

Investment Opportunities in the Oil and Gas Sector in Sub-Saharan Africa

*A Consulting Project
Prepared for
the Development Bank of Southern Africa*

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F R O S T & S U L L I V A N

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Table of Contents

1. Abbreviations	3
2. Executive Summary	4
3. Report Aim and Methodology	11
Project Aim	11
Methodology	11
4. Introduction	12
5. Global Overview of the Oil & Gas Sector	15
5.1 Oil & Gas Value Chain	15
5.1.1 Oil Value Chain	15
5.1.2 Gas Value Chain	16
5.1.3 Oil & Gas Business Activity and the DBSA	17
5.2 Evolution of Prices	19
5.2.1 Crude Oil Prices	19
5.2.2 Natural Gas (LNG) Prices	20
5.3 Global Trends by Sector and Region	23
6. Macro-Economic Overview of Oil & Gas in Sub-Saharan Africa	33
6.1 Proven Oil & Gas Reserves	33
6.2 Oil Production & Consumption	36
6.3 Gas Production & Consumption	38
6.4 Summary of Key Findings	39
7. Major IOCs and NOCs	42
8. Key Investment Opportunities	45
8.1 Oil Refineries	45
8.2 Gas Liquefaction and Regasification Facilities	48

8.3	Others	54
8.4	Investment Opportunities Matrix	57
8.5	Recent Market Trends	61
8.6	Risks and Benefits.....	63
8.7	Financing Recommendations	66
9.	Conclusions	68
10.	Bibliography	70

1. Abbreviations

Bcf	Billion Cubic Feet
CAGR	Compound Annual Growth Rate
DBSA	Development Bank of Southern Africa
DFI	Development Finance Institution
DoE	Department of Energy
DSRA	Debt Service Reserve Account
E&P	Exploration and Production
ECA	Export Credit Agency
EIA	Energy Information Agency
EPCC	Engineering, Procurement, Construction, and Commissioning
ESG	Environmental, Social and [Corporate] Governance
ESHIA	Environmental, Social and Health Impact Assessment
FID	Final Investment Decision
FLNG	Floating Liquefied Natural Gas
FPSO	Floating Production, Storage and Offloading
FSRU	Floating Storage and Regasification Unit
GDP	Gross Domestic Product
GUMP	Gas Utilisation Master Plan
GW	Gigawatt
HFO	Heavy Fuel Oil
IEA	International Energy Agency
IFC	International Finance Corporation
IMF	International Monetary Fund
IPP	Independent Power Producer
IOC	International Oil Company
LC	Letter of Credit
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MMBtu	Million Metric British Thermal Unit
Mmscfd	Million Metric Standard Cubic Feet of Gas per Day
MPRDA	Minerals and Petroleum Resources Development Act (South Africa)
MTPA	Million Tonnes Per Annum
MW	Megawatt
NG	Natural Gas
NOC	National Oil Company
OECD	Organisation for Economic Cooperation and Development
OPEC	Organisation of the Petroleum Export Countries
O&G	Oil and Gas
PIB	Petroleum Industry Bill (Nigeria)
SSA	Sub-Saharan Africa
Tcf	Trillion Cubic Feet
WTI	West Texas Intermediate

2. Executive Summary

The Development Bank of Southern Africa (DBSA) is looking at diversifying its investment portfolio outside of South Africa. The bank is interested to invest into the oil & gas sector and thereby aims to develop an investment strategy for this sector in sub-Saharan Africa. The bank will more particularly look at investment opportunities in the midstream and downstream sectors.

In spite of the current down-cycle in which the global oil & gas industry is currently facing, investment opportunities exist, and more particularly within countries which are aiming to develop a local domestic oil & gas market.

Two main principles should be considered as a long-term drive for the growth of the oil & gas industry globally:

- Global demand for oil and gas is expected to rise in the next 20 years due to sustained global population and economic growth, particularly in non-OECD countries (with China and India as leaders of this growth).
- Gas is increasingly considered as a complementary and bridging resource towards a dominant renewable energy power scenario, as it is easier and quicker to implement than nuclear (and less prone to corruption) and cleaner than other fossil fuels such as coal and oil.

However, many factors are also restraining the development of oil & gas:

- Stricter carbon emission reduction targets and environmental concerns
- Commodity speculation and price volatility
- Strong involvement of the public sector with its associated political instability and uncertain regulatory frameworks
- Depleting reserves which are getting less and less accessible, thereby increasing production costs and decreasing headroom on international oil companies (IOCs') and national oil companies (NOCs') operating margins in the case of down-cycles

According to BP's Energy Outlook 2035, oil & gas consumption is expected to increase by a CAGR of 1.2 per cent between 2015 and 2035, with oil growing annually at 0.8 per cent and gas at 1.8 per cent, respectively.

Strong economic growth is driving the need for a more robust energy infrastructure on the African continent. According to the International Monetary Fund (IMF), sub-Saharan Africa's GDP is expected to grow on average by 4.7 per cent annually until 2020¹. This growth will in turn spur urbanisation and demands for products and services that support growth in energy infrastructure.

According to the IMF and the World Bank, global oil prices are expected to remain below US\$ 70 per barrel between 2015 and 2020. As opposed to crude oil prices, gas prices have

¹ IMF, World Economic Outlook, October 2015

always been varying widely across regions, with the expensive prices encountered in Asia (mainly LNG) and the cheapest ones in North America (due to the shale gas boom). Following the crude oil price slump, gas prices have also decreased significantly since end of last year, for two main reasons: (i) long-term gas supply contracts have generally been indexed to crude oil prices and (ii) more and more LNG supply facilities are being commissioned worldwide and major Asian LNG importers (China, Japan, South Korea) started decreasing their imports due to slower growth. The result is an LNG supply glut which is expected to widen in the next five years.

According to the IMF and World Bank forecasts for the next five years, natural gas prices are expected to range between US\$ 8 and 11/MMBtu in Asia, US\$6 and 8/MMBtu in Europe, and US\$ 2.8 and 4/MMBtu in North America. It is expected that Henry Hub gas prices will more and more influence global LNG prices as the USA ramps up for the first time LNG exports to Asia and Western Europe.

A lot of dynamics are influencing the global oil & gas market. Thereby it is important to understand the global picture in order to see where the sub-Saharan African oil & gas sector is going.

According to BP, as opposed to other regions and whilst having the lowest energy consumption base, Africa will have the highest compound annual growth rate (CAGR) for both oil and gas consumption in the next 20 years. On a global level, Africa is expected to remain a net exporter of oil and gas by 2035.

Africa is expected to continue exporting oil to China, India and Europe. According to the 2015 World Energy Outlook from the IEA, North America is expected to become self-sufficient in terms of oil by mid-2020s and could even become a net exporter of crude oil in the longer term if changes in the country's petroleum legislation occur. An important point to make is the fact that the Middle East and West Africa (Nigeria, Angola and Equatorial Guinea) are losing one of their major oil customers, the USA, as a consequence of the North American shale oil boom.

North Africa will continue supplying gas to Europe whilst sub-Saharan Africa is expected to supply gas mainly to Asia Pacific in competition with new and existing suppliers in the Middle East, North America, Eurasia (Russia) and with Australia and Papua New Guinea. In 2014, Africa mainly exported gas to Europe and Japan. As from 2015 onwards, North America is becoming a net exporter of gas, adding further pressure on global gas prices.

In both global oil & gas markets, disruptions were mainly created by the fact that the USA switched from being a net importer (or on balance) to a net exporter, bringing significant amounts of new sources of oil & gas into competition thanks to the development and production of oil & gas from unconventional resources.

Despite this new source of oil & gas supply, OPEC countries decided not to cut their production quota, thereby leading to a global oil supply glut and dramatic decreases in prices since the second half of 2014, with every country scrambling to maintain its market share.

It will be difficult for oil & gas (LNG) producers in sub-Saharan Africa to compete globally. Exporters will have to offer flexible contracts in terms of destination and price revision provisions. Competition will be fierce as Asian demand growth is expected to slow down in the short to medium term whilst supply sources keep on increasing. Oil & gas export projects in Africa have and will continue serving as anchor projects to further develop a domestic demand for oil & gas on the continent. This is what is expected to happen in Mozambique. Nevertheless, large populous and/or industrially more advanced countries such as Egypt, South Africa, Nigeria, Kenya, Ghana and Ivory Coast might become the next low hanging fruit as their economies (mainly power sector) are expected to increasingly depend on gas and renewable energy. Oil & gas intra-regional trade must increase in Africa but political and security issues combined with high operating costs are still constituting a main stumbling block.

Energy security might also play in favour of certain countries in Africa. Many Asian NOCs and IOCs have started buying shares from African oil & gas concessions with the aim to increase their control on certain major oil & gas resources, and by the same time ensuring a certain level of diversification in their supply portfolio.

Nigeria and Libya rank among the top 15 countries worldwide in terms of crude oil proved reserves. Within sub-Saharan Africa, Nigeria, Angola and Sudan/South Sudan have the largest crude oil proved reserves. In terms of natural gas proved reserves, three African countries rank among the top 15 countries globally – namely Nigeria, Algeria and Mozambique.

In sub-Saharan Africa, the largest oil producers are Nigeria and Angola, and then followed by Congo-Brazzaville, Equatorial Guinea, Gabon, South Sudan and Sudan. Oil consumption is dominated by South Africa, Nigeria, Angola, Sudan/South Sudan, Kenya, Ghana and Ethiopia. When discounting North Africa, sub-Saharan Africa still remains a small gas producer and consumer. Nigeria, Equatorial Guinea and Mozambique are the largest gas producers whilst Angola is expected to seize a larger market share of gas production from 2016 onwards when its activities at its Soyo LNG facility resume. Gas consumption is largely dominated by Nigeria and to a lesser extent South Africa.

Frost & Sullivan believes that key investment opportunities will arise in countries which aim to create a domestic oil & gas economy. Only countries with a sizable economy will be able to create enough economies of scale to justify the expensive infrastructure investments.

Despite several oil refinery projects being announced on a regular basis, most of them do not concretise. Nevertheless, four of them are worth noting: (i) Dangote's gigantic refinery in Nigeria (650,000 bpd) expected to come online in 2018, (ii) Uganda's refinery of 30,000-60,000 bpd, (iii) Angola's refinery of 110,000 bpd and (iv) South Africa's refinery of 360,000 bpd. Among these four projects, only the Nigerian one is expected to be completed in the next five years. It is expected to completely change the Nigerian oil & gas industry (moving it from a net importer of refined petroleum products to a net exporter), as well as the one of its

neighbouring countries. Ghana and Zambia are also considering building a second refinery, but nothing is expected to concretise before 2020.

Gas infrastructure is considerably less developed in Africa as compared to oil. In Africa, all existing LNG facilities have been onshore export LNG facilities. In sub-Saharan Africa, Nigeria has the largest LNG export facility (installed capacity of 21.9 MTPA) as compared to Angola (5.2 MTPA) and Equatorial Guinea (3.7 MTPA).

Several countries plan to import LNG. In addition to Egypt, Ghana, Ivory Coast, Benin, Senegal, Namibia and South Africa are in a more or less advanced stage of constructing and/or chartering new regasification terminals/vessels. Most of the countries are considering FSRUs which are more flexible and can become operational in a much quicker timeframe than onshore terminals.

Cameroon is ambitiously expected to join the LNG-exporter “club” by 2017 whilst Mozambique and less likely Tanzania in the next decade (2019-2020 the earliest for Mozambique and 2025 the earliest for Tanzania). Anadarko and Eni have remained extremely bullish on their LNG investment facilities in Mozambique. Nevertheless, FID has been constantly slipping and is not expected before March 2016 the earliest.

Because the LNG export projects in Mozambique, Equatorial Guinea, Nigeria and Tanzania are specifically catering for global markets the downward pressure on global LNG prices is a major uncertainty for them. According to industry experts, first LNG production from the onshore facility in Mozambique is not expected before 2021-2022, or even later. Anadarko’s Palma LNG project is unprecedented on the continent and therefore, will likely face cost overruns and delays. Also, revenues for the government out of this particular project will mainly come from 2030 onwards due to the fiscal regime and structure of the 2006 Engineering, Procurement, Construction and Commissioning contracts, and not before. This means that a local gas domestic market is still far off in Mozambique.

In West Africa however, commercial developments seem to progress well with regards the installation of (floating) LNG import facilities, as power utilities and IPPs are keen to take advantage of the current LNG decreasing price trends.

The low oil & gas price environment accompanied by the perspectives of a global supply glut is forcing the banks to be more risk-averse in terms of financing large-scale capital-intensive infrastructure projects, and more particularly non-scalable projects. Smaller, more flexible projects will attract more interests in the current uncertain oil & gas environment.

Investment opportunities in oil & gas pipelines and (strategic) storage facilities is set to increase as the continent moves towards a larger monetisation of its oil & gas fields. With the oil & gas market being currently in contango, many opportunities for new or increased storage capacity are going to arise in the next few years with investors hoping to increase their revenues by storing oil & gas and locking themselves into future contracts with higher prices than current spot prices.

Of course, delays in certain of the pipelines' and oil/gas processing projects will likely persist due to the expected long-lasting downward pressure on oil & gas prices. Nevertheless, in the short to medium term, it is expected that the continent will see increasing oil & gas midstream and downstream infrastructure flourishing domestically, and more particularly for gas as many countries intend to increase their gas-to-power potential.

Gas-to-power will be the main anchor sector for the development of a domestic and regional gas economy in sub-Saharan Africa. The list of countries which are (planning to) increasing their gas-to-power generation sources is getting longer: Nigeria, South Africa, Angola, Tanzania, Mozambique, Ivory Coast, Ghana, Cameroon, Kenya and Namibia.

As one might know using HFO or diesel to run power plants is expensive and polluting. Diesel power stations should only be used as a back-up solution or to meet peak power demand. Unfortunately, in countries such as Nigeria, Angola and more recently South Africa, diesel is often used as a short-term solution to compensate for a lack of base load power. It is therefore expected that these countries will provide further opportunities in the next decade to develop a gas-to-power industry if they can access affordable sources of gas. Also, many countries in East and Southern Africa have long relied on hydro power sources for the majority of their energy mix. However, more and more severe droughts are depleting reservoirs and thereby causing serious power shortages. These countries need to diversify their power mix. This is precisely what is currently happening in countries such as South Africa, Tanzania, Ghana, Cameroon, Kenya and Mozambique where the government is showing a will to develop a gas-to-power industry, complemented by other renewable energy power sources such as wind and solar.

Given the fact it is very difficult to predict oil and gas prices after 2020 and considering Frost & Sullivan's assumption of oil & gas prices to remain in the low scenario in the next five years, the best investment opportunities are expected to be in South Africa, Nigeria, Ghana and Ivory Coast. Other countries which should also be closely watched are Senegal and Tanzania, and then followed by Kenya, Cameroon and Mozambique (and to a lesser extent Uganda).

Figure 2.1: Oil & Gas Investment Opportunities Matrix, Low Price Scenario, sub-Saharan Africa, 2015-2020

Supply	O&G Dynamics	Gas-to-Power	Political Risks	Corruption Perceptions	GDP Size	Basic Infrastructure	Regulatory Framework
Angola	Low	Medium	Medium	Low	High	Low	
Cameroon	Medium	Medium	Medium	Medium	Medium	Low	
Congo (Brazza)	Low	Medium	Medium	Low	Low	NA	
Equl Guinea	Low	Low	Medium	Low	Low	NA	
Gabon	Low	Medium	High	Medium	Low	Medium	
Ghana	High	High	Medium	High	High	Medium	
Ivory Coast	High	High	Low	Medium	Medium	High	
Kenya	Medium	Medium	Low	Low	High	High	
Mozambique	Medium	Medium	Medium	Medium	Low	Low	
Namibia	Low	Medium	High	High	Low	High	
Nigeria	High	High	Low	Medium	High	Low	
Senegal	High	Medium	Medium	High	Low	Medium	
South Africa	High	High	Medium	High	High	High	
Tanzania	Medium	High	Medium	Medium	High	Low	
Uganda	Medium	Low	Medium	Medium	Medium	Low	

● High ● Medium ● Low

Source: Frost & Sullivan

Phase 2 Analysis

As reported by KPMG, “Some of the most exciting prospects on the continent are to be found in East Africa – a region that has, up to now, been almost unknown in the oil and gas industry. However, some East African projects could be at risk if oil prices remain low for an extended period of time, largely due to the high initial cost of investing in infrastructure to commercialise these region’s hydrocarbon resources. As a result, West Africa is arguably the region in Africa that is most likely to continue to receive large-scale investment if oil prices remain low.”²

An interesting recent market trend, which is occurring globally, including in Africa is the emergence of offshore gas production facilities (FLNG and FSRU) as opposed to onshore. Projects which progressed lately or even reached FID were all offshore. In a current low oil & gas price environment, whilst many countries are facing budget cuts and do not have the financial strength to engage in megaprojects, the tendency is to rather use floating vessels to produce gas. Also, with many oil & gas reserves still being unproven, certain countries prefer to engage themselves in short- to medium-term solutions for their oil & gas monetisation strategies rather than build large permanent (onshore) facilities. In current circumstances, investors are looking for flexible and scalable solutions. However, an exception to this rule is the mega oil refinery being built by the cash-rich Dangote Group in Nigeria.

Two additional elements which should also be considered when looking to potential investments in the oil & gas industry are (i) the extent to which renewables and biofuels could become a competitive source of fuel supply and (ii) the general elections’ calendar. With regards the latter, it is important to note that 14 elections are foreseen in 2016, and four more in 2017. Elections are an important factor to consider, especially in countries with long-term rulers such as Gabon, the Democratic Republic of Congo, Congo-Brazzaville, Uganda and Angola. Given the strategic importance of the oil & gas sector, one might expect increased political risks and some regulatory uncertainty before and following general elections.

For an investor like the DBSA, Frost & Sullivan would recommend investing in long-term debt facilities related to oil & gas projects in the midstream and downstream sectors. Frost & Sullivan tends to believe that midstream projects such as pipelines and storage facilities present less complexity, and thereby less risks, as opposed to upstream and downstream projects. Nevertheless, downstream projects with strong fundamentals should also be considered.

Adequate measures should be taken to reduce political and commercial risks in any investment decision, such as for instance through the involvement of Export Credit Agencies or political and commercial risk guarantees offered by Development Finance Institutions. Currency mismatch must also be avoided, and if necessary adequately hedged. Environmental, social and governance (ESG) criteria should be applied in any investment decision. The bank should consider with care the importance of the environmental, social and health impact assessment (ESHIA) as well as perform a sustainability analysis to

² KPMG, Oil & Gas in Africa, 2015, page 8

evaluate the risks and benefits that each project could bring to the local population and the domestic economy. Finally, experience has shown that it is best to finance projects where the public sector has no or only a minority stake, and rather focus on private sponsors with a strong experience track record.

3. Report Aim and Methodology

This section discusses the aim of the report and the methodology used to compile the information.

Project Aim

The aim of this project is to understand the opportunities offered by the oil and gas sector in sub-Saharan Africa (SSA), its contribution to gross domestic product (GDP), oil & gas production and consumption patterns; to map the sector's value chain and to provide a matrix of sector and investment opportunities in midstream and downstream links. A global overview of the oil & gas sector is also provided in order to contextualise the opportunities offered by the sector in sub-Saharan Africa.

Methodology

Frost & Sullivan consulted a variety of literature, both regionally and internationally, as secondary research for this report. Frost & Sullivan then engaged in primary interviews with key industry experts to gain a comprehensive understanding of latest market trends. Qualitative and quantitative data points were collected from both primary and secondary sources, and formed the basis to compile this report.

4. Introduction

The DBSA is a state-owned entity with the purpose “of accelerating sustainable socio-economic development and improve the quality of life of the people of the Southern African Development Community by driving financial and non-financial investments in the social and economic infrastructure sectors.”³

The bank is focusing on:

- “Social infrastructure: Infrastructure aimed at addressing backlogs and expediting the delivery of essential social services to support sustainable living conditions and a better quality of life within communities
- Economic infrastructure: Infrastructure aimed at addressing capacity constraints and bottlenecks in order to optimise economic growth potential”⁴

The DBSA is focusing on four main sectors: water, energy, transport and ICT infrastructure. It is currently looking at diversifying its investment portfolio outside of South Africa. It wants to propose an investment strategy for the sub-Saharan African oil & gas sector in which it is barely present.

Even though the sector is currently in a down-cycle with prices at their lowest levels since 2005, investments are still taking place – yet at a slower pace – for two main reasons:

- Global demand for oil and gas is expected to rise in the next 20 years due to sustained global population and economic growth, particularly in non-OECD countries (with China and India as leaders of this growth).
- Gas is increasingly considered as a complementary and bridging resource towards a dominant renewable energy power scenario, as it is easier and quicker to implement than nuclear (and less prone to corruption) and cleaner than other fossil fuels such as coal and oil (main growth areas are in the industrial and power sectors with Asia as the largest net importer of liquefied natural gas (LNG)).

However, many factors are also restraining the development of oil & gas:

- Stricter carbon emission reduction targets and environmental concerns
- Commodity speculation and price volatility
- Strong involvement of the public sector with its associated political instability and uncertain regulatory frameworks
- Depleting reserves which are getting less and less accessible, thereby increasing production costs and decreasing headroom on IOCs’ and NOCs’ operating margins in the case of down-cycles

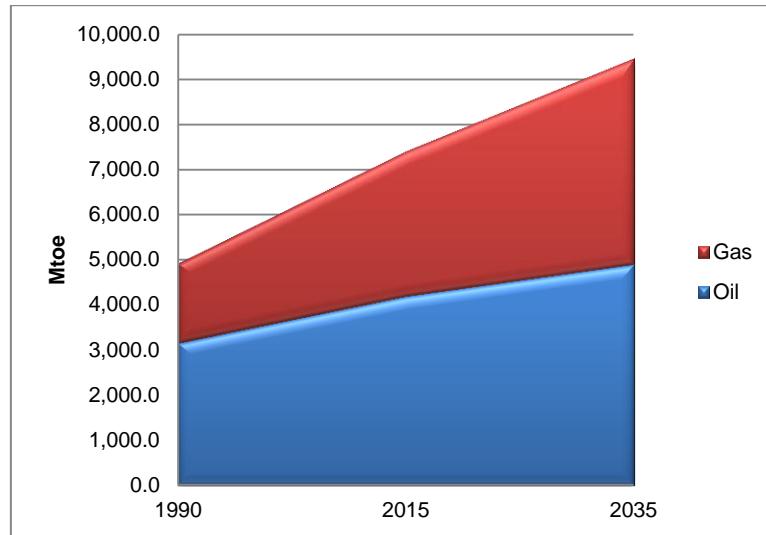
Oil & gas are used to produce a wide variety of petrochemical derivatives. They are also used as an energy feedstock in various industrial processes to produce heat and power. Oil is also the predominant fuel used in the transport sector. According to BP’s [Energy Outlook 2035](#), on a global basis, oil & gas consumption is expected to increase by a CAGR of 1.2 per

³ <http://www.dbsa.org/EN/About-Us/Pages/About-Us.aspx>

⁴ Ibid

cent between 2015 and 2035, with oil growing annually at 0.8 per cent and gas at 1.8 per cent, respectively.

