natural gas, renewable energy, and other alternative energy sources to reduce reliance on fossil fuels and address environmental concerns.
4. Encourage regional cooperation in the gas sector: Policymakers should foster regional cooperation and integration in the natural gas industry, facilitating cross-border infrastructure projects, joint ventures, and knowledge-sharing to maximize the benefits of Africa's abundant gas resources.
5. Attract foreign direct investment in the gas sector: Governments should create favorable investment climates, streamline regulatory processes, and offer incentives to attract international energy companies to invest in gas exploration, production, and LNG projects.
6. Develop local content and skills: Governments should implement policies and programs to develop local content and build the capacity of African companies and workforce to participate in the energy sector, ensuring sustainable development and job creation.
7. Promote environmental sustainability in the coal sector: Policymakers should introduce stricter environmental regulations, incentivize the adoption of clean coal technologies, and support the transition towards renewable energy sources to mitigate the environmental impact of the coal industry.
8. Enhance energy access and affordability: Governments should prioritize initiatives to improve energy access, particularly in rural and underserved areas, and ensure

affordable energy prices for households and businesses to foster inclusive economic growth.

9. Strengthen regional energy integration and trade: Policymakers should facilitate the development of regional energy infrastructure, such as cross-border transmission lines and gas pipelines, to enhance energy security and promote intra-African energy trade.
10. Invest in research and development: Governments and the private sector should allocate resources to research and development in the energy sector, focusing on innovative technologies, renewable energy solutions, and efficient energy utilization to drive the continent's energy transition.

By implementing these suggestions, African countries can unlock the full potential of their energy resources, foster sustainable development, and position themselves as key players in the global energy landscape.

4.3 Conclusion

The energy sector in Africa is a complex and dynamic landscape, shaped by a multitude of factors including geopolitics, technological advancements, economic developments, and environmental concerns. This comprehensive analysis has unveiled the key dynamics and dominant players in the oil, gas, and coal industries across the continent.

The oil sector remains a crucial component of Africa's energy mix, with significant reserves concentrated in countries like Nigeria, Angola, and Algeria. These oil-rich nations play a pivotal role in the global oil market, with Nigeria's influence being particularly notable. However, the sector faces various challenges, including fluctuating oil prices, political instability, corruption, and infrastructure deficiencies, which have hindered the full realization of its potential in many African countries.

The natural gas industry in Africa has witnessed remarkable growth in recent years, driven by increasing domestic and global demand for cleaner energy sources. Countries such as Nigeria, Algeria, Egypt, and Mozambique possess substantial gas

reserves, attracting investments in infrastructure development, liquefied natural gas (LNG) projects, and regional cooperation initiatives.

The emergence of new gas discoveries in East Africa, particularly in Mozambique and Tanzania, has further reshaped the dynamics of the regional gas market, drawing significant attention from international energy companies.

While coal remains a significant energy source in Africa, its role in the continent's energy mix is gradually evolving due to environmental concerns and shifting global energy trends. South Africa stands out as the largest producer and consumer of coal in Africa, with coal-fired power plants accounting for a substantial portion of the country's electricity generation.

However, the dynamics of the coal sector are being influenced by factors such as environmental regulations, technological advancements, and the transition towards cleaner energy alternatives.

Across the energy sector, a diverse array of dominant players, including multinational corporations, national oil companies, and government entities, shape the landscape and drive developments. Companies such as Shell, ExxonMobil, TotalEnergies, and Chevron operate extensively across the continent, contributing to the exploration, production, and distribution of Africa's energy resources.

Additionally, national oil companies like Nigeria National Petroleum Corporation (NNPC), Sonatrach (Algeria), and Sonangol (Angola) exert significant influence within their respective countries' energy sectors, often partnering with international firms to leverage expertise and resources.

As Africa continues to play a vital role in global energy markets, understanding the dynamics of the energy sector and the dominant players shaping it is crucial for policymakers, investors, and stakeholders. Navigating the complexities and opportunities within the continent's energy landscape will be essential for fostering sustainable development, ensuring energy security, and addressing the environmental challenges that lie ahead.

Bibliography of Literature review:

Adeola, Adedapo O., Adedibu S. Akingboye, Odunayo T. Ore, Oladotun A. Oluwajana, Adetola H. Adewole, David B. Olawade, and Abimbola C. Ogunyele. 2022. "Crude Oil Exploration in Africa: Socio-Economic Implications, Environmental Impacts, and Mitigation Strategies." *Environment Systems and Decisions* 42(1):26–50. doi: 10.1007/s10669-021-09827-x.

Anon. n.d.-a. "Africaingles.Pdf."

Anon. n.d.-b. "Africa's New Oil Boom: Path To Prosperity Or Debt Trap?" *OilPrice.Com*. Retrieved May 6, 2024 (https://oilprice.com/Energy/Crude-Oil/Africas-New-Oil-Boom-Path-To-Prosperity-Or-Debt-Trap.html).

Anon. n.d.-c. "Chevron Corp. v. Donziger, 974 F. Supp. 2d 362 | Casetext Search + Citator." Retrieved May 6, 2024 (https://casetext.com/case/chevron-corp-v-donziger-8).

Anon. n.d.-d. "Energy and the Economy in Sub-Saharan Africa | SpringerLink." Retrieved May 6, 2024 (https://link.springer.com/chapter/10.1007/978-3-030-86884-0_34).

Anon. n.d.-e. "Marketing Oil and Gas Brands in Africa." *Springerprofessional.De*. Retrieved May 6, 2024 (https://www.springerprofessional.de/en/marketing-oil-and-gas-brands-in-africa/19654156).

Anon. n.d.-f. "The Future of African Oil and Gas: Positioning for the Energy Transition | McKinsey." Retrieved May 6, 2024 (https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-future-of-african-oil-and-gas-positioning-for-the-energy-transition).

Anyanwu, John, Kaouther Abderrahim, and Amel Feidi. 2010. *Crude Oil and Natural Gas Production in Africa and the Global Market Situation*.

Azevedo, Inês. 2014. "Energy Efficiency and Rebound Effects: A Review." *Annual Review of Energy and the Environment* 39.

Butare, Albert. 2015. “Petroleum, Gas and Mining Sectors in East African Community.” Pp. 229–45 in *Africans Investing in Africa: Understanding Business and Trade, Sector by Sector*, edited by T. McNamee, M. Pearson, and W. Boer. London: Palgrave Macmillan UK.

Daisy, PELHAM. 2020. “Corporate Anti-Corruption Compliance Drivers, Mechanisms, and Ideas for Change.”

Damijan, Sandra, and Joze Damijan. 2013. “The Impact of Corruption and Ownership on the Performance of Firms in Central and Eastern Europe.” *Post-Communist Economies* 25. doi: 10.1080/14631377.2013.787734.

Das, Nandini, and Joyashree Roy. 2020. “India Can Increase Its Mitigation Ambition: An Analysis Based on Historical Evidence of Decoupling between Emission and Economic Growth.” *Energy for Sustainable Development* 57:189–99. doi: 10.1016/j.esd.2020.06.003.

Donwa, P. A., C. O. Mgbame, and O. M. Julius. 2015. “Corruption in the Oil and Gas Industry : Implication for Economic Growth.” *Nigerian Chapter of Arabian Journal of Business and Management Review* 3(9):1–16. doi: 10.12816/0017678.

Hassan, Aminu. 2013. “Review of the Global Oil And Gas Industry: A Concise Journey From Ancient Time to Modern World.” *Petroleum Technology Development Journal* 3:123–41.

Herzog-Hawelka, Janina, and Joyeeta Gupta. 2023. “The Role of (Multi)National Oil and Gas Companies in Leaving Fossil Fuels Underground: A Systematic Literature Review.” *Energy Research & Social Science* 103:103194. doi: 10.1016/j.erss.2023.103194.