Figure 4.1: Forecast Global Oil & Gas Consumption, 1990-2035



Source: BP Energy Outlook 2035 (February 2015)

Strong economic growth is also driving the need for a more robust energy infrastructure on the African continent. According to the IMF, sub-Saharan Africa's GDP is expected to grow on average by 4.7 per cent annually until 2020⁵. This growth will in turn spur urbanisation and demands for products and services that support growth in energy infrastructure.

Over the next 20 years urbanisation growth in Africa is expected to reach proportions that will allow for the creation of mega cities, mega regions and mega trade corridors. In West Africa, Nigeria is expected to have an annual rate of 4.5 per cent in urbanisation growth, whilst Mozambique is experiencing annual urbanisation growth of 3.6 per cent⁶. This will all require increased energy to meet the higher demand.

Furthermore, population in sub-Saharan Africa is expected to follow a CAGR of 2.5 per cent between 2015 and 2020, reaching about 1 billion inhabitants in 2020 compared to 896 million in 2014.

Given the current power deficit in Africa there is even more urgency to address the current and future power demand needs. The average electrification rate in sub-Saharan Africa is 32 per cent, the access to electricity in cities is 59 per cent and in rural areas a low 16 per cent⁷. In order to increase electrification rates, investment in energy infrastructure is required. There is a sense of urgency from all stakeholders such as development finance institutions (DFIs) which include the World Bank, the International Finance Corporation (IFC), the

⁵ IMF, World Economic Outlook, October 2015

⁶ World Bank, World Development Indicators, 2014

⁷ IEA, World Energy Outlook 2014

African Development Bank, national governments and public utility companies to address the energy infrastructure deficit in the most effective way possible.

The drive to cleaner energy and more eco-friendly policies will also increase the demand for cheap and clean energy. This will open the possibility for gas to come to the fore whilst oil will remain a predominant feedstock for the transport and petrochemical industry.

5. Global Overview of the Oil & Gas Sector

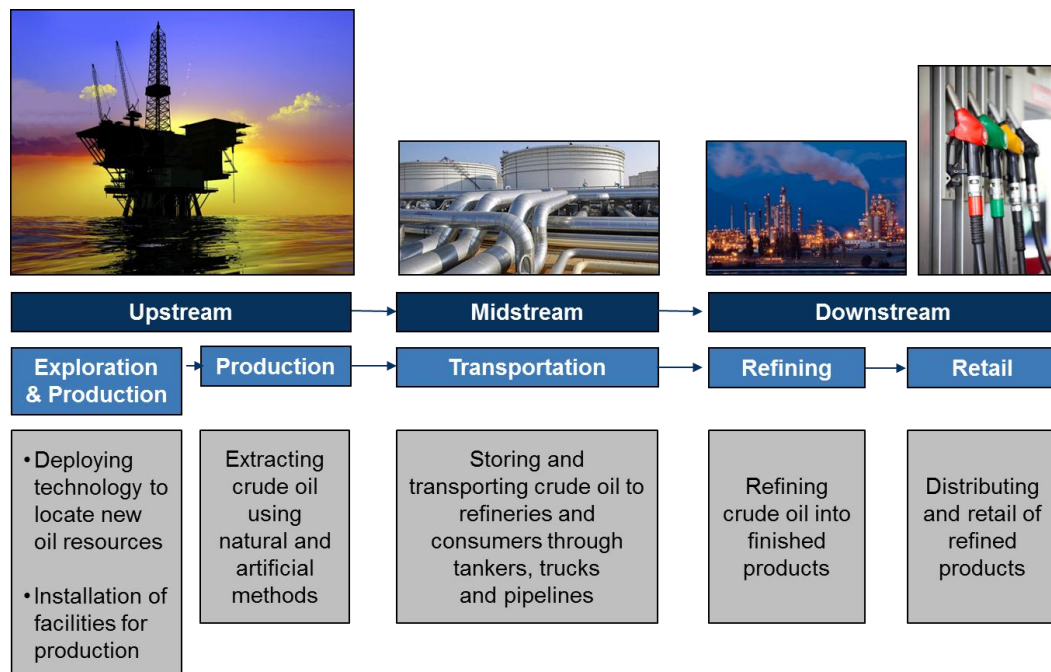
5.1 Oil & Gas Value Chain

5.1.1 Oil Value Chain

Crude oil is mostly recovered through oil drilling. It is then refined and separated into a large number of consumer products from gasoline (petrol) and kerosene to asphalt and chemical components used to make plastics and pharmaceuticals. The petroleum industry is involved in the global processes of exploration, extraction, refining, transporting (often with oil tankers and pipelines), and marketing petroleum products.

The largest volume products of the industry are fuel oil and gasoline. Petroleum is also the raw material for many chemical products, including pharmaceuticals, solvents, fertilizers, pesticides, and plastics.⁸

Figure 5.1.1: Oil Value Chain



Source: Frost & Sullivan

Oil is generally stored in tanks, close to oil refineries or in harbours where marine tankers can discharge their load. Oil terminals can be attached to pipelines and/or can also be fed by rail, barges and road tankers.

Oil-storage trading or *contango* is a market strategy where large, often vertically-integrated oil companies buy oil for immediate delivery and storage – when the prices are generally low – and hold it in storage until oil prices increase. Investors are betting on the future price of oil by using oil futures, where they lock into contracts to buy or sell oil at a future date. For this

⁸ <https://en.wikipedia.org/wiki/Petroleum>

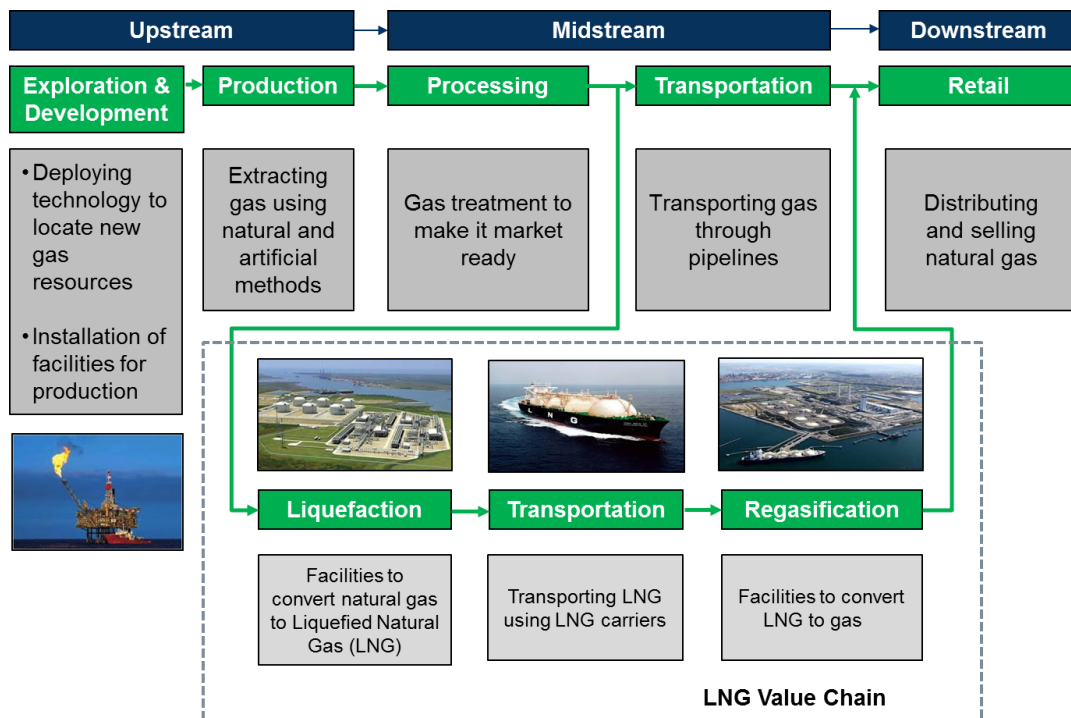
purpose, crude oil is generally stored in salt mines, oil tankers and tanks. Investors can choose to have oil physically delivered or not when contracts must be honoured. When the forward market is in *contango*, it means that the forward price of oil is higher than current spot prices. Since 2015, the global capacity for oil storage has been outpaced by oil production, causing a global oil glut. Consequently, oil storage space has also become a tradable commodity with the offering of oil-storage futures contracts as one of the latest trends.⁹

5.1.2 Gas Value Chain

The gas value chain is similar to the oil value chain, with the exception that gas can be transported either in a gaseous or in a liquid state, in the form of LNG. Liquefaction and regasification are thereby exclusive to the gas value chain.

Global best practices have shown that it is generally more economical to transport natural gas through pipelines for distances shorter than 2,500 km and in the form of LNG and through gas carriers for distances above 2,500 km.

Figure 5.1.2: Gas Value Chain



Source: Frost & Sullivan

Gas is also stored either to serve as a buffer between transportation and distribution (thereby meeting seasonal demand requirement or as insurance against unforeseen supply disruptions) or for commercial reasons (e.g. store when gas prices are low and sell when

⁹ https://en.wikipedia.org/wiki/Oil-storage_trade

prices are high). It is generally stored in large underground reservoirs such as depleted gas reservoirs, aquifers and salt caverns. Natural gas can also be stored in the form of LNG in insulated cylindrical storage tanks.

LNG is the liquid form of natural gas at cryogenic temperature of -161°C (mainly methane). Natural gas is cooled by a refrigeration process and condenses to a liquid at atmospheric pressure. Volume is thereby reduced by a factor of about 600. Natural gas is mainly composed of methane, but it can also contain a certain amount of ethane and heavier hydrocarbons such as propane and butane (liquefied petroleum gases or LPG), which are generally recovered as by-products from the liquefaction process.

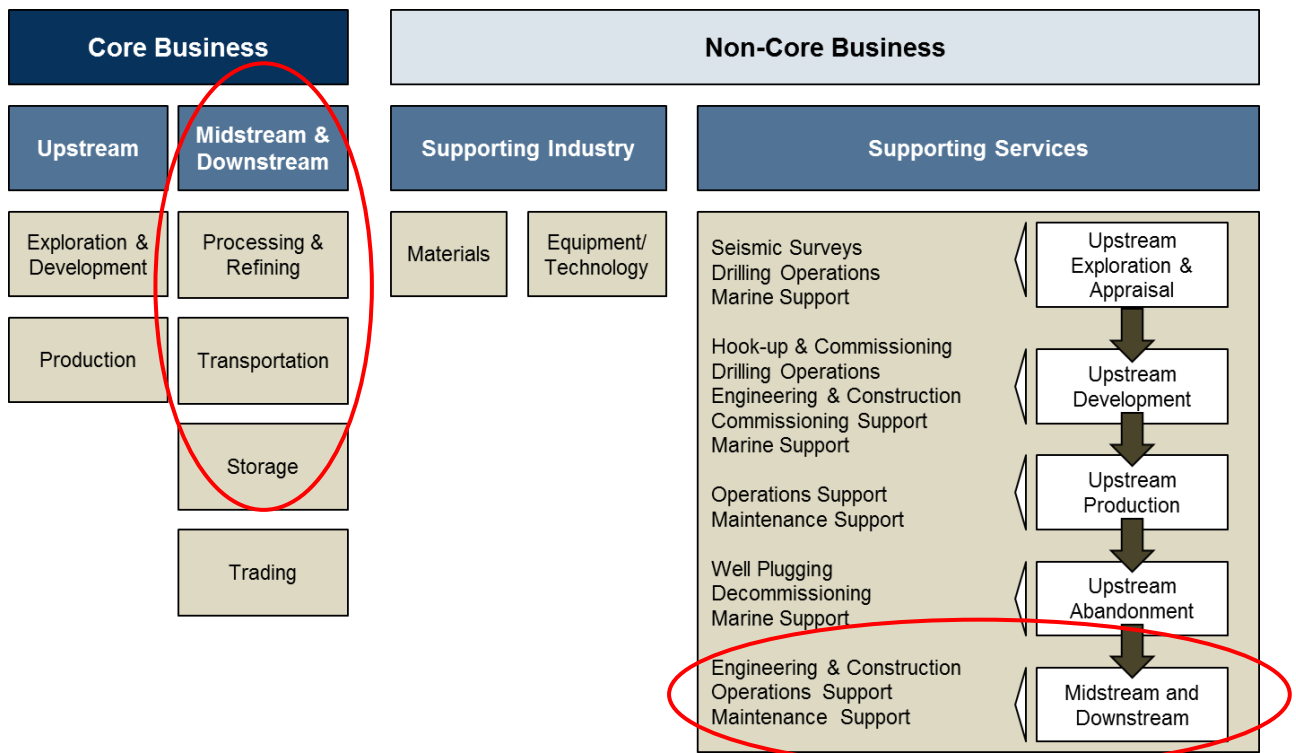
Gas (LNG and LPG) carriers (or tankers) are vessels specifically designed to transport LNG and LPG over long distances. Liquid gases are either transported at pressures greater than atmospheric or at below ambient temperatures, or a combination of both. Gas carriers can be classified as follows: (i) fully pressurized, (ii) semi-pressurized and semi-refrigerated, and (iii) fully refrigerated.

At delivery, LNG is either stored or processed in a regasification plant, onshore or on floating barges before being injected into the transmission and distribution pipeline network.

5.1.3 Oil & Gas Business Activity and the DBSA

The DBSA is currently looking at finding new investment opportunities in the midstream and downstream oil & gas value chain, as a trigger to fuel economic growth in sub-Saharan Africa, with the aim to contribute to increasing regional GDP per capita and job opportunities.

Figure 5.1.3: Description of Business Activities in the Oil & Gas Industry



Source: Frost & Sullivan

The DBSA will not look at the financing of oil & gas upstream and trading activities as these activities typically include a different (higher) level of risks, which are generally taken by asset finance departments of commercial banks. Furthermore, these activities do not provide the same level of direct socio-economic benefits than activities in the midstream and downstream segments and thereby are not in line with the DBSA’s mission:

“The DBSA vision, mission and values are supported by the organizational strategy which aims of providing sustainable infrastructure finance and implementation support in selected African markets to improve the quality of life of people, in support of economic growth and regional integration.”¹⁰

¹⁰ <http://www.dbsa.org/EN/About-Us/Pages/About-Us.aspx>

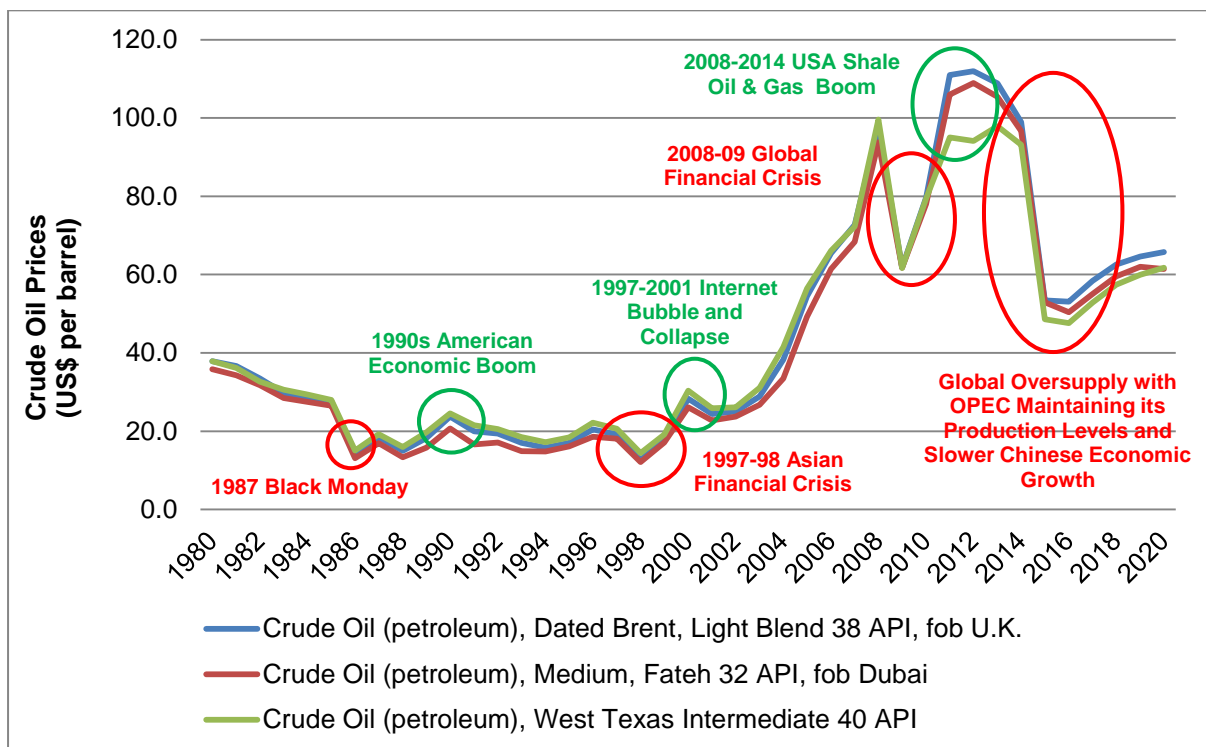
5.2 Evolution of Prices

5.2.1 Crude Oil Prices

In international trade, crude oil is priced according to a very liquid and transparent market-linked pricing mechanism. The market makers or references are the Brent in Europe, West Texas Intermediate (WTI) in the USA, and Dubai/Oman Crude in the Middle East.

As shown in the graph below, volatility in crude oil prices has increased significantly in the past ten years due to increased speculation and global trading activities.

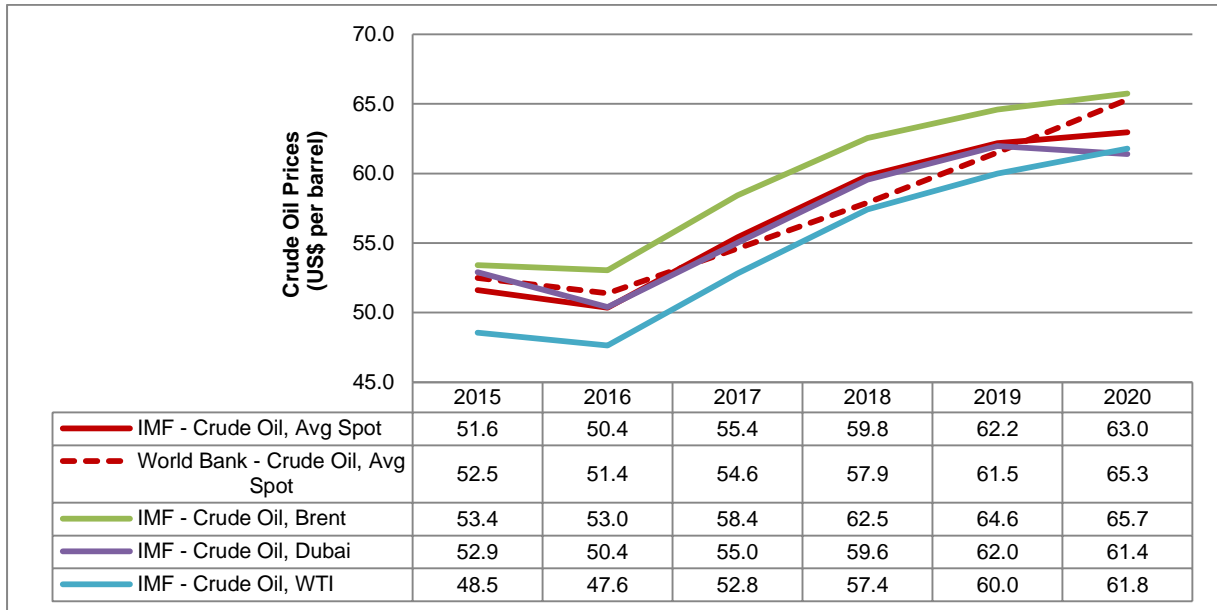
Figure 5.2.1.1: Crude Oil Price Evolution, Europe-Middle East-USA, 1980-2020



Source: IMF – World Economic Outlook (October 2015)

The latest crude oil price forecast of the IMF and the World Bank has been revised downwards in October 2015, as reflected in the graph below. Both institutions produced forecasts that are more conservative than the EIA and IEA latest base case scenario. In the [IEA World Energy Outlook 2015](#), the central scenario for oil prices forecast that the market would rebalance at US\$80 per barrel in 2020, "with further increases in price thereafter."

Figure 5.2.1.2: Crude Oil Price Forecast, Europe-Middle East-USA, 2015-2020



Source: IMF – World Economic Outlook (October 2015), World Bank – Commodities Price Forecast (October 2015)

5.2.2 Natural Gas (LNG) Prices

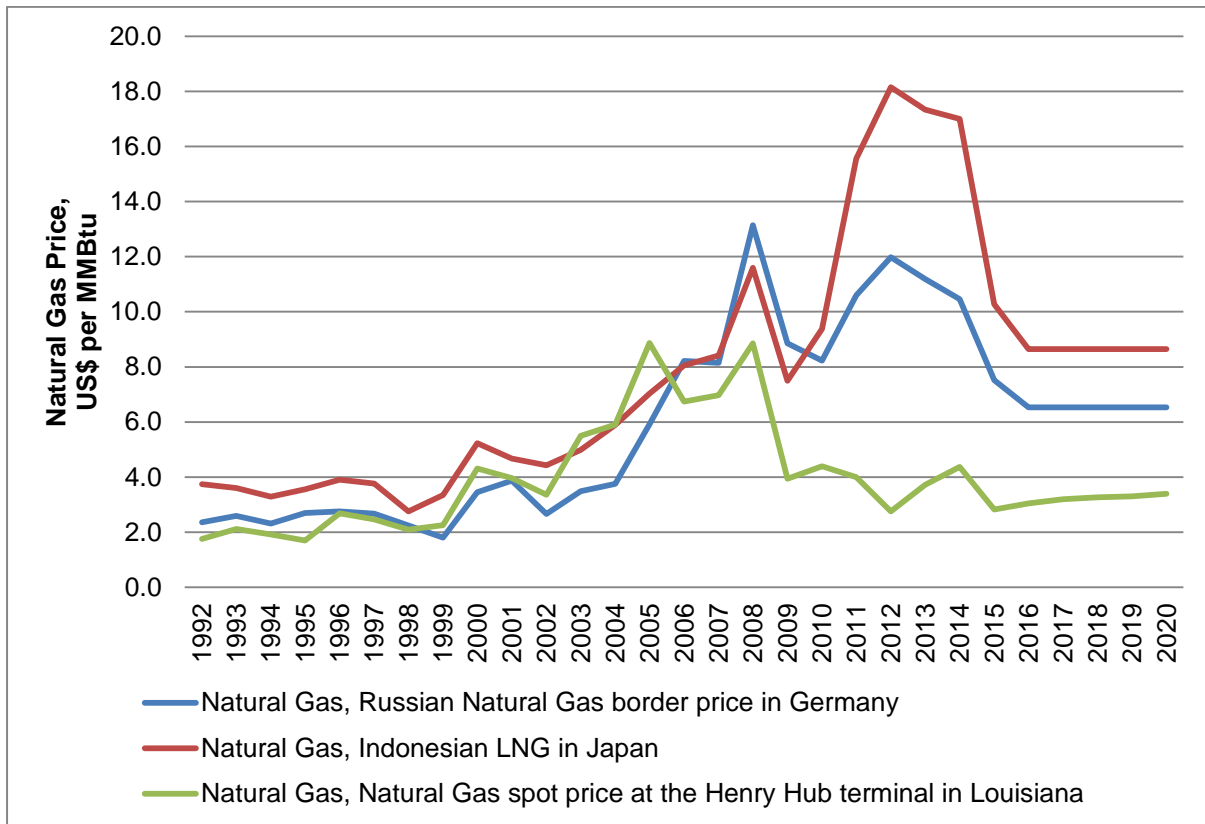
In most parts of the world, natural gas prices have been linked to global oil prices. However, in the USA, natural gas prices have decoupled since 2008 from oil prices when the industry started using hydraulic fracturing. The surge of shale gas supply in the USA led to a significant decrease in gas prices in the country.

The Henry Hub natural gas price is the primary reference to set gas prices in North America. In other regions of the world, gas prices are typically indexed to crude oil or other petroleum product prices because of the liquidity and transparency of crude oil prices and the possibility to substitute gas with petroleum products.

There is no globally integrated market for gas, thereby leading to significant price discrepancies between regions. As stated by the US Energy Information Agency (EIA) in September 2015, *“In Asia most natural gas is imported as LNG and the price is indexed to crude oil on a long-term, contractual basis. The Asia Pacific market accounts for three-quarters of global LNG trade and one-third of global natural gas trade. Although long-term crude oil-indexed contracts remain Asia’s dominant pricing mechanism, natural gas is beginning to be traded on the spot market as one-time transactions, or under short-term contracts, which more closely reflect international natural gas supply and demand balances.”*¹¹

¹¹ <http://www.eia.gov/todayinenergy/detail.cfm?id=23132>

Figure 5.2.2: Natural Gas Price Evolution, Europe-Japan-USA, 1992-2020



Source: IMF – World Economic Outlook (October 2015)

Now, a few Asian countries, including Japan, China, and Singapore, are competing with each other to develop regional gas trading hubs with the goal to increase gas price formation transparency.

It is expected that Henry Hub gas prices will more and more influence global LNG prices as the USA ramps up LNG exports to Asia and Western Europe. The US EIA further reports that *“The flexibility in destination clauses in U.S. LNG export contracts and the introduction of hub indexes are expected to promote greater liquidity in global LNG trading and shift pricing away from oil-based indexes, contributing to the development of the Asian regional trading hubs and pricing indexes.”*¹²

As reflected in the following two graphs, global LNG prices have decreased significantly for the past two years, with prices in Asia and South America being approximately halved. Interestingly, prices are starting to converge across regions, yet with American ones still significantly below LNG prices in other regions.

¹² Ibid

Figure 5.2.3: World LNG Estimated Landed Prices, October 2013



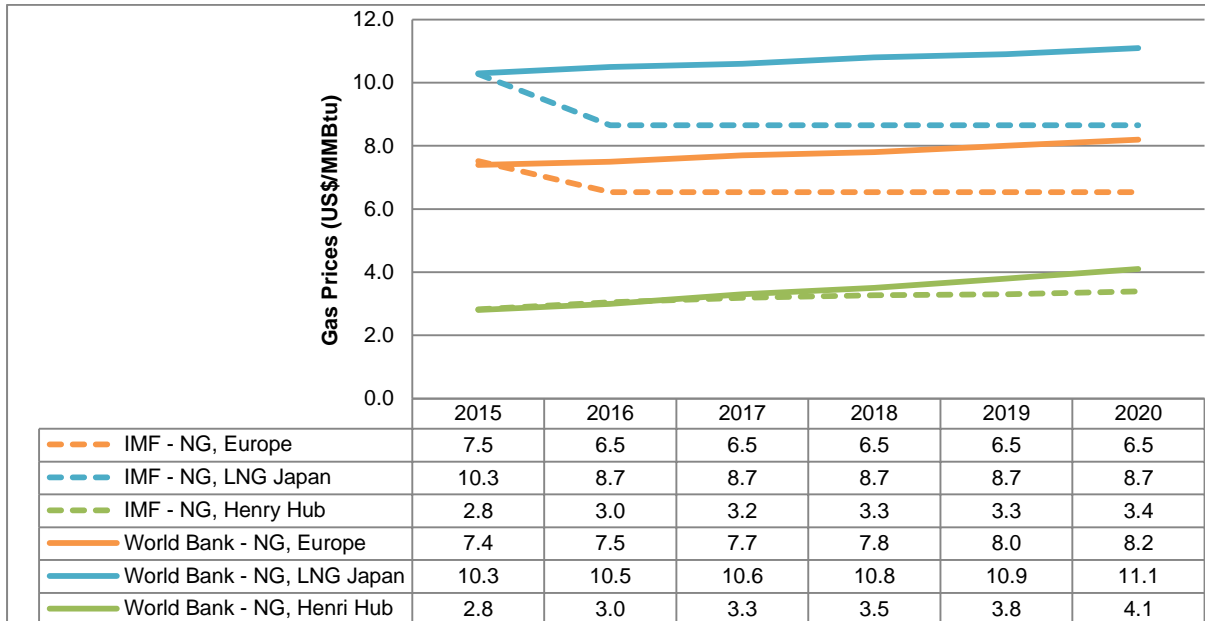
Figure 5.2.4: World LNG Estimated Landed Prices, October 2015



Source: Federal Energy Regulatory Commission (FERC)

According to the IMF and World Bank forecasts for the next five years, natural gas (NG) prices are expected to range between US\$ 8 and 11/MMBtu in Asia, US\$6 and 8/MMBtu in Europe, and US\$ 2.8 and 4/MMBtu in North America.

Figure 5.2.5: Natural Gas Price Forecast, Europe-Japan-USA, 2015-2020



Source: IMF – World Economic Outlook (October 2015), World Bank – Commodities Price Forecast (October 2015)

5.3 Global Trends by Sector and Region

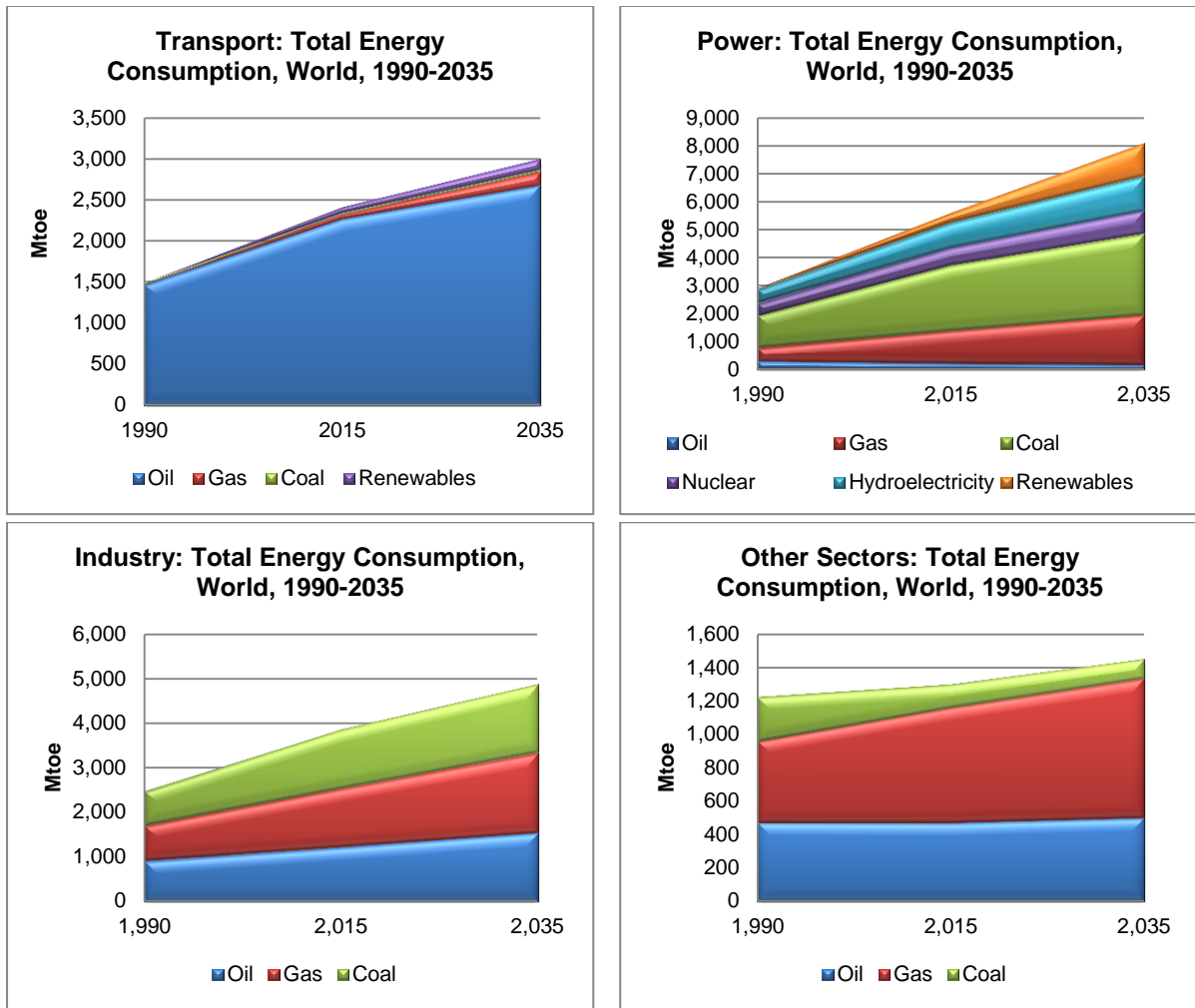
A lot of dynamics are influencing the global oil & gas market. It is important to understand the global picture in order to see where the sub-Saharan African oil & gas sector is going.

According to the IEA World Energy Outlook 2015, *“Cuts of more than 20% in upstream investment by many oil companies in 2015 have been compensated only in part by a fall in supplies and services costs. This negatively affects the medium-term outlooks for production from numerous non-OPEC countries, including Brazil, Russia and Canada. Within OPEC, output growth is led by Iraq and Iran, although both face distinct challenges to mobilise the necessary investment.”*¹³

Globally, sources of energy consumption growth will mainly come from the transport sector for oil and from the power and industrial sectors for gas.

¹³ http://www.worldenergyoutlook.org/media/weowebiste/2015/WEO2015_Factsheets.pdf

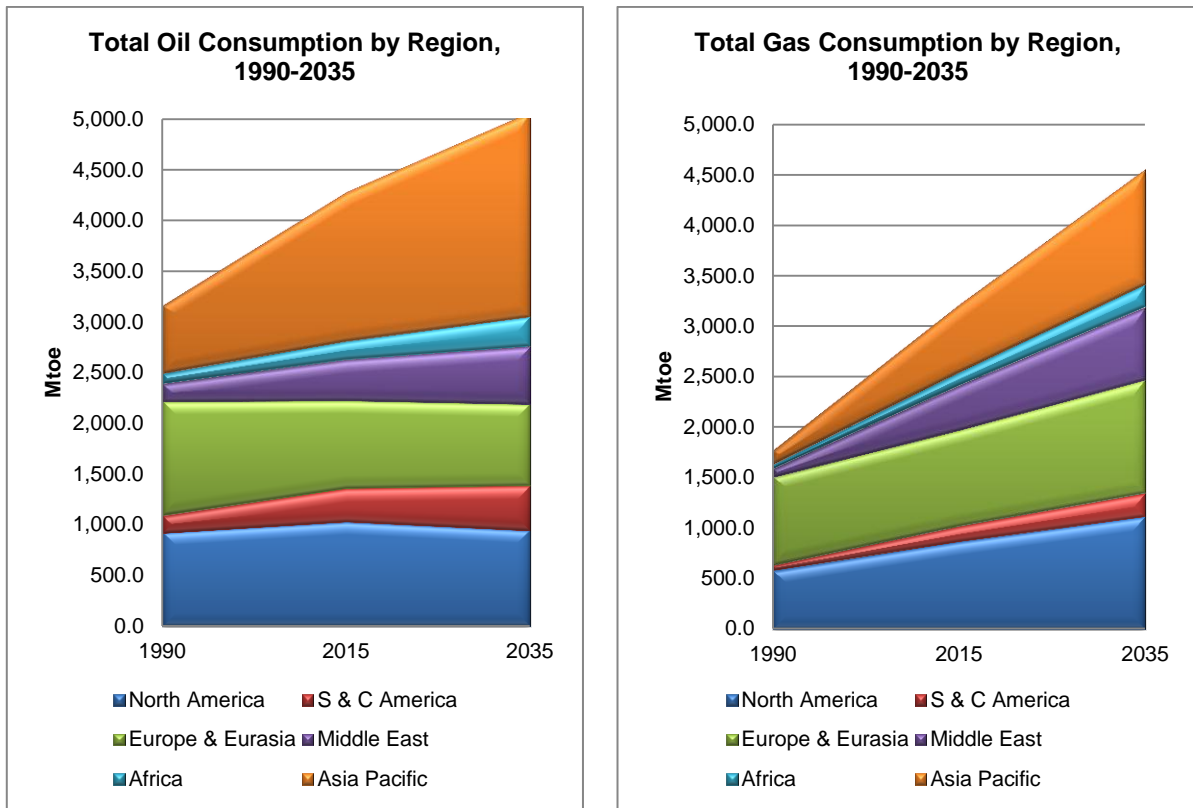
Figure 5.3.1: Forecast Global Energy Consumption by Sector and Fuel Type, 1990-2035



Source: BP Energy Outlook 2035 (February 2015)

In terms of regions, it is clearly Asia Pacific which is the main source of growth for oil consumption whereas gas consumption is expected to increase in all regions, but with Asia Pacific, Europe & Eurasia and North America contributing the most to this growth.

Figure 5.3.2: Forecast Oil & Gas Consumption by Region, 1990-2035



Source: BP Energy Outlook 2035 (February 2015)

Interestingly but not unsurprisingly, oil consumption is expected to decrease in North America and Europe by 2035. Whilst having the lowest energy consumption base, Africa will have the highest CAGR for both oil and gas consumption.

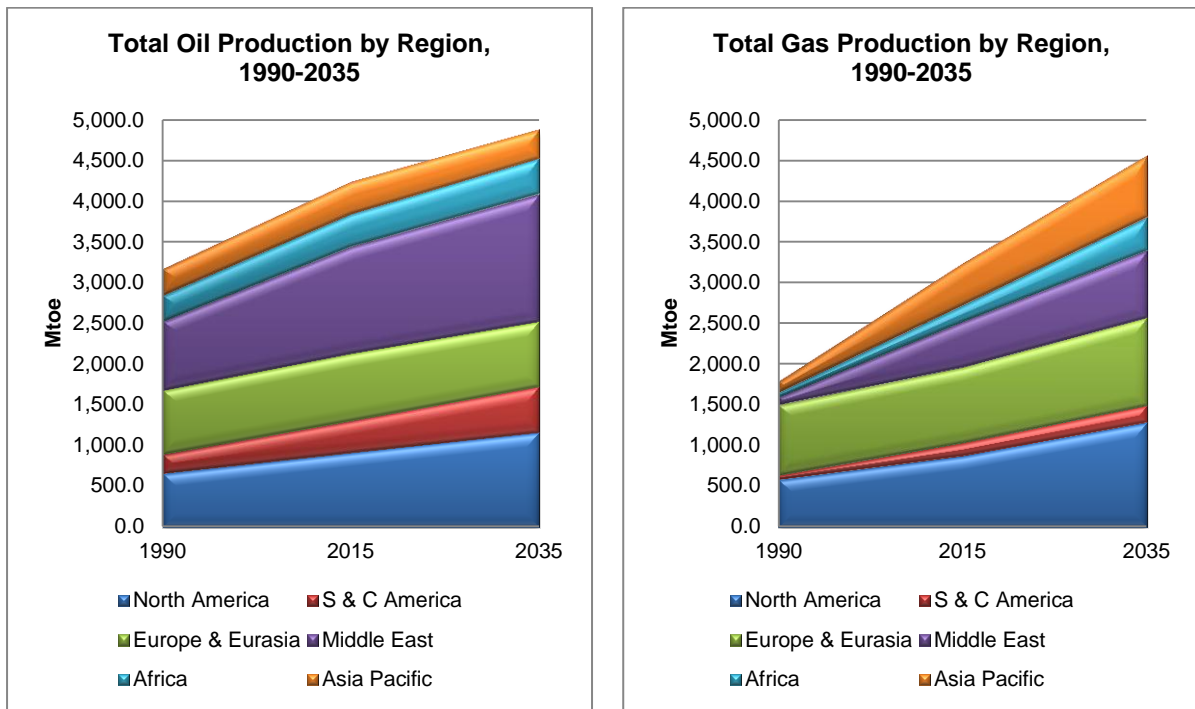
Figure 5.3.3: Oil & Gas Consumption CAGR by Region, 2015-2035

Region	Oil	Gas
North America	-0.4%	1.3%
South & Central America	1.5%	2.1%
Europe & Eurasia	-0.4%	0.8%
Middle East	1.7%	2.5%
Africa	2.4%	2.9%
Asia Pacific	1.6%	2.7%

Source: BP Energy Outlook 2035 (February 2015)

The Middle East will remain the largest oil producing region by 2035 whilst North America and Europe/Eurasia the largest gas producing regions.

Figure 5.3.4: Oil & Gas Production by Region, 1990-2035



Source: BP Energy Outlook 2035 (February 2015)

When comparing consumption with production, one can see that oil & gas inter-regional trade is significant and expected to keep on increasing. On a global level, Africa is expected to remain a net exporter of oil and gas by 2035.

Figure 5.3.5: Net Oil Importer/Exporter by Region, 1990-2035

	OIL		
	1990	2015	2035
North America	Net importer	Net importer	Net exporter (1)
S & C America	Net exporter	Net exporter	Net exporter
Europe & Eurasia	Net importer	Net importer	= (2)
Middle East	Net exporter	Net exporter	Net exporter
Africa	Net exporter	Net exporter	Net exporter
Asia Pacific	Net importer	Net importer	Net importer

Disrupting event, changing market dynamics

Largest source of inter-regional trade

(1) Currently, export of crude oil is prohibited by law in the USA.
 (2) On balance.

Source: BP Energy Outlook 2035 (February 2015), Frost & Sullivan

Africa is expected to continue exporting oil to China, India and Europe. According to the 2015 World Energy Outlook from the IEA, North America is expected to become self-sufficient in terms of oil by mid-2020s¹⁴ and could even become a net exporter of crude oil in

¹⁴ http://www.worldenergyoutlook.org/media/weowebiste/2015/WEO2015_Factsheets.pdf

the longer term if changes in the country’s petroleum legislation occur. However, the matter which relates to energy security is extremely sensitive. After a lift of the 40-year ban on crude oil export was voted by the House of Representatives in October 2015, the proposal is currently being reviewed by the US Senate. An important point to make is the fact that the Middle East and West Africa (Nigeria, Angola and Equatorial Guinea) are losing one of their major oil customers, the USA, as a consequence of the North American shale oil boom. Oil refining capacity is increasing in China, India, Vietnam, Malaysia, the Middle East and Africa. Capacity is also increasing in the USA, but the country is directing itself towards self-sufficiency thanks to the development of its unconventional resources. Oil refining capacity is decreasing in Japan, Australia and Europe where labour costs are too high and environmental regulations too stringent. Singapore and Thailand are increasing their competitiveness into the manufacturing of high value-added petrochemicals.

Figure 5.3.6: Net Gas Importer/Exporter by Region, 1990-2035

	GAS		
	1990	2015	2035
North America	=	=	Net exporter
S & C America	=	=	Net importer
Europe & Eurasia	Net importer	Net importer	Net importer
Middle East	=	Net exporter	Net exporter
Africa	Net exporter	Net exporter	Net exporter
Asia Pacific	=	Net importer	Net importer

Disrupting event, changing market dynamics

Largest source of inter-regional trade

Source: BP Energy Outlook 2035 (February 2015), Frost & Sullivan

North Africa will continue supplying gas to Europe whilst sub-Saharan Africa is expected to supply gas mainly to Asia Pacific in competition with new and existing suppliers in the Middle East, North America, Eurasia (Russia) and with Australia and Papua New Guinea. In 2014, Africa mainly exported gas to Europe and Japan. As from 2015 onwards, North America is becoming a net exporter of gas, adding further pressure on global gas prices.

In both global oil & gas markets, disruptions were mainly created by the fact that the USA switched from being a net importer (or on balance) to a net exporter, bringing significant amounts of new sources of oil & gas into competition thanks to the development and production of oil & gas from unconventional resources.

Despite this new source of oil & gas supply, OPEC countries decided not to cut their production quota, thereby leading to a global oil supply glut and dramatic decreases in prices since the second half of 2014, with every country scrambling to maintain its market share.