Musisi, Norbert. 2017. “Challenges in African Oil and Gas Sector.”

Roe, Alan. 2016. *Tanzania: From Mining to Oil and Gas*.

Zajontz, Tim. 2022. “Debt, Distress, Dispossession: Towards a Critical Political Economy of Africa’s Financial Dependency.” *Review of African Political Economy* 49:173. doi: 10.1080/03056244.2021.1950669.

References

[1] https://www.cia.gov/the-world-factbook/countries/ethiopia/

[2] https://en.wikipedia.org/wiki/GCL-Poly

[3] https://www.cia.gov/the-world-factbook/countries/sudan/

[4] https://www.trade.gov/country-commercial-guides/sudan-oil-and-gas#:~:text=Sudan%20exported%20%24317%20million%20in,to%20refine%2090%2D95%2C000%20bpd.

[5] https://www.elibrary.imf.org/view/journals/002/2020/073/article-A003-en.xml

[6] https://www.cia.gov/the-world-factbook/countries/uganda/

[7] https://theconversation.com/uganda-will-soon-be-exporting-oil-an-energy-economist-outlines-3-keys-to-success-217814#:~:text=The%20peak%20production%20is%20projected,capital%20expenditures%20and%20operating%20expenses.

[8] https://totalenergies.com/projects/oil/tilenga-and-eacop-projects-acting-transparently

[9] https://www.gem.wiki/East_African_Crude_Oil_Pipeline_(EACOP)

[10] https://aenert.com/countries/africa/energy-industry-in-kenya/

[11] https://www.upstreamonline.com/field-development/totalenergies-and-africa-oil-quit-kenya-oil-project-leaving-tullow-without-partners/2-1-1454711

[12] https://economictimes.indiatimes.com/industry/energy/oil-gas/ongc-oil-india-in-talks-for-50-stake-in-3-4-bn-kenya-oilfield-chinese-firm-enters-fray/articleshow/100416407.cms?from=mdr

[13] https://thepeoplesmap.net/project/lamu-coal-power-plant/

[14] https://www.cia.gov/the-world-factbook/countries/tanzania/

[15] https://en.wikipedia.org/wiki/Ubungo_I_Thermal_Power_Station

[16]https://en.wikipedia.org/wiki/Mtwara%E2%80%93Dar_es_Salaam_Natural_Gas_Pipeline#:~:text=The%20Mtwara%E2%80%93Dar%20es%20Salaam,Region%20to%20Dar%20es%20Salaam.

[17] https://www.cia.gov/the-world-factbook/countries/mozambique/

[18]https://www.theglobaleconomy.com/Malawi/coal_consumption/#:~:text=Coal%20consumption%2C%20thousand%20short%20tons&text=The%20latest%20value%20from%202022,is%2050117.23%20thousand%20short%20tons.

[19] https://mininginmalawi.com/mining-in-malawi-462/

[20] https://www.cia.gov/the-world-factbook/countries/zimbabwe/

[21] https://www.cia.gov/the-world-factbook/countries/south-africa/

[22] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/coal/020924-thermal-coal-series-south-africas-logistics-hurdles-turn-boon-for-growing-indian-appetite#:~:text=South%20Africa%20exported%20an%20average,steady%20flow%20of%20export%20revenues.