As summarised by Gary Ashton in a recent article published in October 2015, there is now a battle between OPEC and the US to see which one of them will become the new swing producer (and thereby price maker). *“OPEC is facing competition from US shale like never before. Experts have been expecting the cartel’s control of the market to end, arguing that cartels do not last forever. 2015 will determine which group is the real swing producer in the*

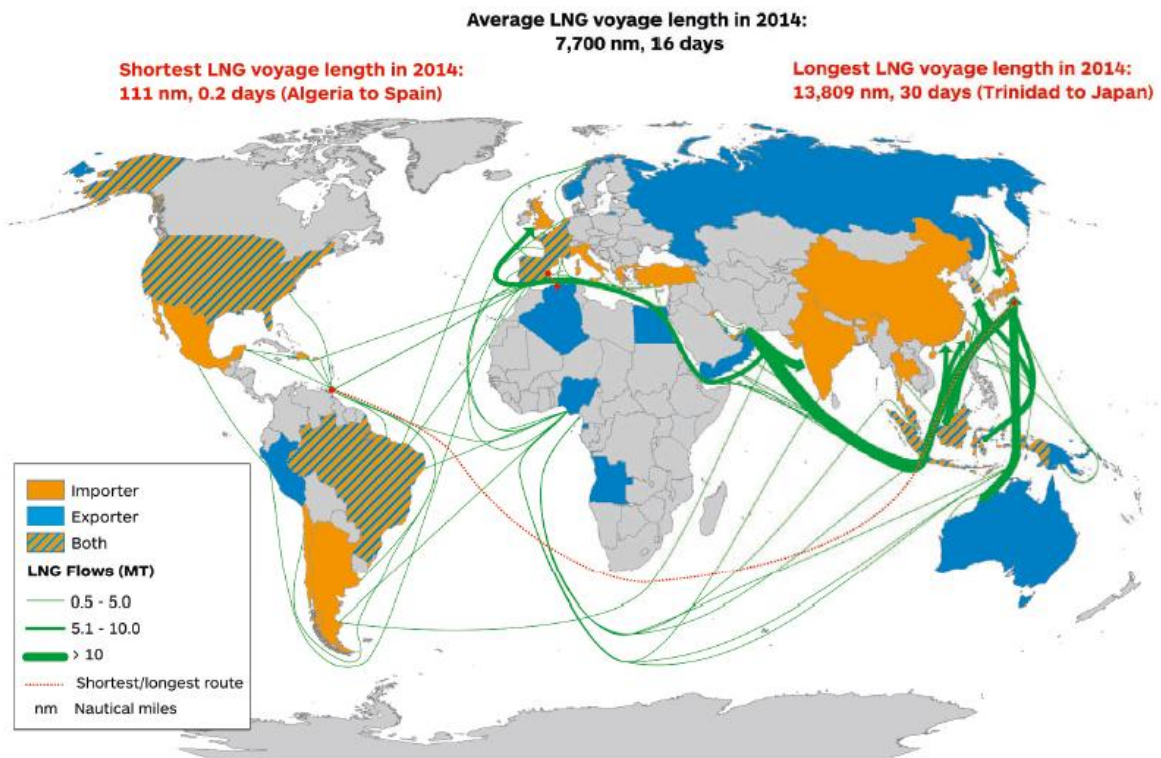
*global oil market. If OPEC is to remain dominant, its ability to retain this influential position will most likely come from a greater agility in reacting to market forces compared to the US shale industry. On the other hand, it is too early to say that the US doesn't have any role as a new swing producer. In this lower oil price environment, the US delayed project development. But with efficiency improving, a rebound in price above US\$70 per barrel seems to be the magic number that will cause US drilling to accelerate. It could yet turn out that in such a scenario, it is the US shale industry that will be reacting while OPEC remains an observer.*¹⁵

Because in most parts of the world gas prices are related to oil prices, gas prices also followed a decreasing trend for the past year. A slower growth of the Chinese, Japan (and the prospect of Japan restarting some of its nuclear reactors) and South Korean economies, coupled with massive volume of new LNG export capacity expected to flood the market over the next five years is also leading to a global gas (LNG) supply glut and further pressure on LNG prices for the next five years. Certain experts believe that recovery will happen sooner for oil than for gas (LNG) prices.

The main importer of oil and gas (LNG) has been Asia and is expected to remain so for the next 20 years. Traditionally, Indonesia and Malaysia supplied Japan and South Korea, the two largest importers of LNG in the world, with LNG. Brunei, Myanmar and Australia are now also exporting LNG to these markets, bringing up more competition. Historically, LNG has been mainly purchased through long-term contracts. However, by 2022, most of these long-term contracts concluded between Malaysia and Indonesia on the supply side and Japan and South Korea on the buyer side are set to expire. Malaysia and Indonesia's gas reserves are decreasing whilst their own local demand for gas is increasing; thereby reducing their ability to further export large amounts of gas to their neighbours after 2022 (they will more likely become net importers of gas in the next decade). As a consequence, Japan and South Korea are starting to look for new LNG supply sources at competitive prices. Similarly, China, India, Thailand, Singapore and Taiwan are also looking at increasing LNG/gas imports. The USA, Australia, Russia and the Middle East are well positioned to fill the gap. However, new countries such as Mozambique could also provide them with new LNG supply sources after 2022. The competitive advantage will be pricing and flexible contracts, which are no longer related to oil indexes.

¹⁵ <http://www.investopedia.com/articles/investing/052015/us-shale-becoming-global-swing-producer.asp>

Figure 5.3.7: Major LNG Shipping Routes, 2014



Source: IHS

Given current expectations that LNG prices might continue decreasing, there is an increasing trend towards short-term and spot LNG price contracts. Whilst spot prices were a third higher than long-term Asian LNG contract prices in early 2014, the tendency has reversed with spot prices expected to remain below long-term contract prices for the rest of the decade unless some unexpected outages occur on the supply side.

In terms of buying power, LNG importers are currently in a favourable position to negotiate interesting prices. Japan could also become an LNG trading hub, where it would engage in trading activities in South East Asia with more and more spot price contracts being concluded.

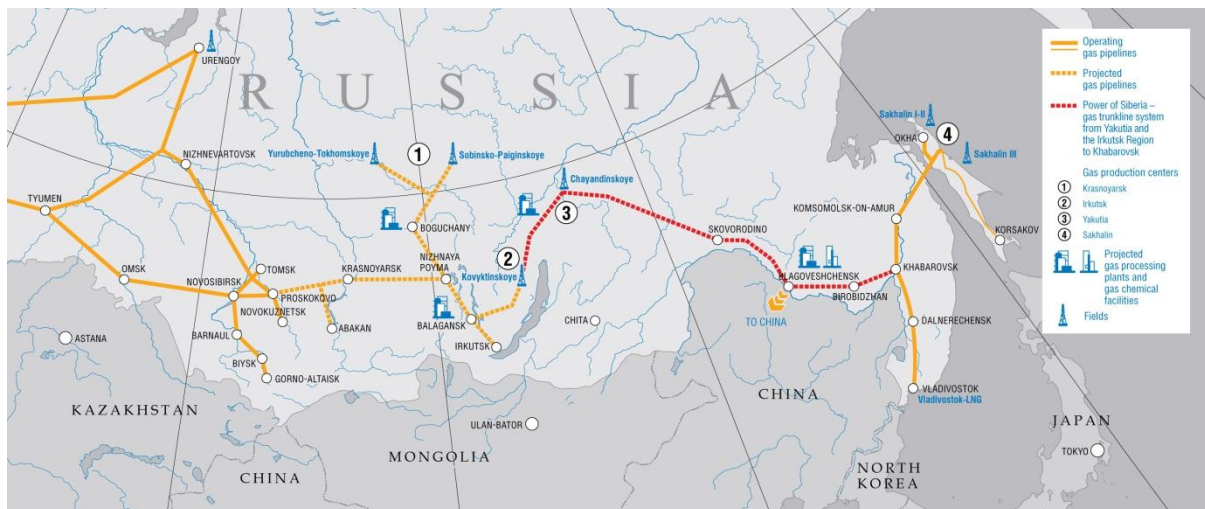
Countries with the highest population such as China and India, as well as traditional established markets such as Japan and South Korea, will remain one of the main sources of gas consumption in the next 20 years. However, demand for gas could be somewhat tempered as the Chinese economy is expected to grow at a slower pace and Japan restarts some of its nuclear power stations. China increased its regasification capacity from 6 MTPA in 2008 to 39.5 MTPA in 2014. The country completed two regasification terminals in 2014. Seven new terminals and two expansion projects with a total capacity of 28 MTPA were under construction as of early 2015.¹⁶ India still needs to further develop its gas regasification and inland gas pipeline network infrastructure, but the country is slowly engaging in this direction (gas is still strongly competing with cheap coal sources).

¹⁶ International Gas Union, World LNG Report, 2015 Edition, page 49

Four new countries have commissioned new import terminals in 2015: Egypt, Jordan, Pakistan and Poland. Egypt became the first LNG importer in Africa.¹⁷

Russia is now also turning to Asia Pacific as a new source of gas demand as it tries to decrease its dependence on Europe for its gas end markets. New gas pipelines are planned to be constructed between Russia and China, yet at high costs. They could be operational as from 2019.

Figure 5.3.8: Russia-China Planned Gas Pipelines, 2014



Source: Gazprom

As mentioned earlier, Africa is expected to remain a net exporter of oil & gas by 2035. This means that oil & gas infrastructure will continue being developed but first with a focus on export markets. These export projects will serve as anchor projects to further develop a domestic demand for oil & gas on the continent. This is what is expected to happen in Mozambique. Nevertheless, large populous and/or industrially more advanced countries such as Egypt, South Africa, Nigeria, Kenya, Ghana and Ivory Coast might become the next low hanging fruit as their economies (mainly power sector) are expected to increasingly depend on gas and renewable energy. Oil & gas intra-regional trade must increase in Africa but political and security issues combined with high operating costs are still constituting a main stumbling block.

Main countries focusing on oil & gas production in sub-Saharan Africa are Nigeria (oil & gas), Angola (oil & gas), Equatorial Guinea (oil & gas), Congo-Brazzaville (oil), Gabon (oil), Ghana (oil), Mozambique (gas), Ivory Coast (gas), Tanzania (future gas), Kenya (future oil) and Uganda (future oil). These countries will have to work on their cost competitiveness globally to:

- Improve their market share in the global oil & gas supply market by providing flexible contracts in terms of destination and/or price revision provisions.

¹⁷ Ibid

- Secure a local demand (in the region) to ensure that they do not exclusively depend on global volatile markets. However, it is important to consider that a country like South Africa, which is currently considering importing gas, will look at the most affordable sources, which might not necessarily come from Africa.

Another important point to consider for the benefit of Africa is the fact that, after European and American IOCs, many Asian IOCs have been buying shares into African oil & gas exploration and production (E&P) concessions. Asian countries are also deeply concerned about energy security and portfolio diversification. As published in 2014 in an article from an interview with Standard & Poor's and Platts, *"For these new Asian markets, energy security is the overriding point. That has two branches: one is acquiring the producing assets, and the second is gaining the technology necessary to exploit them."*¹⁸ Therefore, being involved in the entire oil & gas value chain allow them more control on the assets, a serious advantage that countries in Africa can offer them as compared to North America and the Middle East. At the same time, these IOCs are also looking at diversifying their portfolios and increase their engagement into African midstream and downstream activities, as for example Korea Gas Corporation (KOGAS) leveraging its domestic expertise by constructing and operating a gas distribution network around Maputo.

Listed below are other major short- to medium-term global oil & gas trends which have the potential to impact the African oil & gas market (source: Interfax¹⁹):

- Oil and financial sanctions on Iran are expected to be lifted in 2016, which means that Iran will be able again to ramp up its oil exports. However, the country will need to invest in its infrastructure first before being able to recover to its former export levels.
- A weakening global economy prevents oil prices to recover. A potential interest rate rise this year by the United States Federal Reserve – which will further strengthen the dollar against its global peers – is another bearish factor.
- China's gas production is growing faster than its demand, reducing its need for imports. China National Offshore Oil Corporation (CNOOC) is reselling surplus LNG cargoes, a trend that could continue.
- India has been trying to take advantage of cheap spot LNG and reduce the volumes it takes from its relatively expensive long-term contract with Qatar. Gas price cuts in the country could support offtake.
- North America's gas output is rising as a result of production from US shale plays, despite low oil and gas prices globally. The combined marketed gas production of the US and Canada increased by 6.5 per cent on an annual basis in the first seven months of 2015.
- Shale production will remain the driver of US gas output. This will limit gas price gains in the coming months. However, persistent low oil prices are slowing the production growth of US shale.

¹⁸ Standard & Poor's – Platts, *The Shale Boom and Geopolitical Stress*, 2014, page 5

¹⁹ <http://interfaxenergy.com/>

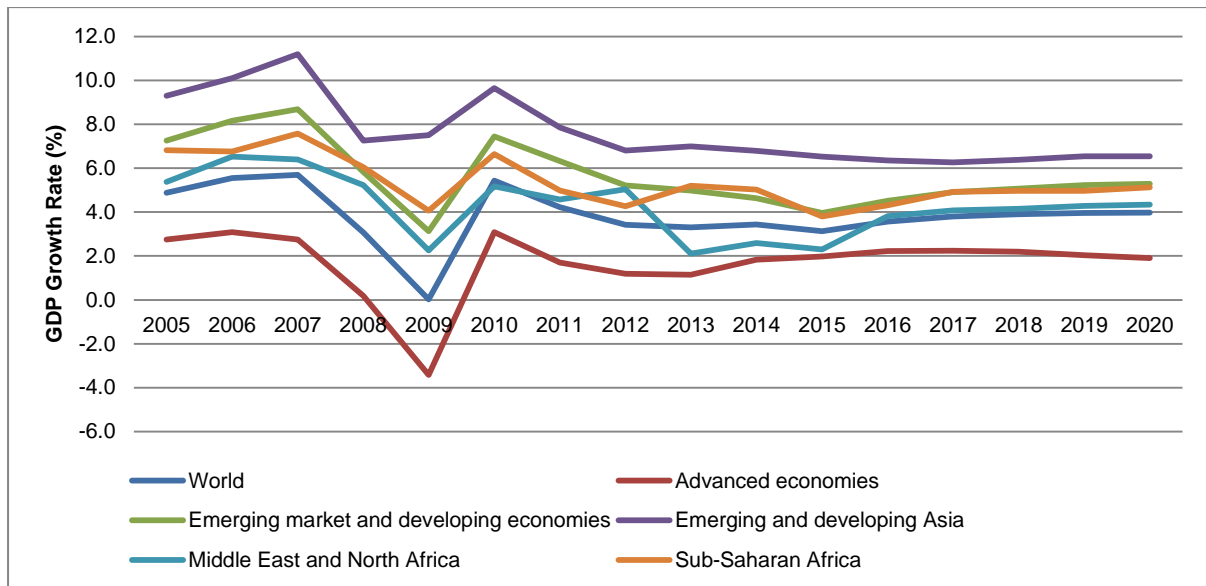
- Regional suppliers such as Qatar, Nigeria and Algeria are renegotiating their LNG contracts with key consumers to improve their flexibility and make them more competitive.
- Algeria is struggling to meet its growing domestic demand as the government is focused on increasing gas and LNG exports to generate revenue.
- Egypt and Jordan are increasing their reliance on LNG imports. In October, Egypt awarded tenders to import 55 cargoes to be delivered by the end of 2016, while Jordan issued a tender for 39 shipments for delivery in 2016 and 2017.
- Low oil and LNG prices will encourage continued dependence on imported LNG by regional consumers in the Middle East and Africa. Meanwhile, regional suppliers are expected to defend their share of gas and LNG exports in a low-price environment.

6. Macro-Economic Overview of Oil & Gas in Sub-Saharan Africa

As recently reported by KPMG²⁰, the decrease of oil & gas prices will, on aggregate, “have a negative impact on African GDP growth and current account balances due to the region’s position as net exporter.”

Consequently, perspectives on economic growth are rather lukewarm for the next five years. The IMF expects sub-Saharan Africa’s economy to grow by 3.8 per cent in 2015 – its weakest pace since 2009, principally as a result of low commodity prices. The region’s economy grew by 5 per cent in 2014, and growth is only expected to resume to 5 per cent from 2018 onwards. However, after emerging and developing Asia, it is sub-Saharan Africa which is performing best in terms of GDP growth on a global level.

Figure 6.1: Regional GDP Growth Evolution, 2005-2020



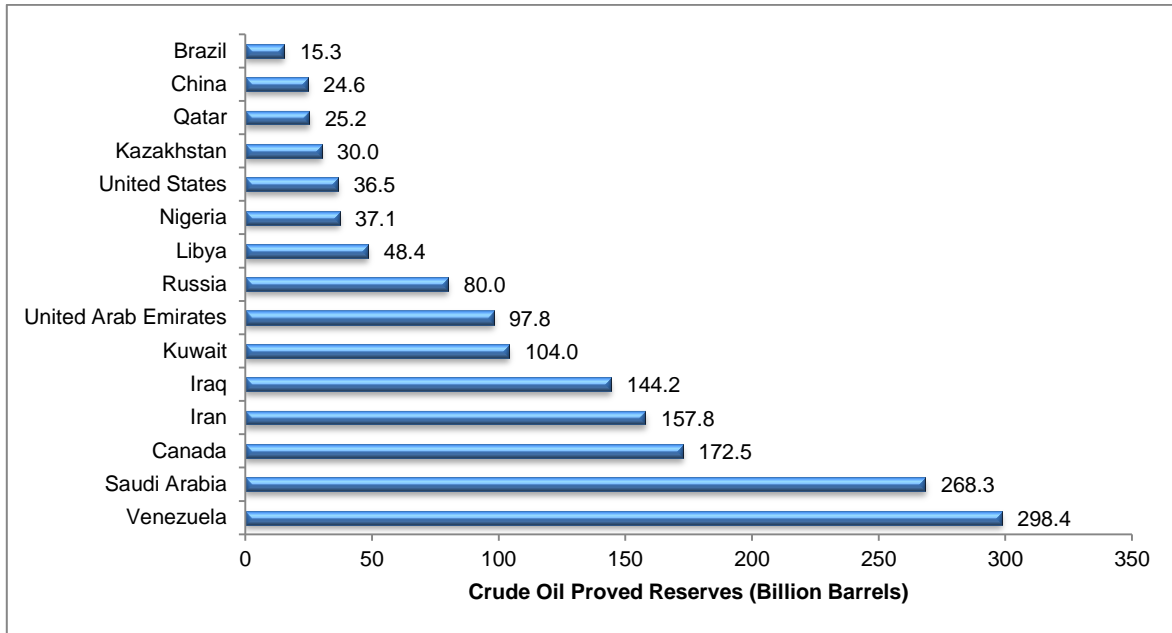
Source: IMF – World Economic Outlook (October 2015)

6.1 Proven Oil & Gas Reserves

In terms of crude oil proved reserves, two African countries – namely Libya and Nigeria, rank among the top 15 countries globally. The top 15 constitutes more than 90 per cent of total crude oil proved reserves globally.

²⁰ KPMG, Oil & Gas in Africa, 2015, page 9

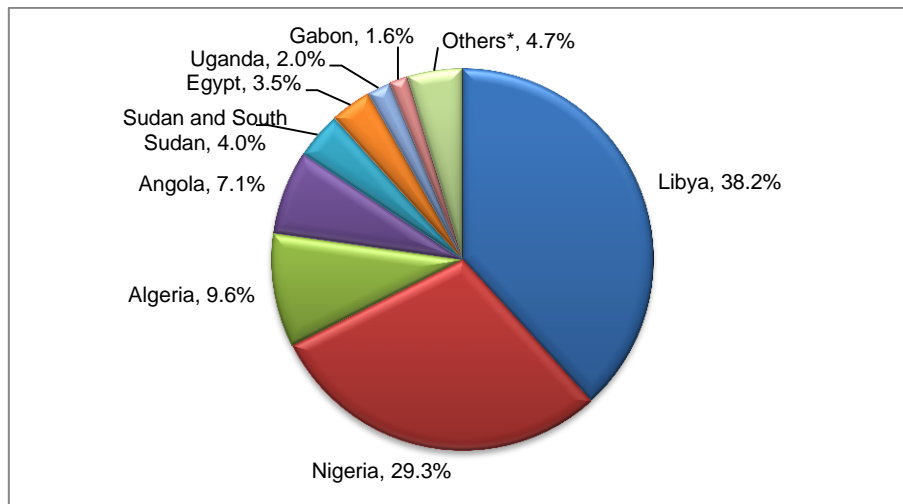
Figure 6.1.1: Top 15 Crude Oil Proved Reserves, Global, 2015



Source: EIA

Africa has about 7.7 per cent of the global crude oil proved reserves, and sub-Saharan Africa only 3.7 per cent.²¹ Nigeria, Angola and Sudan/South Sudan have the largest crude oil proved reserves in sub-Saharan Africa to date.

Figure 6.1.2: Percentage Share of Crude Oil Proved Reserves in Africa, 2015



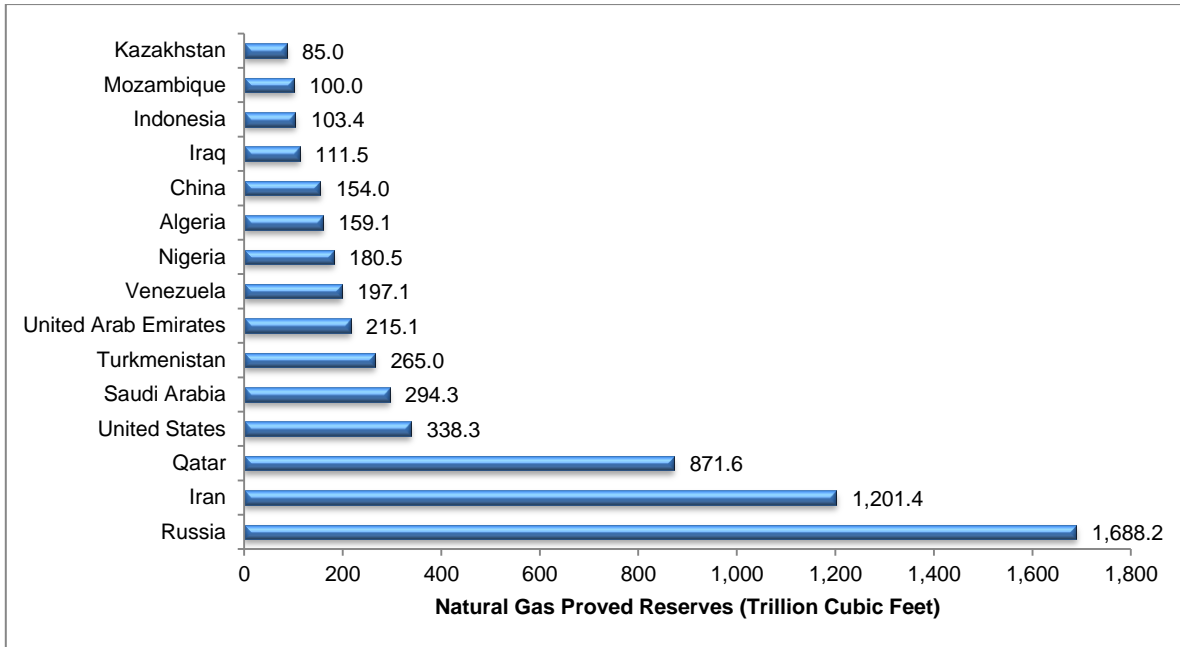
Source: EIA

Note: *Others include Congo-Brazzaville, Chad, Equatorial Guinea, Ghana, Tunisia, Cameroon, DRC, Niger and Ivory Coast.

²¹ <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=57&aid=6>

In terms of natural gas proved reserves, three African countries rank among the top 15 countries globally – namely Nigeria, Algeria and Mozambique. The top 15 constitutes more than 85 per cent of total natural gas proved reserves globally.