[23] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/coal/070423-south-africa-endures-worst-daily-power-outage-limited-impact-seen-for-coal-exports

[24] https://iced.niti.gov.in/

[25] https://oec.world/en/profile/country/bwa?yearlyTradeFlowSelector=flow1

[26] https://www.cia.gov/the-world-factbook/countries/botswana/

[27] https://www.reuters.com/world/africa/botswanas-minergy-seeks-govt-bailout-after-halting-coal-mining-ops-2023-03-08/

[28] https://economictimes.indiatimes.com/industry/indl-goods/svs/metals-mining/india-jindal-plans-to-start-building-botswana-coal-mine-in-2022/articleshow/87801545.cms?from=mdr

[29] https://www.upstreamonline.com/exclusive/at-least-3-billion-barrels-totalenergies-venus-is-sub-saharan-africas-biggest-ever-oil-discovery/2-1-1174983

[30] https://gisportal.namcor.com.na/viewer/

[31] Upstream Development & Production - NAMCOR

[32] https://geoexpro.com/what-could-be-behind-the-downgrade-of-shells-deep-water-discoveries-in-namibia/

[33] https://africaoilgasreport.com/2023/07/oil-patch-sub-sahara/the-orange-basin-deepwater-namibia-the-worlds-newest-and-hottest-oil-and-gas-hunting-grounds/

[34] https://oilprice.com/Energy/Crude-Oil/Namibias-Oil-And-Gas-Sector-Sparks-Global-Investment-Rush.html

[35] https://www.offshore-technology.com/projects/kudugasfieldnamibia/?cf-view

[36] https://oilreviewafrica.com/exploration/kudu-remains-national-strategic-project-namibia-petroleum-commissioner

[37] https://www.cia.gov/the-world-factbook/countries/namibia/

[38] https://www.reuters.com/business/energy/angola-quit-opec-reducing-membership-12-countries-2023-12-22/

[39] https://www.trade.gov/country-commercial-guides/angola-energy#:~:text=The%20country's%20current%20energy%20mix,(solar%2Ffossil%20fuel).

[40] https://www.reuters.com/business/energy/ceraweek-angola-maintain-oil-output-11-million-bpd-through-least-2027-2024-03-20/

[41] https://oec.world/en/profile/country/ago

[42] https://shipnext.com/port/malongo-terminal-aomal-ago#:~:text=General%20overview%3A%20Malongo%20is%20a,Gulf%20Oil%20Company%20(CABGOC).

[43] https://www.trade.gov/energy-resource-guide-angola-oil-and-gas#:~:text=The%20country%20holds%209%20billion,development%20and%20significant%20business%20opportunities.

[44] https://www.cia.gov/the-world-factbook/countries/angola/

[45] https://www.iea.org/countries/congo

[46] https://www.opec.org/opec_web/en/about_us/5090.htm

[47] https://www.cia.gov/the-world-factbook/countries/congo-republic-of-the/

[48] https://www.gem.wiki/Congo_FLNG_Terminal

[49] https://www.aa.com.tr/en/africa/8-african-nations-to-withdraw-cash-reserves-from-france/1646104

[50] https://www.trade.gov/country-commercial-guides/gabon-oil-0

[51] https://www.cia.gov/the-world-factbook/countries/gabon/

[52] https://www.opec.org/opec_web/en/about_us/3520.htm

[53] https://energycapitalpower.com/gabon-oil-gas-opportunities-mature-fields/

[54] https://www.offshore-technology.com/data-insights/oil-gas-field-profile-rabi-conventional-oil-field-gabon/?cf-view

[55] https://www.offshore-technology.com/data-insights/oil-gas-field-profile-rabi-conventional-oil-field-gabon/?cf-view

[56] https://www.offshore-technology.com/news/gabon-to-buy-assala-energy/#:~:text=The%20move%20by%20Gabon%20Oil,North%20Tchibala%20Field%2C%20Gabon

[57] https://www.worldoil.com/magazine/2017/november-2017/news-resources/world-of-oil-gas/

[58] https://shipnext.com/port/gamba-gagax-gab

[59] https://www.aljazeera.com/news/2023/8/30/a-coup-in-gabon-who-what-and-why

[60] https://www.eeas.europa.eu/delegations/ghana/eu-and-india-carry-out-joint-naval-exercise-gulf-guinea_en?s=101#:~:text=On%2024%20October%2C%20India%20and,in%20support%20of%20the%20region.