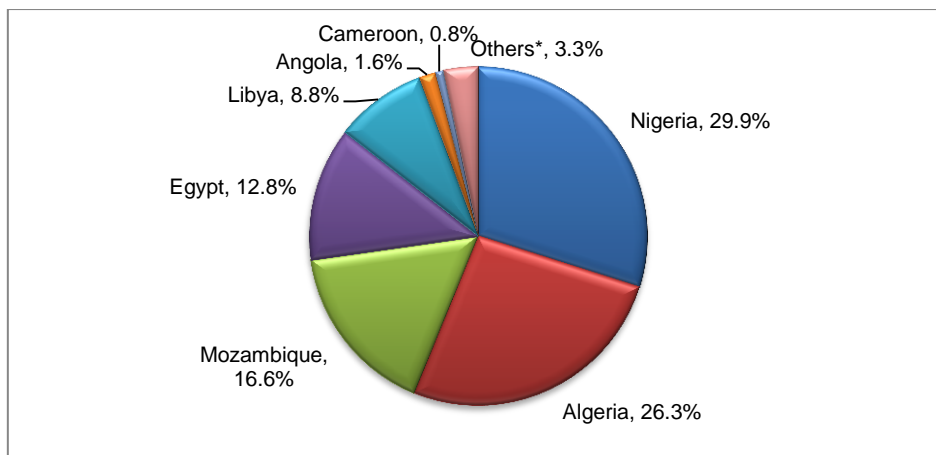
Figure 6.1.3: Top 15 Natural Gas Proved Reserves, Global, 2015



Source: EIA

Africa has about 8.7 per cent of the global natural gas proved reserves, and sub-Saharan Africa only 4.5 per cent.²² Nigeria, Mozambique and Angola have the largest natural gas proved reserves in sub-Saharan Africa to date.

Figure 6.1.4: Percentage Share of Natural Gas Proved Reserves in Africa, 2015



Source: EIA

Note: *Others include Congo-Brazzaville, Sudan, South Sudan, Tunisia, Namibia, Rwanda, Equatorial Guinea, Ivory Coast, Gabon, Mauritania, Ethiopia, Ghana, Uganda, Tanzania, Somalia and Morocco

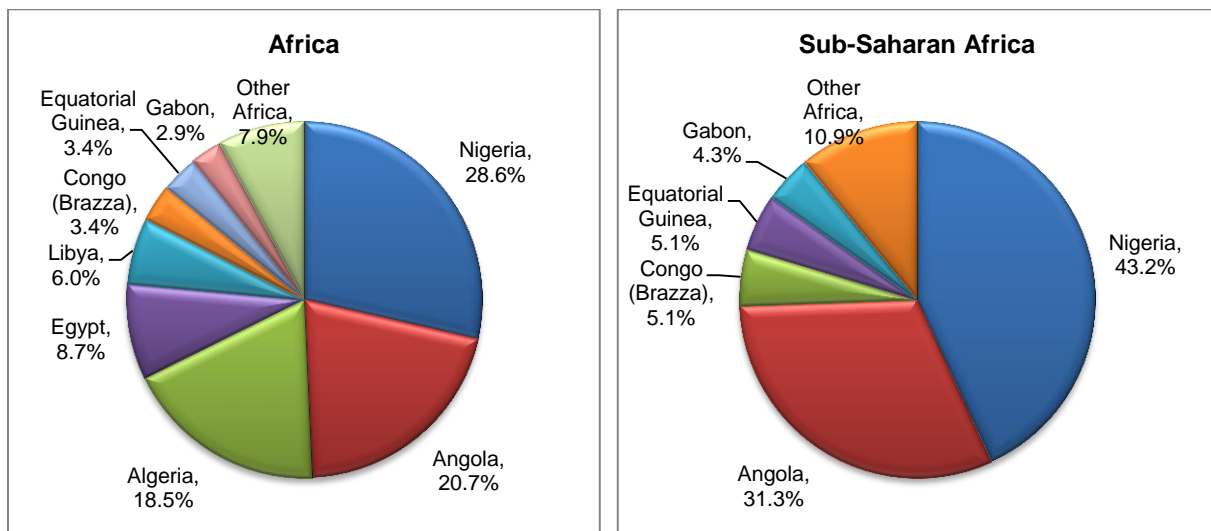
²² <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=3&pid=3&aid=6>

6.2 Oil Production & Consumption

According to the 2015 BP Statistical Review of World Energy, Africa produced 8.3 million barrels of oil per day in 2014. It corresponds to 9.3 per cent of the global oil production, estimated at 88.7 million barrels per day, whilst sub-Saharan Africa accounted for 6.3 per cent of the total. In sub-Saharan Africa, the largest oil producers are Nigeria and Angola, and then followed by Congo-Brazzaville, Equatorial Guinea, Gabon, South Sudan and Sudan.

Compared to the year before, Africa produced 5 per cent less oil in 2014, mainly attributable to disruptions in the Libyan oil sector.

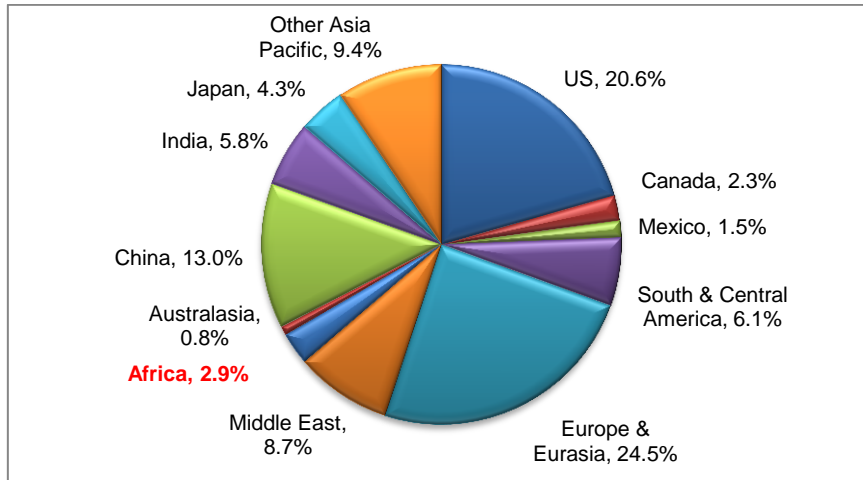
Figure 6.2.1: Percentage Share of Oil Production, Africa and sub-Saharan Africa, 2014



Source: BP Statistical Review of World Energy 2015

Notably, in terms of oil refinery throughputs, Africa only accounts for 2.9 per cent of the world total as the continent remains a net importer of refined petroleum products due to a lack of infrastructure in oil refineries and pipelines.

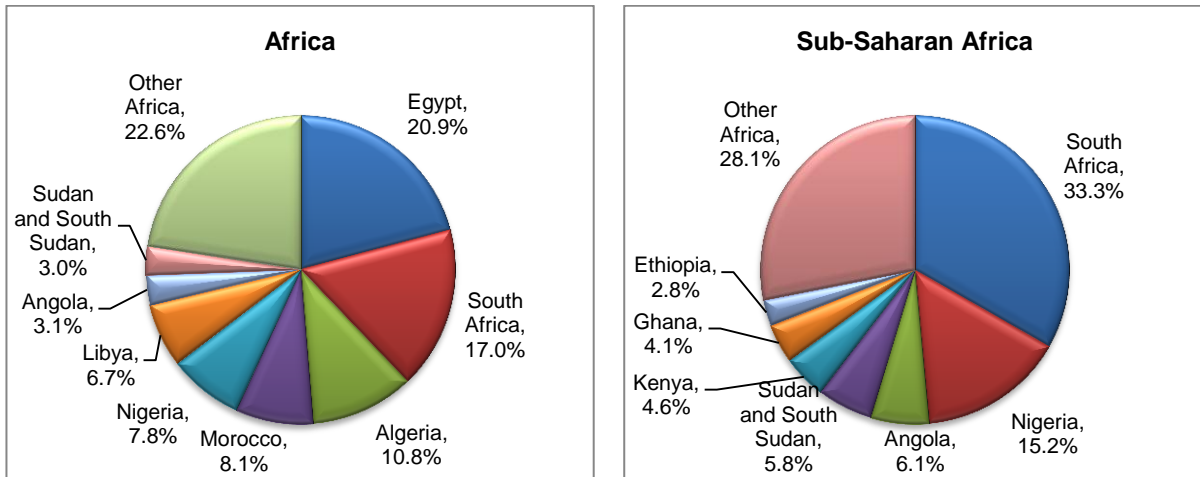
Figure 6.2.2: Percentage Share of Oil Refinery Throughputs by Region, 2014



Source: BP Statistical Review of World Energy 2015

According to BP, Africa represents 4.3 per cent of the global oil consumption in 2014 with North Africa, South Africa and Nigeria playing a preponderant role. In sub-Saharan Africa, oil consumption represents 2.1 per cent of global oil consumption and is dominated by South Africa, Nigeria, Angola, Sudan/South Sudan, Kenya, Ghana and Ethiopia.

Figure 6.2.3: Percentage Share of Oil Consumption, Africa and sub-Saharan Africa, 2014



Source: BP Statistical Review of World Energy 2015, EIA

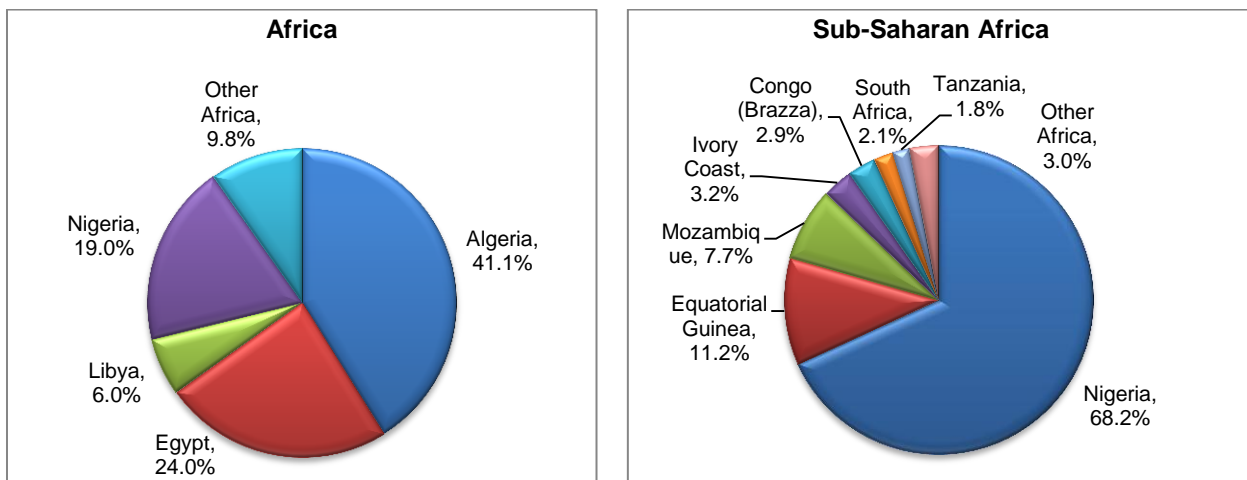
Compared to the year before, Africa increased its consumption of oil by 4.2 per cent in 2014, with the highest growth encountered in Egypt.

6.3 Gas Production & Consumption

According to BP, Africa produced 19.6 billion cubic feet (Bcf) of natural gas²³ per day in 2014. It corresponds to 5.8 per cent of the global natural gas production, estimated at 334.8 Bcf per day, whilst sub-Saharan Africa accounted for only 1.7 per cent of the total.

Compared to the year before, Africa reduced its 2014 production of natural gas by 1 per cent, mainly attributable to the depleting gas reserves and lower domestic natural gas production in Egypt, which is becoming a net importer of natural gas.

Figure 6.3.1: Percentage Share of Natural Gas Production, Africa and sub-Saharan Africa, 2014



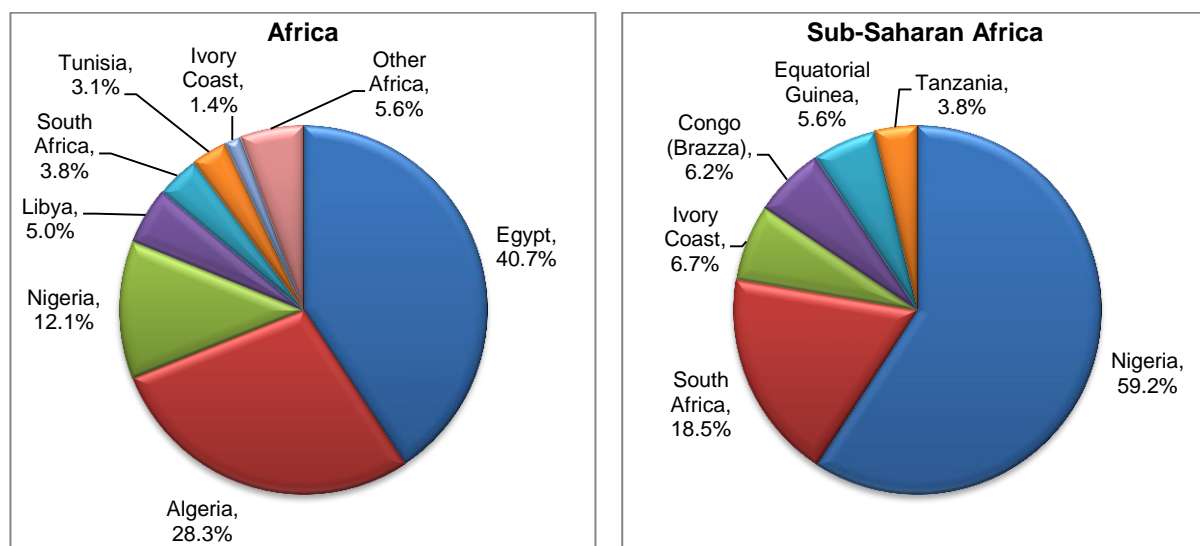
Source: BP Statistical Review of World Energy 2015, EIA

In sub-Saharan Africa, Nigeria, Equatorial Guinea and Mozambique are the largest gas producers. Angola is expected to seize a larger market share of gas production from 2016 onwards when its activities at its Soyo LNG facility resume.

According to BP, Africa represents 3.5 per cent of the global gas consumption in 2014 with Egypt and Algeria being the largest consumers. In sub-Saharan Africa, gas consumption is largely dominated by Nigeria and to a lesser extent South Africa, with the region only counting for 0.7 per cent of global gas consumption.

²³ Excludes gas flared or recycled. Includes natural gas produced for gas-to-liquids transformation.

Figure 6.3.2: Percentage Share of Gas Consumption, Africa and sub-Saharan Africa, 2014



Source: BP Statistical Review of World Energy 2015, EIA

Compared to the year before, Africa’s gas consumption was stable in 2014 (-0.1 per cent) with an increase in Algeria, compensated by a decrease in Egypt. The rest of the continent’s gas consumption remained stable.

6.4 Summary of Key Findings

Nigeria is clearly a dominant market player in the sub-Saharan African oil & gas industry. However, with the recent discoveries of new oil & gas resources, new countries might come to the fore from 2020 onwards:

- Kenya and Uganda for oil production
- Mozambique and Tanzania for gas production

Figure 6.4.1: Oil & Gas Production/Consumption Summary, Africa, 2014

	Total Africa	% Global	Total SSA	% Global	Top 3 in SSA
Oil Proved Reserves (billion barrels)	126.7	7.7%	61.2	3.7%	1. Nigeria 2. Angola 3. Sudan/S. Sudan
Oil Production (million barrels per day)	8.3	9.3%	5.5	6.3%	1. Nigeria 2. Angola 3. Congo (Brazza)
Oil Consumption (million barrels per day)	3.8	4.3%	1.9	2.1%	1. South Africa 2. Nigeria 3. Angola
Gas Proved Reserves (Tcf)	606	8.7%	311.6	4.5%	1. Nigeria 2. Mozambique 3. Angola

Gas Production (Bcf per day)	19.6	5.8%	5.7	1.7%	1. Nigeria 2. Equ. Guinea 3. Mozambique
Gas Consumption (Bcf per day)	11.6	3.5%	2.4	0.7%	1. Nigeria 2. South Africa 3. Ivory Coast

Source: BP, EIA, Frost & Sullivan

The major trading partner of the top oil exporters in sub-Saharan Africa used to be the USA. Since the past three years, as the USA are becoming more and more self-sufficient, African countries are looking for new markets to sell their oil and rather focusing on Asia, Europe and to a lesser extent Latin America.

Figure 6.4.2: Major Oil Export Trading Partners, sub-Saharan Africa, 2010-2014

Top 3 Oil Exporter	2010 Major Exporting Markets	2014 Major Exporting Markets
Nigeria	USA, India, Brazil, Netherlands	India, Netherlands, Brazil, Spain
Angola	China, USA, India, Taiwan	China, India, USA, Spain
Equ. Guinea	USA, Spain, Italy, Canada	China, UK, France, Brazil

Source: Trade Map, Frost & Sullivan

The major trading partners of the top gas exporters in sub-Saharan Africa remain Asian countries.

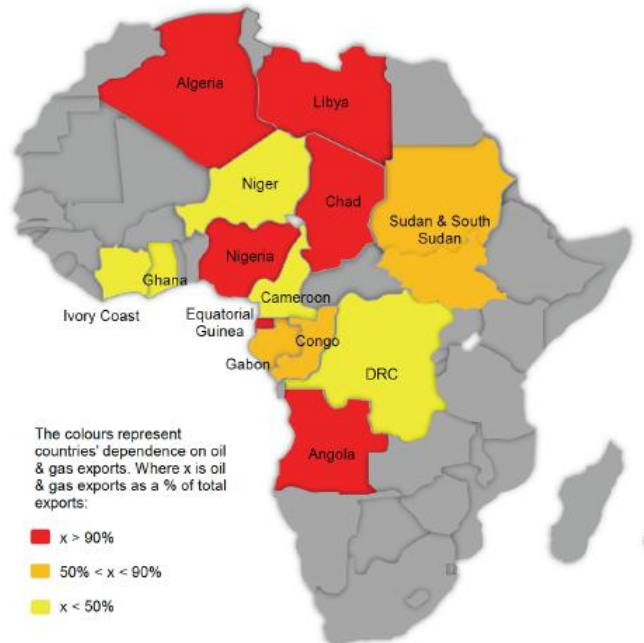
Figure 6.4.3: Major Gas Export Trading Partners, sub-Saharan Africa, 2010-2014

Top 3 Gas Exporter	2010 Major Exporting Markets	2014 Major Exporting Markets
Nigeria	Belgium, India, USA	Confidential country, Japan, Spain
Equ. Guinea	South Korea, Japan, Taiwan	Singapore, Japan, China
Angola	Brazil, South Korea, China	China, Japan, South Korea

Source: Trade Map, Frost & Sullivan

Even though the overall effect of lower oil & gas prices will on aggregate impact negatively the GDP growth of Africa, the effect might be quite different from one country to another. North and Central/West Africa have mainly been exporters of oil & gas, whilst East and Southern Africa importer of oil. Thereby the effect of low oil & gas prices will rather be negative in the countries highlighted in the map below as compared to the countries in grey.

Figure 6.4.4: Map of African Net Oil Exporters, 2014



Source: KPMG

Oil also accounts for 75 per cent of the government's revenues in Angola, Congo-Brazzaville and Equatorial Guinea.

When we look at the dependence from oil & gas exports on the countries' GDP, the story becomes slightly different. The table on the next page summarises the value (in US\$) of oil and gas imports and exports for each country of sub-Saharan Africa.

The countries which are the most exposed to global oil and gas markets as a percentage of their GDP (oil & gas exports larger or equal to 40 per cent of their 2014 GDP) are Equatorial Guinea (78.5 per cent), Angola (47.8 per cent), Sudan/South Sudan (45 per cent) and Gabon (41.7 per cent). Other countries having a significant exposure (oil & gas exports larger than 10 per cent but smaller than 40 per cent) are Congo-Brazzaville (29.9 per cent), Chad (20.2 per cent), Nigeria (15.5 per cent) and Guinea (14.1 per cent).

Figure 6.4.5: Oil & Gas Imports/Exports (in US\$), sub-Saharan Africa, 2014

Country	2014 Crude Oil Exports	2014 Crude Oil Imports	2014 Natural Gas Exports	2014 Natural Gas Imports	2014 Total O&G Exports	2014 Total O&G Imports	O&G EX-IM	Net exporter/importer	2014 GDP (current prices)	2014 O&G Exports as % GDP
Angola	61,191,639,000	25,855,000	660,084,000	1,142,000	61,851,723,000	26,997,000	61,824,726,000	Net exporter	129,326,000,000	47.8%
Benin	11,000	0	2,900,000	20,810,000	2,911,000	20,810,000	-17,899,000	Net importer	8,685,000,000	0.0%
Botswana	23,000	177,000	52,000	16,383,000	75,000	16,560,000	-16,485,000	Net importer	15,217,000,000	0.0%
Burkina Faso	0	2,000	0	56,635,000	0	56,637,000	-56,637,000	Net importer	12,503,000,000	0.0%
Burundi	0	0	8,000	482,000	8,000	482,000	-474,000	Net importer	3,094,000,000	0.0%
Cabo Verde	0	0	0	10,317,000	0	10,317,000	-10,317,000	Net importer	1,858,000,000	0.0%
Cameroon	2,469,166,000	1,429,928,000	25,000	81,713,000	2,469,191,000	1,511,641,000	957,550,000	Net exporter	31,777,000,000	7.8%
CAR	0	0	0	142,000	0	142,000	-142,000	Net importer	1,726,000,000	0.0%
Chad	2,814,504,000	0	0	143,000	2,814,504,000	143,000	2,814,361,000	Net exporter	13,945,000,000	20.2%
Congo (Brazza)	4,009,545,000	4,000	41,286,000	360,000	4,050,831,000	364,000	4,050,467,000	Net exporter	13,552,000,000	29.9%
Ivory Coast	652,054,000	2,612,550,000	769,000	129,178,000	652,823,000	2,741,728,000	-2,088,905,000	Net importer	33,741,000,000	1.9%
DRC	980,760,000	132,000	31,000	467,000	980,791,000	599,000	980,192,000	Net exporter	35,918,000,000	2.7%
Djibouti	0	0	0	4,000	0	4,000	-4,000	Net importer	NA	NA
Equatorial Guinea	8,832,503,000	1,000	3,357,594,000	50,000	12,190,097,000	51,000	12,190,046,000	Net exporter	15,530,000,000	78.5%
Eritrea	0	0	0	761,000	0	761,000	-761,000	Net importer	3,858,000,000	0.0%
Ethiopia	0	1,703,000	2,000	15,978,000	2,000	17,681,000	-17,679,000	Net importer	54,809,000,000	0.0%
Gabon	7,584,784,000	2,127,000	231,000	24,335,000	7,585,015,000	26,462,000	7,558,553,000	Net exporter	18,209,000,000	41.7%
Gambia	0	148,000	0	50,000	0	198,000	-198,000	Net importer	824,000,000	0.0%
Ghana	3,834,221,000	1,169,000	21,253,000	76,621,000	3,855,474,000	77,790,000	3,777,684,000	Net exporter	38,616,000,000	10.0%
Guinea	946,746,000	21,243,000	2,000	405,000	946,748,000	21,648,000	925,100,000	Net exporter	6,707,000,000	14.1%
Kenya	0	0	2,128,000	6,762,000	2,128,000	6,762,000	-4,634,000	Net importer	60,937,000,000	0.0%
Lesotho	0	71,000	76,000	10,495,000	76,000	10,566,000	-10,490,000	Net importer	2,220,000,000	0.0%
Liberia	0	1,000	0	320,000	0	321,000	-321,000	Net importer	2,013,000,000	0.0%
Madagascar	0	0	672,000	15,451,000	672,000	15,451,000	-14,779,000	Net importer	10,674,000,000	0.0%
Malawi	0	71,000	0	960,000	0	1,031,000	-1,031,000	Net importer	6,055,000,000	0.0%
Mali	0	0	0	26,178,000	0	26,178,000	-26,178,000	Net importer	12,094,000,000	0.0%
Mauritius	0	0	1,257,000	105,313,000	1,257,000	105,313,000	-104,056,000	Net importer	12,588,000,000	0.0%
Mozambique	0	43,000	568,658,000	39,396,000	568,658,000	39,439,000	529,219,000	Net exporter	16,684,000,000	3.4%
Namibia	21,000	308,000	239,000	8,103,000	260,000	8,411,000	-8,151,000	Net importer	13,632,000,000	0.0%
Niger	0	4,000	11,263,000	149,000	11,263,000	153,000	11,110,000	Net exporter	8,024,000,000	0.1%
Nigeria	76,234,949,000	2,178,000	12,963,262,000	74,440,000	89,198,211,000	76,618,000	89,121,593,000	Net exporter	573,999,000,000	15.5%
Rwanda	10,000	0	212,000	3,140,000	222,000	3,140,000	-2,918,000	Net importer	7,897,000,000	0.0%
Senegal	0	522,120,000	6,101,000	108,442,000	6,101,000	630,562,000	-624,461,000	Net importer	15,683,000,000	0.0%
Sierra Leone	0	0	2,652,000	226,000	2,652,000	226,000	2,426,000	Net exporter	4,815,000,000	0.1%
South Africa	69,979,000	16,212,059,000	69,771,000	422,162,000	139,750,000	16,634,221,000	-16,494,471,000	Net importer	350,082,000,000	0.0%
Sudan (N+S)	6,430,462,000	103,000	565,000	13,172,000	6,431,027,000	13,275,000	6,417,752,000	Net exporter	14,304,000,000	45.0%
Swaziland	0	4,000	22,534,000	4,320,000	22,534,000	4,324,000	18,210,000	Net exporter	4,416,000,000	0.5%
Tanzania	0	3,485,000	1,001,000	101,573,000	1,001,000	105,058,000	-104,057,000	Net importer	48,089,000,000	0.0%
Togo	4,000	71,000	1,000	12,488,000	5,000	12,559,000	-12,554,000	Net importer	4,594,000,000	0.0%
Uganda	25,000	87,000	79,000	15,921,000	104,000	16,008,000	-15,904,000	Net importer	27,616,000,000	0.0%
Zambia	95,000	179,450,000	7,242,000	1,235,000	7,337,000	180,685,000	-173,348,000	Net importer	26,611,000,000	0.0%
Zimbabwe	0	171,000	0	16,549,000	0	16,720,000	-16,720,000	Net importer	13,833,000,000	0.0%

Source: Trade Map, Frost & Sullivan

7. Major IOCs and NOCs

Even though it is difficult to depict major trends without a deep analysis of recent farm-in/out activities, one can conclude that there has been an increasing involvement of IOCs and NOCs from emerging countries such as China, India, Thailand, South Korea, Malaysia, Russia and Brazil since 2009. This happened often in partnership with global established North American and European IOCs.

Figure 7.1: Key Oil & Gas Players²⁴, sub-Saharan Africa, 2014-2015

Country	NOCs	IOCs
Angola	Sonangol	<p>North America: ExxonMobil, Chevron, Marathon Oil, Cobalt International Energy, ConocoPhillips, Falcon Oil</p> <p>Europe: BP, Statoil, Eni, Total, Repsol, Galp Energia, Maersk, MOL</p> <p>Asia: China Sonangol International, Sonangol Sinopec International, Unipet</p> <p>South America: Petrobras, Cubapetroleo (CUPET)</p> <p>Africa: Somoil, Afex</p>
Cameroon	Société Nationale des Hydrocarbures (SNH)	<p>North America: Kosmos Energy, ExxonMobil, Murphy Oil, Chevron, Noble Energy, Fusion</p> <p>Europe: Total, Shell, Engie (GDF Suez), Perenco, Bowleven, Rodeo Development (Victoria Oil & Gas), Glencore, MOL (Pronodar), New Age (African Global Energy), Tower Resources</p> <p>Eurasia: Lukoil</p> <p>Asia: PetroVietnam (PVEP), Petronas, Addax Petroleum</p> <p>Africa: EurOil, Afex, Pecten, Africa Fortesa</p>
Congo (Brazza)	Société Nationale des Pétroles du Congo (SNPC)	<p>North America: Murphy Oil, Chevron, ExxonMobil</p> <p>Europe: Total, Eni, SOCO International, Perenco, New Age (African Global Energy)</p> <p>Asia: PetroVietnam (PVEP)</p> <p>Africa: Africa O&G, Prestoil</p>
Equ. Guinea	GEPetrol, Sonagas	<p>North America: Marathon Oil, ExxonMobil, Murphy Oil, PanAtlantic, Noble Energy, Hess, Brenham Oil & Gas, Murphy Oil, RoyalGate Energy</p> <p>Europe: Ophir Energy, Glencore</p> <p>Asia: CNOOC, Xuan Energy, Afex</p> <p>Africa: Starc, PetroSA</p>
Gabon	Gabon Oil Company (GOC)	<p>North America: ExxonMobil, VAALCO Energy, Marathon Oil, Harvest Natural Resources, Cobalt International, Noble Energy</p> <p>Europe: Total, Shell, Repsol, Eni, Ophir Energy, Impact Oil & Gas, Perenco</p> <p>Asia: Addax Petroleum, CNOOC, Oil India Limited (OIL), Marvis</p> <p>South America: Petrobras</p> <p>Africa: PetroSA</p>
Ghana	Ghana National Petroleum	<p>North America: Kosmos Energy, Hess, PanAtlantic, Anadarko, Lushann International, Heritage Oil, Erin Energy</p>

²⁴ The list is non-exhaustive

	Corporation (GNPC)	(former CAMAC Energy) Europe: Eni, Tullow Oil, Shell, Ophir Energy, Afren, Aker Eurasia: Lukoil Oceania: Tap Oil Africa: PetroSA, Gasop, Oranto, Sahara Oil, Amni International
Ivory Coast	Société Nationale d'Opérations Pétrolières de Côte d'Ivoire (Petroci)	North America: PanAtlantic, Canadian Natural Resources (CNRL), Anadarko Europe: Total, Tullow Oil, Afren, Edison, African Petroleum Eurasia: Lukoil Oceania: Azonto Petroleum Africa: Foxtrot
Kenya	National Oil Corporation of Kenya (NOCK)	North America: Anadarko, Erin Energy, Marathon Oil, ERHC, Apache, Pancontinental, Africa Oil, Rift Energy, Simba Energy, Vangold, Imara Energy, Pacific Seaboard Europe: Eni, Total, Tullow Oil, Swiss Oil Company, BG Group, Ophir Energy, Afren, Maersk, Bowleven, Edgo Energy, Tower Resources Asia: CNOOC, Taipan Resources, PTTEP Oceania: Sunbird Energy, FAR, Swala Energy Africa: A-Z Petroleum
Mozambique	Empresa Nacional de Hidrocarbonetos (ENH)	North America: Anadarko, Wentworth, ExxonMobil Europe: Eni, Total, Maurel & Prom, Galp Energia, Statoil Eurasia: Rosneft Asia: PTT Exploration and Production (PTTEP), Mitsui, ONGC Videsh (OVL), China National Petroleum (CNPC), KOGAS, Petronas, Bharat Petroleum (BPRL), Energi Mega Persada (EMP), Delonex Energy, Indian Oil (IOL) Africa: Sasol, CMH
Nigeria	Nigerian National Petroleum Corporation (NNPC)	North America: ExxonMobil, Chevron, Star Deep Water Petroleum, Erin Energy, Syntroleum Europe: Shell, Total, Statoil, Eni, Hardy Oil and Gas, Hardy Oil & Gas, Heritage Oil, New Age (African Global Energy), Afren Asia: Sinopec, Addax Petroleum, Nexen Petroleum (CNOOC), South America: Petrobras Oceania: Jacka Resources Africa: Oando, Oranto, South Atlantic Petroleum (SAPETRO), SEPLAT, Elf (EPNL), Esso Exploration and Production Nigeria (EEP NL), Neconde Energy, Pan Ocean
South Africa	PetroSA	North America: Anadarko, Chevron, ExxonMobil, Falcon Oil, Forest Oil, Canadian Natural Resources, Rift Energy Europe: Total, Eni, Shell, BP, Anglo American, Impact Oil & Gas, New Age (African Global Energy), Tower Resources, Thombo Petroleum, Impact Oil & Gas Asia: Cairn India Oceania: Sunbird Energy, BHP Billiton, Kinetiko Energy, Bundu (Challenger Energy) Africa: Engen, Sasol

South Sudan	Nile Petroleum Corporation (Nilepet)	<p>North America: ExxonMobil</p> <p>Europe: Shell, Total</p> <p>Middle East: Kuwait</p> <p>Asia: Sinopec, CNPC, ONGC, Petronas</p> <p>Africa: Petrodar Operating Company (PDOC), Dar Petroleum Operating Company (DPOC), Sudd Petroleum Operating Company (SPOC), Greater Nile Petroleum Operating Company (GNPOC), Tri-Ocean Energy</p>
Tanzania	Tanzania Petroleum Development Corporation (TPDC)	<p>North America: ExxonMobil, Wentworth, PetroQuest, NOR Energy</p> <p>Europe: Shell, Statoil, BG Group, Ophir Energy, Afren, Maurel & Prom, Aminex, Heritage Oil, Signet Petroleum</p> <p>Asia: Pavilion Energy</p> <p>South America: Petrobras</p> <p>Oceania: Jacka Resources, Beach Energy, Bounty Oil & Gas, Swala Energy, Woodside Petroleum</p> <p>Africa: Ndovu Resources (Aminex), Orca, Pan African</p>
Uganda	Uganda National Oil Company (Natoil)	<p>North America: ExxonMobil</p> <p>Europe: Total, Tullow Oil, Shell, BP</p> <p>Eurasia: Lukoil, Gazprom</p> <p>South America: Petrobras</p> <p>Asia: CNOOC, Petrochina</p>

Source: Frost & Sullivan

8. Key Investment Opportunities

A sustained growth in the oil & gas upstream sector in sub-Saharan Africa requires significant investment in infrastructure such as pipelines, storage facilities, import/export terminals, refineries, gas liquefaction and regasification facilities, central processing facilities, and so forth. The majority of oil & gas acreage in sub-Saharan Africa remains inactive, which leads to a strong potential for further development of the industry.

8.1 Oil Refineries

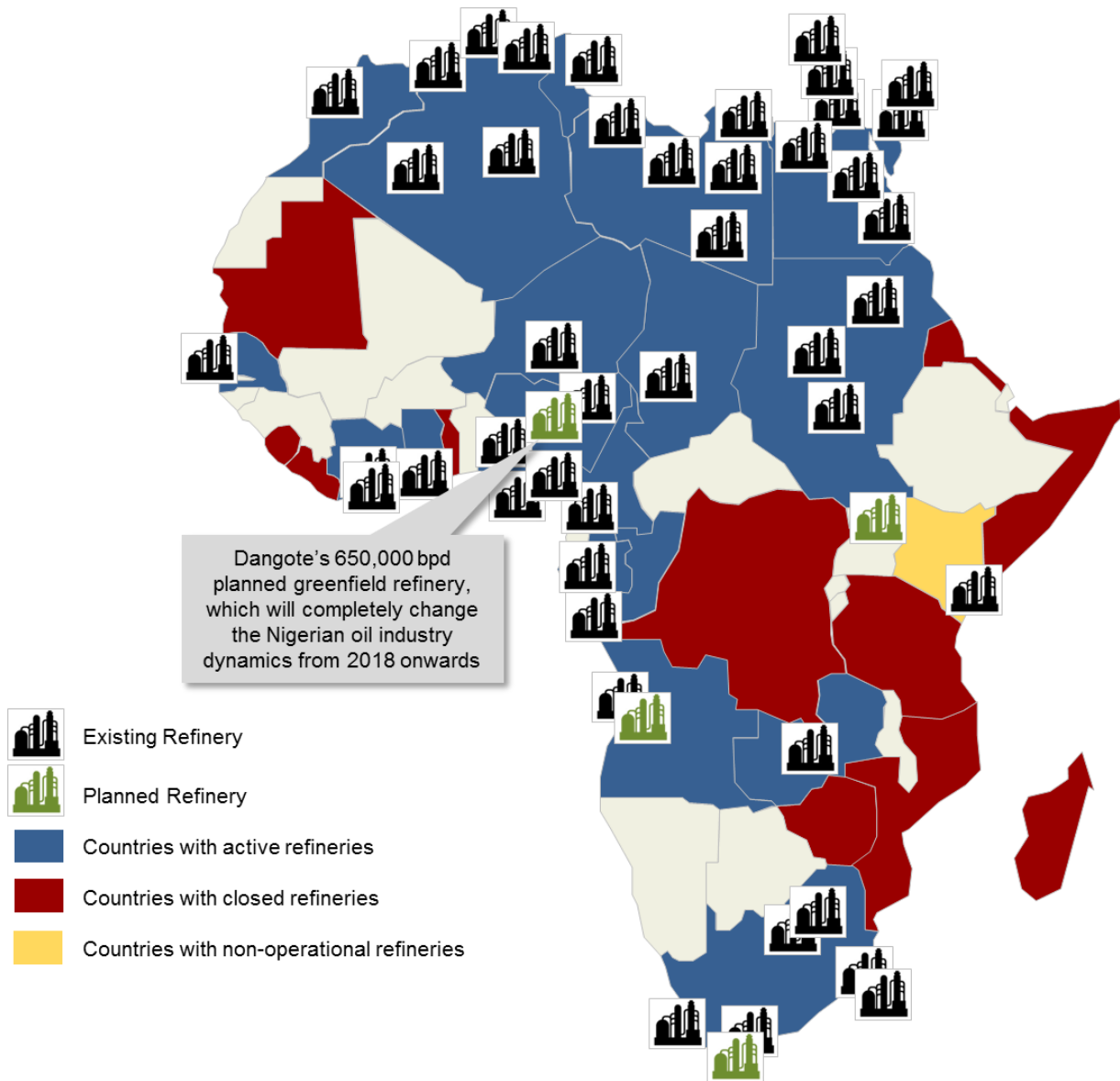
As reported by KPMG, *“Despite Africa’s substantial oil resources, refining capacity on the continent remains limited. As such, countries like Angola and Nigeria export crude oil, only to import refined oil at an additional cost.”*²⁵ Moreover, most refineries in sub-Saharan Africa are operating well below their capacity, thereby reflecting the inefficiencies caused by corruption, theft, poor maintenance and other operational issues.

In total, 58 oil refineries have been built in Africa with a total refining capacity of about 3.6 million barrels per day, including 35 in sub-Saharan Africa. Nevertheless, due to low worldwide refining margins, tightening product specifications, small domestic markets and high operating costs, many refineries were forced to close down. Since the 1960s about 15 refineries have closed across Africa, 12 of which were in sub-Saharan Africa. The refinery of Mombasa, Kenya, has been idle since September 2013 and prospects for resumption are not looking good. A lot of new refinery announcements have been made in the past decade, but not much has been concretised. According to the London-based consulting firm CITAC, *“of these projects, the only new refineries to have been commissioned are the Chinese-built refineries in Algeria (Soralchin), Chad (SRN) and Niger (SORAZ). There have also been capacity expansions and/or upgrades in Sudan (KRC), Morocco (Samir) and Algeria (Skikda and Arzew). Throughout the past decade, operating refineries in the region have made significant investments in improving efficiency and product quality, but few have increased refining capacity.”*²⁶

²⁵ KPMG, Oil & Gas in Africa, 2015, page 4

²⁶ CITAC, Oil Refining In Africa – Summary, 2015 Edition, pages 1 and 2

Figure 8.1.1: Existing and Planned Refineries, Africa, 2015



Source: CITAC, Frost & Sullivan

Despite the fact that many new refinery projects have been announced, only four new refineries have a higher likelihood of being concretised in the near future.

Figure 8.1.2: Planned/Proposed Greenfield Refineries, sub-Saharan Africa, 2015-2020

Country	Capacity (bpd)	Completion Date	Owner(s)	Details
Nigeria	650,000	2018	Dangote	Integrated refining complex including a refinery (which will meet Euro V standards), a petrochemical and fertiliser plant as well as a natural gas power plant.
Uganda	30,000 – 60,000	2018-2020	RT Global Resources / Upstream: Tullow Oil, CNOOC, Total	On hold – Strong push from government, but the project is expected to face delays due to the unfavourable oil price environment. Refinery planned to be built by Rosatom. A pipeline between Uganda and Kenya (port of Lamu) is expected to allow Uganda to export surplus (refined) oil. However, both the pipeline and the refinery will face delays due to a decrease of investments/interests from IOCs in upstream E&P activities.
Angola	110,000	2018	Sonangol	Construction awarded to the Chinese Tianchen Engineering Corp.
South Africa	360,000	2018	PetroSA	To meet Euro V standards. Planned to be located in Coega Industrial Development Zone.

Source: Frost & Sullivan

These projects might incur further delays and year of completion might consequently be postponed. Nevertheless, there is a high likelihood that Dangote’s project will be completed first. This project is expected to completely change the oil & gas industry of Nigeria (from a net importer of refined petroleum products to a net exporter), but also of neighbouring countries which might benefit from its exports.

A feasibility study is also being undertaken in Ghana to build a second refinery by the South Africa-based New Alpha Refinery with a capacity of 200,000 bpd. The Australia-based Maysen and Borowski Claymont Joint Venture (MBCJV) and local Phoenix Materials and Constructing Company are also looking at the feasibility to build a second refinery in Zambia. Feedstock will be transported via a new crude oil pipeline from Tanzania.

In South Africa, the government has determined the country should migrate from its current fuel specifications and standards (CF1), which are comparable with Euro II emissions standards, to CF2, which is comparable to Euro V emissions standards. This would mean a major upgrade of the six existing refineries in South Africa. It was initially foreseen to

implement the migration by July 2017. However, due to little clarity as to how the upgrade will be funded, it may be delayed to 2020.

Kenya is also looking at the possible conversion of its KPRL refinery into a storage terminal for imported petroleum products.

8.2 Gas Liquefaction and Regasification Facilities

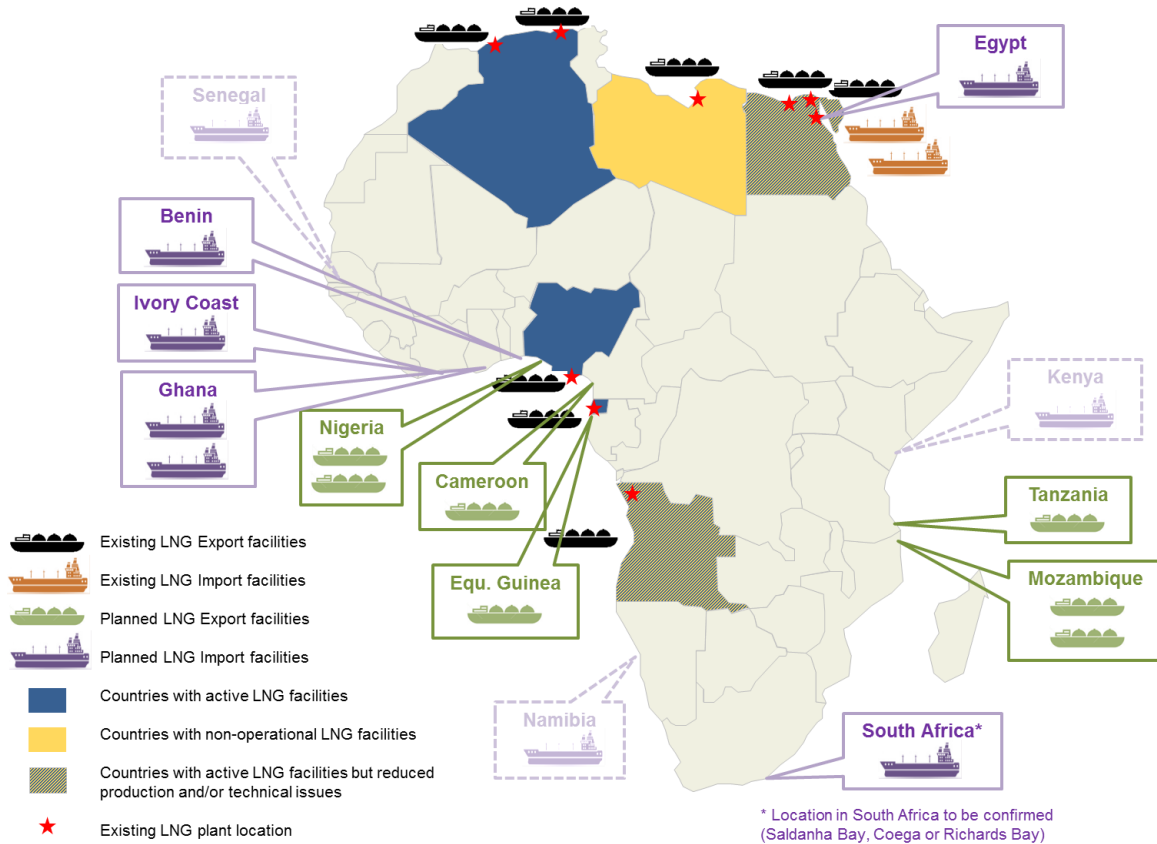
Gas infrastructure is considerably less developed in Africa as compared to oil. In Africa, all existing LNG facilities have been onshore export LNG facilities. However, due to important gas shortages, Egypt became in 2015 the first country on the continent to import LNG. Two floating storage and regasification units (FSRU) commenced operations in the country in April and October 2015.

Libya was the first country to export LNG on the continent, but the facility at Marsa El Brega has not been operational since the 2011 civil war. After Libya, Algeria then followed by Nigeria, Equatorial Guinea and more recently Angola, have built LNG export facilities. Even though it has been commissioned in 2013, Angola's LNG facility has remained shut down most of the time due to technical issues. Operations were expected to resume by the end of 2015.

Several countries plan to import LNG. In addition to Egypt, Ghana, Ivory Coast, Benin, Senegal, Namibia and South Africa are in a more or less advanced stage of constructing and/or chartering new regasification terminals/vessels. Most of the countries are considering FSRUs which are more flexible and can become operational in a much quicker timeframe than onshore terminals. South Africa is still considering both options. Kenya's plans are on hold following a recent domestic gas discovery made by the Canadian oil & gas company Africa Oil Corporation.