[61] https://aenert.com/countries/africa/energy-industry-in-nigeria/

[62] https://oec.world/en/profile/bilateral-product/electricity/reporter/nga

[63] https://www.cia.gov/the-world-factbook/countries/nigeria/

[64] https://www.opec.org/opec_web/en/about_us/167.htm

[65] https://oilreviewafrica.com/gas/gas/trans-saharan-gas-pipeline-is-the-longest-in-the-europe-middle-east-and-africa-says-globaldata

[66] https://www.nsenergybusiness.com/projects/dangote-refinery-lagos/

[67] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/oil/011424-nigerias-long-awaited-dangote-refinery-starts-diesel-jet-fuel-output

[68] https://www.cia.gov/the-world-factbook/countries/cameroon/

[69] https://www.cia.gov/the-world-factbook/countries/benin/

[70] https://www.cia.gov/the-world-factbook/countries/ghana/

[71] https://www.spglobal.com/commodityinsights/en/market-insights/blogs/oil/031924-ctracker-us-eia-oil-ghana-steel-middle-east-diesel-exports-europe#:~:text=2.,at%20a%20conference%20in%20Accra.

[72] https://www.tullowoil.com/application/files/2115/7960/2357/tullow-ten-brochure.pdf

[73] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/oil/031524-falling-production-waning-investment-leave-ghanas-oil-sector-at-a-crossroads

[74] https://www.ghanaweb.com/GhanaHomePage/business/COPEC-reveals-the-cause-of-Tema-Oil-Refinery-collapse-1042378#:~:text=Tema%20Oil%20Refinery%20(TOR)%20shut,raw%20material%20for%20the%20refinery.

[75] https://www.ogj.com/refining-processing/refining/article/14304514/chinese-investor-starts-operations-at-new-refinery-in-ghana

[76] https://www.cia.gov/the-world-factbook/countries/cote-divoire/

[77] https://energychamber.org/wp-content/uploads/15.The-State-of-African-Energy-Q2-2023-Outlook-Report.pdf

[78] https://iclg.com/practice-areas/oil-and-gas-laws-and-regulations/ivory-coast#:~:text=Ivory%20Coast%20holds%201.191%20trillion,Manta%2C%20CI%2D40%20Baobab.

[79] https://www.aa.com.tr/en/africa/west-african-countries-to-stop-using-cfa-franc/1680570

[80] https://www.cia.gov/the-world-factbook/countries/senegal/

[81] https://aowenergy.com/Articles/senegal-enters-the-lng-race-with-significant#:~:text=According%20to%20the%20International%20Monetary%20Fund%2C%20between,oil%20and%2040%20trillion%20cubic%20feet%20of

[82] https://www.reuters.com/world/africa/senegals-new-president-announces-oil-gas-mining-sector-audit-2024-04-03/#:~:text=Senegal's%20first%20offshore%20oil%20development,need%20to%20start%20your%20day.

[83] https://www.offshore-technology.com/data-insights/natural-gas-in-senegal/?cf-view

[84] https://www.offshore-technology.com/projects/greater-tortue-ahmeyim-gta-lng-project-mauritania-and-senegal/

[85] BP Considers Exiting Natural Gas Field Offshore Senegal | OilPrice.com

[86] https://www.cia.gov/the-world-factbook/countries/mauritania/

[87] https://african.business/2022/10/energy-resources/gas-the-new-deal-for-mauritania

[88] https://www.cia.gov/the-world-factbook/countries/morocco/

[89] https://www.reuters.com/world/africa/algeria-end-gas-supplies-morocco-supply-spain-directly-sources-2021-10-25/

[90] https://aenert.com/countries/africa/energy-industry-in-algeria/

[91] https://www.cia.gov/the-world-factbook/countries/algeria/

[92] https://www.opec.org/opec_web/en/about_us/146.htm

[93] https://ppac.gov.in/import-export