Cameroon is expected to join the LNG-exporter "club" by 2017 whilst Mozambique and less likely Tanzania in the next decade (2019-2020 the earliest for Mozambique and 2025 the earliest for Tanzania).

Figure 8.2.1: Existing and Planned LNG Facilities, Africa, 2015



Source: Frost & Sullivan

The largest LNG exporters on the continent to date are Algeria and Nigeria.

Figure 8.2.2: Existing LNG Export Facilities, Africa, 2015

Country	Project Name	Type	Installed Capacity (MTPA)	Owner(s)	Details
Libya	Marsa El Brega	Onshore	3.2	LNOC	Inactive since early 2011
Algeria	Skikda GL1/2K	Onshore	6.7	Sonatrach	GL1K: 4 trains and GL2K: 2 trains
Algeria	Arzew GL1/2/3Z	Onshore	19.5	Sonatrach	GL1Z : 6 trains, GL2Z : 6 trains and GL3Z : 1 train
Nigeria	NLNG T1-6	Onshore	21.9	NNPC, Shell, Total, Eni	6 trains
Egypt	ELNG T1-2	Onshore	7.2	BG, Petronas, EGAS, EGPC, Engie	2 trains – Operations greatly reduced since start of 2014 due to gas supply issues
Egypt	Damietta LNG T1	Onshore	5	Gas Natural Fenosa, Eni, EGPC, EGAS	1 train – Not operational since end of 2012 due to fuel supply issues
Equ. Guinea	EG LNG T1	Onshore	3.7	Marathon Oil, Sonagas,	1 train

Angola	Soyo LNG T1	Onshore	5.2	Mitsui, Marubeni Chevron, Sonangol, BP, Eni, Total	1 train – Plan to resume operations by end 2015 due to technical issues
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Source: International Gas Union (IGU), Frost & Sullivan

With regards new gas liquefaction facilities, recent developments have shown that projects which progressed the most lately were the offshore FLNG export projects. None of the onshore LNG export projects have started the construction phase. The offshore FLNG project in Cameroon made significant progress in September 2015 when a gas convention was signed between all interested parties, the last step which was required to reach a final investment decision (FID). With regards other (F)LNG projects, the two projects in Mozambique are close to reach an FID, which is expected to take place in 2016, but after having been constantly pushed back.

Figure 8.2.3: Planned/Proposed LNG Export Facilities, Africa, 2015

Country	Project Name	Type	Installed Capacity (MTPA)	Owner(s)	Details
Cameroon	GoFLNG Hilli	Floating	1.2	Golar Upstream partners : Perenco, Société Nationale des Hydrocarbures (SNH)	FID reached in Q3 2015. 4-train vessel to be supplied by Golar under a tolling agreement. 8-year project life at production of 1.2 MTPA (2 trains being utilised). Offtaker to be Gazprom. Expected to start operations in Q2 2017
Cameroon	Cameroon LNG	Onshore	3.5	Engie, SNH	Uncertain (unlikely), especially with the recent progress of GoFLNG
Mozambique	Palma LNG	Onshore	12	Anadarko, Mitsui, OVL, ENH, BPRL, PTTEP, OIL	FID expected in 2016. 2 trains of 6 MTPA. Completion expected between 2020-2025
Mozambique	Coral South FLNG	Floating	2.5-3	Eni, CNPC, ENH, KOGAS, Galp Energia	FID expected in 2016. 1 FLNG vessel of 2.5 MTPA. Offtaker will be BP (non-binding). Completion expected by 2019-2020

Equ. Guinea	GoFLNG Gandria (Fortuna FLNG)	Floating	2.2	Golar Upstream partners: Ophir Energy, GEPetrol	FID expected in 1H 2016. Vessel to be supplied by Golar under a tolling agreement. 20-year project life at production of 2.2 MTPA. Expected to start operations in 1H 2019
Equ. Guinea	EG LNG T2	Onshore	3.7	Marathon Oil, Sonagas, Mitsui, Marubeni	Cancelled – Additional train to existing LNG facility
Tanzania	Tanzania LNG	Onshore	10	Statoil, BG Group/Shell, Ophir Energy, Pavilion Energy, TPDC	Uncertain – 2 trains of 5 MTPA. FID not before 2018 and commercial operation mid-2020s
Nigeria	Brass LNG	Onshore	10	NNPC, Eni, Total	Uncertain (shareholders still committed). 2 trains of 5 MTPA
Nigeria	NLNG T7	Onshore	8	NNPC, Shell, Total, Eni	Uncertain – FID delayed (shareholders still committed) – Additional train to existing LNG facility
Nigeria	Olokola (OK) LNG	Onshore	12.6	NNPC	On hold (unlikely) – 2 trains of 6.3 MTPA

Source: Frost & Sullivan

Despite the global LNG supply glut, Anadarko, Eni, Perenco and Ophir Energy have remained bullish about their offshore FLNG projects (only Anadarko's is onshore). At the time of writing, none of them has presented any signs of putting their investment plans on hold. But FIDs have been constantly slipping. However, all other onshore LNG projects in Tanzania, Nigeria and Equatorial Guinea are likely to be delayed, halted or even cancelled as not much commercial/development progress occurred in the past year.

Because the LNG export projects in Mozambique, Equatorial Guinea, Nigeria and Tanzania are specifically catering for global markets the downward pressure on global LNG prices is a major uncertainty for them. According to industry experts, first LNG production from the onshore facility in Mozambique is not expected before 2021-2022, or even later. Anadarko's Palma LNG project is unprecedented on the continent and therefore, will likely face cost overruns and delays. Also, revenues for the government out of this particular project will mainly come from 2030 onwards due to the fiscal regime and structure of the 2006 Engineering, Procurement, Construction and Commissioning contracts (EPCCs), and not before. This means that a local gas domestic market is still far off in Mozambique.

In West Africa however, commercial developments seem to progress well with regards the installation of (floating) LNG import facilities, as power utilities and IPPs are keen to take advantage of the current LNG decreasing price trends.

Figure 8.2.4: Existing LNG Import Facility, Africa, 2015

Country	Type	Regas Capacity (mmscfd)	Owner	Details
Egypt	FSRU	500	Höegh Gallant	5-year contract which started in April 2015. Charterer is Egyptian Natural Gas Holding Company (EGAS)
Egypt	FSRU	750	BW Group	5-year contract which started in October 2015. Charterer is Egyptian Natural Gas Holding Company (EGAS)

Source: Frost & Sullivan

Egypt already eyes a third FSRU by 2017 whilst Golar and West African Gas Limited signed a 5-year contract for the first FSRU to be delivered in sub-Saharan Africa (Ghana) by early next year. Numerous other FSRUs have been proposed, mainly in West Africa, to cater for the region's increasing gas-to-power appetite. The three projects in Ghana are expected to compete with one another and it is unlikely that all three will be implemented.

Figure 8.2.5: Planned/Proposed LNG Import Facility, Africa, 2015

Country	Type	Regas Capacity (mmscfd)	Owner	Delivery Date
Egypt	FSRU	TBC	TBC	Proposed – End 2016 or 2017
Ghana	FSRU	750	Golar – West African Gas Limited (WAGL)	Planned: Q2 2016 – 5 year contract with WAGL (60% owned by NNPC and 40% by Sahara Energy Resource)
Ghana	FSRU	TBC	Excelerate Energy – Ghana 1000 (General Electric and Endeavour Energy)	Proposed – Ghana 1000 is an integrated gas-to-power project that will consist of 1,300 MW to be delivered in two phases, an FSRU and related infrastructure necessary to import LNG. Timings are uncertain. An agreement was signed between Excelerate Energy and the Ghana 1000 consortium in February 2015 for the reservation of an FSRU. Timing TBC
Ghana	FSRU	TBC	Golar – Quantum Power Ghana Gas	Proposed – No recent development or information available. The aim of Quantum Power with this project is

				to provide cheap sources of gas to IPPs and industrial customers in Ghana
Ivory Coast	FSRU	TBC	Excelerate Energy – Endeavour Energy, Starenergie2073	Proposed – FID expected end 2015. The Songon project aims to add 375 MW of gas-fired power generation in Ivory Coast. LNG to be supplied through an FSRU
Namibia	FSRU	TBC	Excelerate Energy – NamPower, Xaris Holdings, Ariya Capital Group, General Electric	On hold – The Walvis Bay power plant project will be a 250-300 MW gas-fired power plant, whose gas will be imported in the form of LNG. Project currently on hold
South Africa	FSRU / Onshore	TBC	TBC	Proposed – Various options being evaluated. There might be more than one LNG import facility
Kenya	FSRU	TBC	TBC	On hold amid a recent domestic onshore gas discovery of 1.8 Tcf by Africa Oil Corporation
Benin	FSRU	< 100	Gasol – Volta River Authority	Proposed – Long-term agreement signed between Gasol and Volta River Authority in Ghana to install an FSRU in Benin
Senegal	FSRU	TBC	Nebras Power	<i>Memorandum of Understanding signed in 2015</i>

Source: Frost & Sullivan

The Senegalese FSRU is by far the less advanced project. Nigeria is targeting selling its LNG to all these potential new customers: Benin, Ghana, Ivory Coast, Namibia and later Senegal. Cameroon, Equatorial Guinea and Angola are expected to compete fiercely with Nigeria in terms of LNG supply in the region. Achieving cost competitiveness in producing gas will be essential.

Moreover all countries exporting LNG outside of Africa will also face high competition from new sources of LNG being developed in different parts of the world (USA, Australia, Papua New Guinea, and so forth). According to Wood Mackenzie, global LNG supply is around 250 MTPA and 140 MTPA of capacity is under construction. If there are no project postponements, it is estimated that an additional 100 MTPA of LNG will be approved in the next 6 to 18 months, extending the likelihood of a glut of LNG in Asia to 2025.

The low oil & gas price environment accompanied by the perspectives of a global supply glut is forcing the banks to be more risk-averse in terms of financing large-scale capital-intensive infrastructure projects, and more particularly non-scalable projects. Smaller, more flexible projects will attract more interests in the current uncertain gas environment. It has been argued that compared with onshore alternatives, small-scale FLNG and FSRU projects offer fewer benefits to the domestic market in terms of local content development. And the importance of local content development as an investment criterion has increased

significantly in the past few years in many African countries. However, despite the fact they are turned towards exporting gas, host countries can also benefit from these projects thanks to the source of revenues they can generate for local governments (e.g., royalties, taxes, concession interests).

Golar and Exceletrate Energy are among the world's largest independent owners and operators of LNG carriers. Both companies have recently won several FLNG and FSRU contracts in sub-Saharan Africa.

8.3 Others

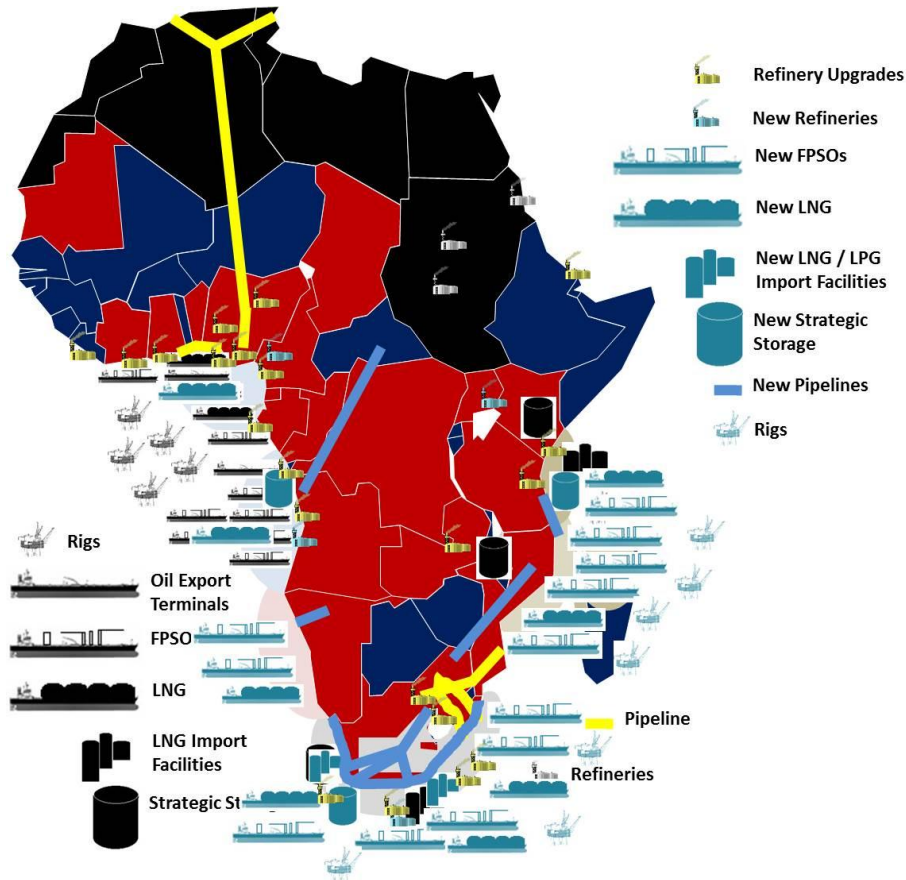
Investment opportunities in oil & gas pipelines and (strategic) storage facilities is set to increase as the continent moves towards a larger monetisation of its oil & gas fields.

With the oil & gas market being currently in contango, many opportunities for new or increased storage capacity are going to arise in the next few years with investors hoping to increase their revenues by storing oil & gas and locking themselves into future contracts with higher prices than current spot prices.

Of course, delays in certain of the pipelines' and oil/gas processing projects will likely persist due to the expected long-lasting downward pressure on oil & gas prices. Nevertheless, in the short to medium term, it is expected that the continent will see increasing oil & gas midstream and downstream infrastructure flourishing domestically, and more particularly for gas as many countries intend to increase their gas-to-power potential.

The map below from the South African Oil & Gas Alliance (SAOGA) summarises the major oil & gas projects across sub-Saharan Africa for the next 20 years. As depicted below most oil & gas activities has been concentrated on the West African coast. However, in the next 20 years, lots of activities are also expected to develop in Southern and Eastern Africa. West Africa will nevertheless witness important gas infrastructure developments.

Figure 8.3.1: Existing and Future Oil & Gas Activity, sub-Saharan Africa, 2035



Source: SAOGA

It is also important to look at prospects for the gas power industry. Indeed, gas-to-power will be the main anchor sector for the development of a domestic and regional gas economy in sub-Saharan Africa. The list of countries which are (planning to) increasing their gas-to-power generation sources is getting longer:

- Nigeria
- South Africa
- Angola
- Tanzania
- Mozambique
- Ivory Coast
- Ghana
- Cameroon
- Kenya
- Namibia

New prospects could also come from Ethiopia where gas drilling is expected to take place as from 2015 onwards as deposits were discovered in the 1970s, but never exploited. Gas pipelines might begin to be designed and laid down as from 2016 to transport the gas to an LNG facility in Djibouti.

Many examples of gas-to-power projects are under the spotlight in Africa.

Kenya is planning to build a 700-800 MW gas-fired power plant, either sourced with LNG from Qatar, or from its own domestic resources if proved economically recoverable.

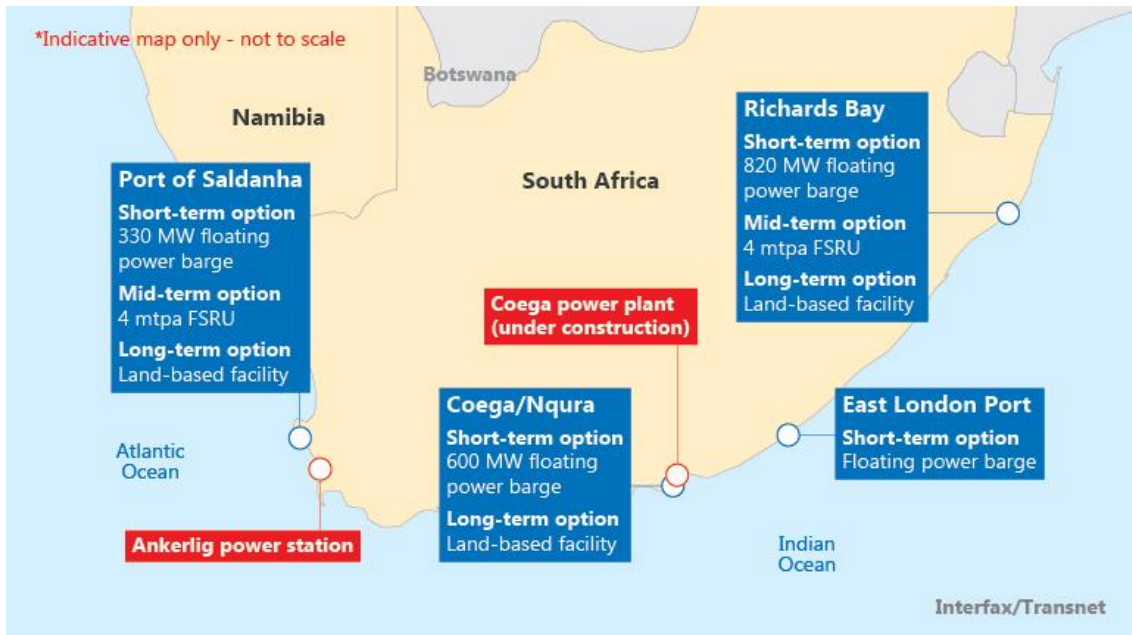
Tanzania has set the ambitious plan to add 2,000 MW of new gas-fired power generation capacity in the next five years. Symbion and TANESCO are developing a new 600 MW gas-fired power plant at Mtwara. In the short term, Symbion's plan is to construct gas-fired power plants in Tanzania for domestic use, but in the longer term, the company plans to produce additional gas power to be exported to neighbouring countries such as Kenya, Zambia, Uganda and Mozambique.

Namibia's gas sector has been facing some major challenges lately when Tullow Oil decided to sell its stake in the Kudu gas field. However, the National Petroleum Corporation of Namibia (Namcor) managed to find a new developer in 2015, BW Offshore. This project still creates a lot of scepticism as experts and Namibia's Finance Ministry affirm it is not economically viable (it is estimated that the government would need to pay about US\$ 3 billion to finance this project by 2020 whilst state budget is already strained). The development of the field would be accompanied by the construction of an 885 MW gas-fired power plant, which would be supplied with Kudu gas. Despite the doubts casted over this project, BW Offshore recently affirmed to reach an FID by March 2016. NamPower, the primary offtaker of the Kudu power station, is also discussing electricity export agreements with South Africa and Zambia. The Kudu project is in direct competition with the Walvis Bay LNG-to-power plant for which an FSRU would be needed.

Nigeria gas-to-power opportunities are also set to arise if President Buhari succeeds to restructure Nigeria Gas Company (NGC), the subsidiary of the state-owned NNPC. Reforms in gas pricing will also help stimulate investments in midstream gas infrastructure (which have been uneconomic to date), which are required to unlock the gas-to-power potential. Allowing a strong involvement of the private sector will be essential, a trend that Buhari seems eager to continue after Goodluck Jonathan's privatisation programme in the power sector.

South Africa also intends to develop its gas-to-power sector imminently. Eskom's 1,338 MW Ankerlig OCGT power plant is expected to be converted from diesel to gas by 2018, with gas supplied by Sunbird Energy from its Ibhubesi gas field. Following a ministerial determination of 2012, the IPP office of the South African Department of Energy (DoE) is expected to launch a tender for 3,126 MW of new IPP gas-fired power generation (base load and/or mid-merit). The Minister of Energy recently announced that this amount might even be increased. As a preliminary step to the formal request for proposal, a request for information was launched in May 2015. 170 submissions were made in response to the DoE's request for information, underlying the strong potential to be offered by a gas-to-power programme. The long-awaited Gas Utilisation Master Plan (GUMP) is currently being finalised by the DoE.

Figure 8.3.2: South Africa Power Infrastructure Plans, 2015



Source: Interfax, Transnet

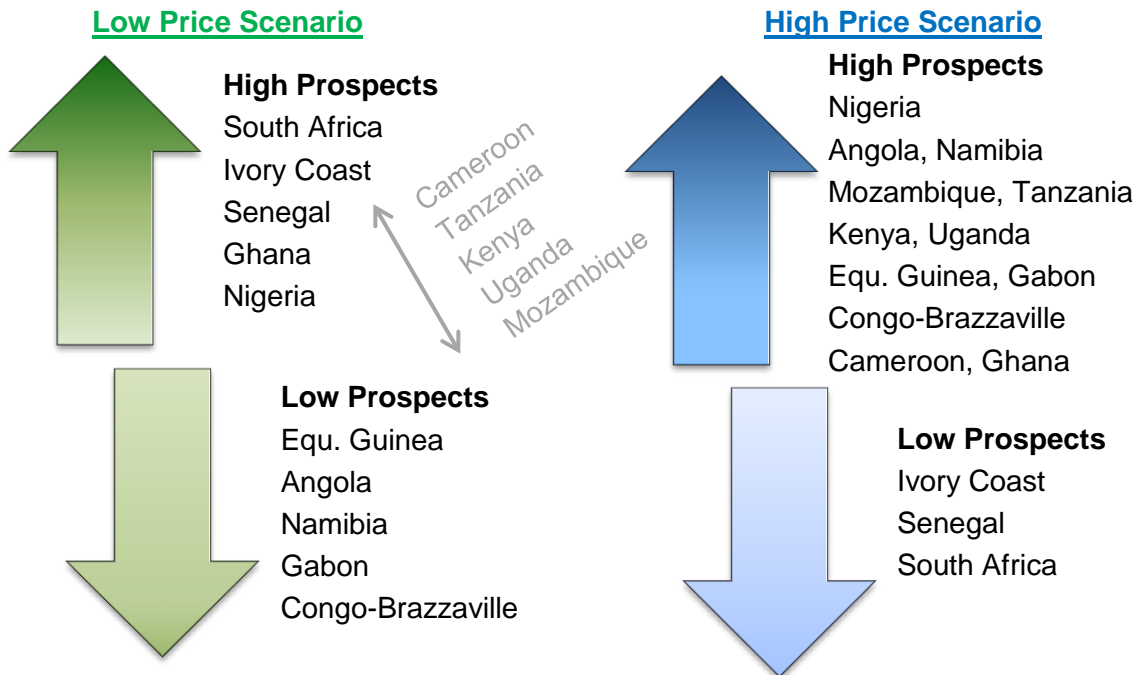
Many options are available to South Africa for its 3.1 GW gas-to-power programme. Experts in the industry believe that South Africa is likely to opt for an integrated LNG-to-power solution in order to streamline development of the country’s nascent gas industry. Onshore and offshore solutions will be considered. As depicted on the map, the short-term option could make use of floating power barges. Mid-term solutions could include FSRUs and long-term options permanent land-based facilities.

8.4 Investment Opportunities Matrix

Investment opportunities in the sub-Saharan African oil & gas industry will vary in function of oil & gas prices, and thereby in function of the country being a net producer or a net consumer of oil & gas. As mentioned in earlier sections, many countries also have high prospects to create (or increase) a gas-to-power industry, which must be considered in the short to medium term as these power projects will be the catalyst to create domestic integrated gas economies beyond their sole usage for electricity generation.

In the next five years, Frost & Sullivan expects the market to stay in a low oil & gas price scenario (average crude oil price is <=US\$70 per barrel).

Figure 8.4.1: Oil & Gas Investment Prospects, sub-Saharan Africa, 2015-2020



Source: Frost & Sullivan

Nevertheless one should note that it is difficult to generalise prospects on a country basis as for instance a country might be a net exporter of oil, but a net importer of gas such as Ghana and therefore might benefit and lose in both scenarios. Or a country like Kenya is net importer of oil & gas and thereby wins in a low price scenario. Nevertheless, the country also possesses oil reserves which will have better prospects to be exploited in a high price scenario (same for Uganda with its unexploited oil reserves and Tanzania with its large untapped gas reserves). Nigeria is also a more complex case as the country is definitely standing to lose from lower exports in a low price environment, but at the same time, it pushes the business case for increased domestic consumption as the feedstock become cheaper for end user markets (and fuel subsidies are being cut).

As one might know using HFO or diesel to run power plants is expensive and polluting. Diesel power stations should only be used as a back-up solution or to meet peak power demand. Unfortunately, in countries such as Nigeria, Angola and more recently South Africa, diesel is often used as a short-term solution to compensate for a lack of base load power. It is therefore expected that these countries will provide further opportunities in the next decade to develop a gas-to-power industry if they can access affordable sources of gas. Also, many countries in East and Southern Africa have long relied on hydro power sources for the majority of their energy mix. However, more and more severe droughts are depleting reservoirs and thereby causing serious power shortages. These countries need to diversify their power mix. This is precisely what is currently happening in countries such as South Africa, Tanzania, Ghana, Cameroon, Kenya and Mozambique where the government is showing a will to develop a gas-to-power industry, complemented by other renewable energy power sources such as wind and solar.

Figure 8.4.2: Gas-to-Power Potential, sub-Saharan Africa, 2015-2020

Countries	Gas-to-Power Potential [1 = low and 4 = high]
Nigeria	4
Ivory Coast	4
South Africa	4
Ghana	3
Tanzania	3
Mozambique	2
Cameroon	2
Kenya	2
Gabon	2
Congo (Brazza)	2
Angola	2
Namibia	2
Senegal	2
Uganda	1
Equatorial Guinea	1
Ethiopia	1
South Sudan	1

Source: Frost & Sullivan

Of course, in addition to oil & gas demand and supply factors, other factors must also be considered in terms of gauging investment opportunities in each country such as political risks (including corruption), the regulatory framework, the size of the economy and the level of available basic infrastructure.

When combining all these factors together, an investment matrix can be elaborated to highlight the best opportunities. Given the fact it is very difficult to predict oil and gas prices after 2020 and considering Frost & Sullivan’s assumption of oil & gas prices to remain in the low scenario in the next five years, **the best investment opportunities are expected to be in South Africa, Nigeria, Ghana and Ivory Coast. Other countries which should also be closely watched are Senegal and Tanzania, and then followed by Kenya, Cameroon and Mozambique (and to a lesser extent Uganda).**

Figure 8.4.3: Oil & Gas Investment Opportunities Matrix, Low Price Scenario, sub-Saharan Africa, 2015-2020

Supply	O&G Dynamics	Gas-to-Power	Political Risks	Corruption Perceptions	GDP Size	Basic Infrastructure	Regulatory Framework
Angola	●	●	●	●	●	●	
Cameroon	●	●	●	●	●	●	
Congo (Brazza)	●	●	●	●	●	NA	
Equ. Guinea	●	●	●	●	●	NA	
Gabon	●	●	●	●	●	●	
Ghana	●	●	●	●	●	●	
Ivory Coast	●	●	●	●	●	●	
Kenya	●	●	●	●	●	●	
Mozambique	●	●	●	●	●	●	
Namibia	●	●	●	●	●	●	
Nigeria	●	●	●	●	●	●	
Senegal	●	●	●	●	●	●	
South Africa	●	●	●	●	●	●	
Tanzania	●	●	●	●	●	●	
Uganda	●	●	●	●	●	●	

Phase 2 Analysis

● High ● Medium ● Low

Source: Frost & Sullivan

Methodology:

O&G Dynamics is green if countries have been designed as 'high prospects' in the low price scenario, orange if the countries are between high and low prospects and red if the countries are in the low prospects. Source: Frost & Sullivan, Trade Map (2014-15)

Gas-to-power potential at 3 or 4 is green, 2 is orange and 1 is red. Source: Frost & Sullivan (2015)

Political Risks above 0 is green, between -1 and 0 is orange and below -1 is red. Source: World Bank (2014)

Corruption Perceptions Index above 40 is red, between 25 and 40 is orange and below 25 is red. Source: Transparency International (2014)

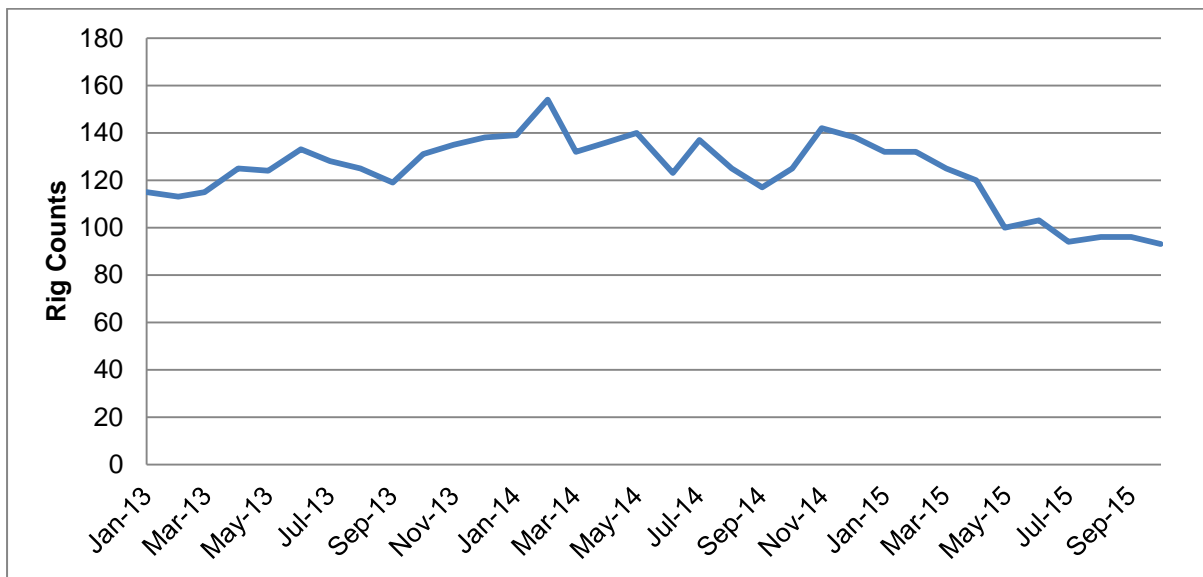
GDP size (US\$ billion) above 100 is green, between 50 and 100 is orange and below 50 is red. Source: IMF (2014)

Basic Infrastructure Index above 3 is green, between 2.5 and 3 is orange and below 2.5 is red. Source: World Economic Forum (2015-16)

8.5 Recent Market Trends

The African peak rig count was reached in February 2014 at 154. Since November 2014, rig counts have followed a downward trend to reach their lowest level since 2012 at 93 in October 2015. The graph reflects the recent decrease of activities in the African oil & gas exploration segment, especially offshore. However, certain IOCs have affirmed that they will continue to stick on the development programme of their lower cost E&P concessions, but rather focusing on production than exploration (such as in Nigeria). In the rest of West Africa, from Cameroon down to Angola (with most oil & gas resources being offshore), exploration activities are expected to decrease significantly while prices remain low.

Figure 8.5.1: Rig Count Evolution, Africa, 2013-2015



Source: Baker Hughes

When looking at drilling trends on a per country basis, one can see that drilling decreased significantly in Nigeria, Angola, Cameroon, Chad (even stopped drilling from July 2015 onwards), Congo-Brazzaville, Gabon and Libya. Algeria and Kenya remained fairly stable over the period. Some countries have even shown a picking up trend since last month (October 2015): Angola, Congo-Brazzaville and Ivory Coast. However, it remains to be seen if this trend will gain momentum.

Mozambique and Tanzania have been regularly under the spotlight in the past three years following recent major offshore gas discoveries. Even though Anadarko and Eni remain bullish on the development of their gas discoveries in Mozambique, it is likely that the current low price environment will delay or even scale back the development of these resources. Unless Asian IOCs/NOCs, holders of the concession with Anadarko and Eni see an opportunity in these projects to secure a new source of energy supply on which they can have control for the long term. Also, an advantageous fiscal regime offered by the Government of Mozambique to Anadarko and Eni to develop the Rovuma Area 1 and 4 offshore resources could compensate for the expected loss of revenues from LNG sales on the global market. But this means also fewer benefits for the local economy. Tanzania's LNG project seems more unlikely in the current low price environment; however, gas infrastructure developments are expected to take place for domestic (power) use.

Serious challenges have been hampering the development of the Nigerian oil & gas industry such as the signing of the Petroleum Industry Bill (PIB), security issues and oil theft. However, if adequate reforms are being brought by the new President Buhari, the country will offer substantial investment prospects. As reported by KPMG, *“Some of the most exciting prospects on the continent are to be found in East Africa – a region that has, up to now, been almost unknown in the oil and gas industry. However, some East African projects could be at risk if oil prices remain low for an extended period of time, largely due to the high initial cost of investing in infrastructure to commercialise these region’s hydrocarbon resources. As a result, West Africa is arguably the region in Africa that is most likely to continue to receive large-scale investment if oil prices remain low.”*²⁷

A country in West Africa which is expected to suffer considerably is Equatorial Guinea. As much as 78.5 per cent of its GDP was driven from oil & gas exports in 2014, the highest in sub-Saharan Africa. The country is feeling the effects of low oil and LNG prices on its LNG exports. The country has a 17-year contract to supply LNG to BG Group. However, unlike other major suppliers in the region, it is less willing to offer flexible contracts, making its LNG less competitive. In September 2015, LNG exports declined by 16.7 per cent compared to the year before. Total exports are expected to fall by about 12.4 per cent on an annual basis in 2015.²⁸

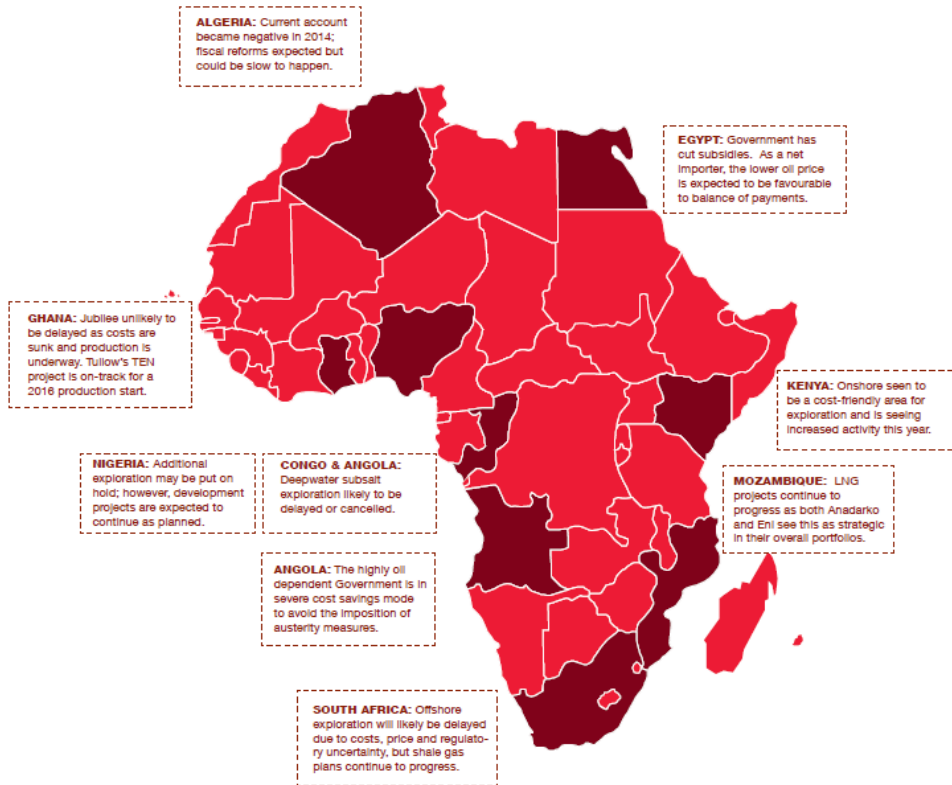
An interesting recent market trend, which is occurring globally, including in Africa is the emergence of offshore gas production facilities (FLNG and FSRU) as opposed to onshore. Projects which progressed lately or even reached FID were all offshore. In a current low oil & gas price environment, whilst many countries are facing budget cuts and do not have the financial strength to engage in megaprojects, the tendency is to rather use floating vessels to produce gas. Also, with many oil & gas reserves still being unproven, certain countries prefer to engage themselves in short- to medium-term solutions for their oil & gas monetisation strategies rather than build large permanent (onshore) facilities. In current circumstances, investors are looking for **flexible and scalable solutions**. However, an exception to this rule is the mega oil refinery being built by the cash-rich Dangote Group in Nigeria.

Although capital spending is likely to fall off in the near term, a few megaprojects will still be required to meet long-term global energy demand.

²⁷ KPMG, Oil & Gas in Africa, 2015, page 8

²⁸ <http://interfaxenergy.com/analytics/>

Figure 8.5.2: Impact on Africa of Reduced Oil & Gas Prices



Source: PWC

8.6 Risks and Benefits

The major risks and challenges inherent to the sub-Saharan African oil & gas sector are political instability, uncertain regulatory frameworks, environmental concerns, oil & gas price volatility, creditworthiness of related state-owned enterprises, weak basic infrastructure and fossil fuel subsidies.

Figure 8.6.1: Oil & Gas Sector: Key Risks, sub-Saharan Africa

Risks	Comment
Political Instability	The oil & gas sector has always been of strategic importance, and thereby implies strong government interference. Being a major source of revenue for oil & gas-rich countries, the sector has been prone to corruption and in certain cases unequal distribution of wealth. In poor countries, past experience has shown that resources' covetousness does generally bring more instability than the opposite.
Uncertain Regulatory Framework	Uncertain regulatory frameworks with laws being changed regularly combined with high subsidies to the petroleum industry is not helping to attract investors into the oil & gas sector of certain countries.
	In South Africa, the amendments to the Minerals and

Petroleum Resources Development Act (MPRDA) have caused a major slowdown in conventional oil and gas exploration activity in the country's deep offshore.

In Nigeria, the fact that the Petroleum Industry Bill has been under revision for many years – without being finalised – has completely paralysed investments in the sector. However, President Buhari seems to be determined to reform the oil industry. The focus will be put on the following: (i) restructuring of NNPC, (ii) tackling of oil & gas theft, and (iii) revision of fiscal terms under which the industry operates.

Environmental Concerns

Environmental concerns as well as the introduction of a carbon tax in countries such as South Africa should certainly be considered when looking at the potential fiscal impact they could have on an oil & gas project. Many DFIs impose strict environmental criteria to invest in certain projects and would sometimes even consider not investing if certain sustainability criteria are not met. It is rather clear that any investment in the power sector should rather focus on gas-fired power generation as opposed to oil products. It is important to apply strict environmental, social and governance (ESG) criteria in any investment decision, evaluate sustainability of projects and include a sound and detailed environmental, social and health impact assessment (ESHIA). One should be particularly wary of the “resource curse” many countries have fallen into as this would entirely contradict the mission of the DBSA.

Price Volatility and Forex

Price volatility is expected to remain in the short to medium term as Saudi Arabia maintains its high crude oil production levels and the USA becomes more self-sufficient thanks to the exploitation of its unconventional oil & gas resources. As recently reported by the IMF Chief Economist *“lower oil prices typically lead to a depreciation of oil exporters’ currencies and the drop in oil price has contributed to an abrupt depreciation of currencies in a number of oil exporting countries including Nigeria. The trend is another hit to these oil-exporting countries’ economies.”*²⁹ Operating cost competitiveness is key for IOCs/NOCs’ business to stay afloat. But low oil & gas prices are also a trigger to further push the development of local (oil & gas economies (e.g. power, transport, heating, fertilizers, and so forth.).

NOC and Offtaker Creditworthiness

Governments in sub-Saharan Africa often suffer from poor finances and cannot attract the required funding to build such expensive infrastructure projects. This issue is even more exacerbated in current global low oil & gas price environment, meaning that governments that are highly dependent on oil & gas exports as a source of revenues are facing increasing pressure to diversify their economies. According to the IMF, oil &

²⁹ <http://blog-imfdirect.imf.org/2014/12/22/seven-questions-about-the-recent-oil-price-slump/#more-8706>

	gas account for about 75 per cent of the government’s revenues in Angola, Congo-Brazzaville and Equatorial Guinea. This makes them the most weakened countries by the current oil & gas price down-cycle in sub-Saharan Africa. This is also precisely the battle engaged by President Buhari in Nigeria who specifically mentioned earlier in 2015 that his government will rather focus on agriculture and not oil.
Weak Basic Infrastructure	In countries like Mozambique and Tanzania, the level of basic infrastructure remains limited, generally around a few industrial areas and close to the capital. However, the Palma LNG project is expected to be built in the northern province of Cabo Delgado, one of the poorest areas of the country, with almost no existing infrastructure. Building greenfield projects in such locations becomes extremely expensive. Stringent local content obligations also make it more difficult for investors as they often face a lack of skilled resources.
Fossil Fuel Subsidies	Fossil fuel subsidies have often made investments in midstream and downstream oil & gas projects uneconomic. As confirmed by the OECD, lower oil prices present a strong opportunity for governments to phase out fossil fuels subsidies.

Source: Frost & Sullivan

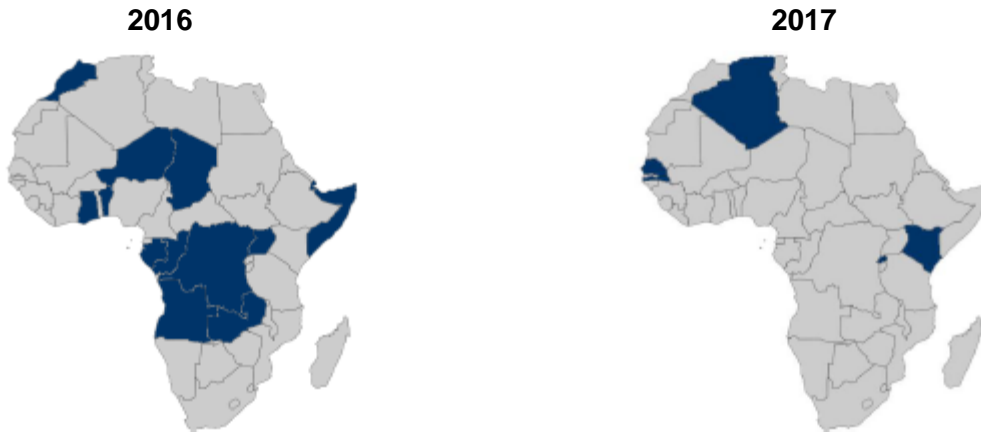
Benefits are rather straightforward, ranging from large untapped resource potential to sustained economic growth driving higher levels of industrialisation.

Figure 8.6.2: Oil & Gas Sector: Key Benefits, sub-Saharan Africa

Benefits	Comment
Untapped Resource Potential	The availability of unexploited local oil & gas resources/reserves presents gigantic benefits for the continent if management of resources is done transparently and wealth from the industry is redistributed equally among the population.
Sustained Economic Growth	Sub-Saharan Africa remains, after emerging Asia, the region with the highest economic growth, driving industrialisation and electrification.
Industrialisation	Growing gas-to-power across the region and increasing petrochemical industries in regional hubs such as South Africa, Nigeria, Angola, and later on Kenya are set to create strong local end user markets in sub-Saharan Africa.

Source: Frost & Sullivan

Two additional elements which should also be considered when looking to potential investments in the oil & gas industry are (i) the extent to which renewables and biofuels could become a competitive source of fuel supply and (ii) the general elections’ calendar. With regards the latter, it is important to note that 14 elections are foreseen in 2016, and four more in 2017. Elections are an important factor to consider, especially in countries with long-term rulers such as Gabon, the Democratic Republic of Congo, Congo-Brazzaville, Uganda and Angola. Given the strategic importance of the oil & gas sector, one might expect some regulatory uncertainty before and following general elections.

Figure 8.6.3: General Elections, Africa, 2016-2017

Source: NKC African Economics

8.7 Financing Recommendations

For an investor like the DBSA, Frost & Sullivan would recommend investing in long-term debt facilities related to oil & gas projects in the midstream and downstream sectors. Frost & Sullivan tends to believe that midstream projects such as pipelines and storage facilities present less complexity, and thereby less risks, as opposed to upstream and downstream projects. Nevertheless, downstream projects with strong fundamentals should also be considered.

A few basic recommendations are summarised below:

1. All political risks must be allocated to the government via a sovereign guarantee or through the strong implicit support of the government to its NOCs. If the guarantee is too weak, it is common to ask for a 3-month debt service reserve account (DSRA) or ask the involvement of the World Bank's International Development Association (IDA). With the latter, another bank is emitting a letter of credit (LC) in favour of the government and the LC is covered by the IDA (World Bank). Certain countries, such as Tanzania and South Africa, are not very keen to provide sovereign guarantees anymore. Indeed, such guarantees increase their level of indebtedness, which is often unsustainable. Furthermore, in Tanzania for instance, the IMF has imposed some restrictions on the government. A ceiling of about US\$ 800 million has been imposed on how much the country can borrow.
2. To further de-risk political and commercial risks, it is important to involve Export Credit Agencies (ECAs) and multilateral development finance institutions.
3. Exchange rate risks should be minimised. There should be no currency mismatch between contracts, and if a gap exists it should be hedged.
4. Experience has shown that it is better to finance projects undertaken by private counterparties. If possible, it is better to avoid commercial risks on the government

(or make sure it is covered by ECAs for the poorer countries). Governments should only have a minority share (less than 25 per cent) in the projects requiring finance.

5. It is important to make the right choice between project finance versus corporate finance. If the project to be financed includes more than one sponsor, project finance could be considered.
6. Environmental, social and governance (ESG) criteria should be applied in any investment decision. The bank should consider with care the importance of the environmental, social and health impact assessment (ESHIA) as well as perform a sustainability analysis to evaluate the risks and benefits that each project could bring to the local population and the domestic economy.

9. Conclusions

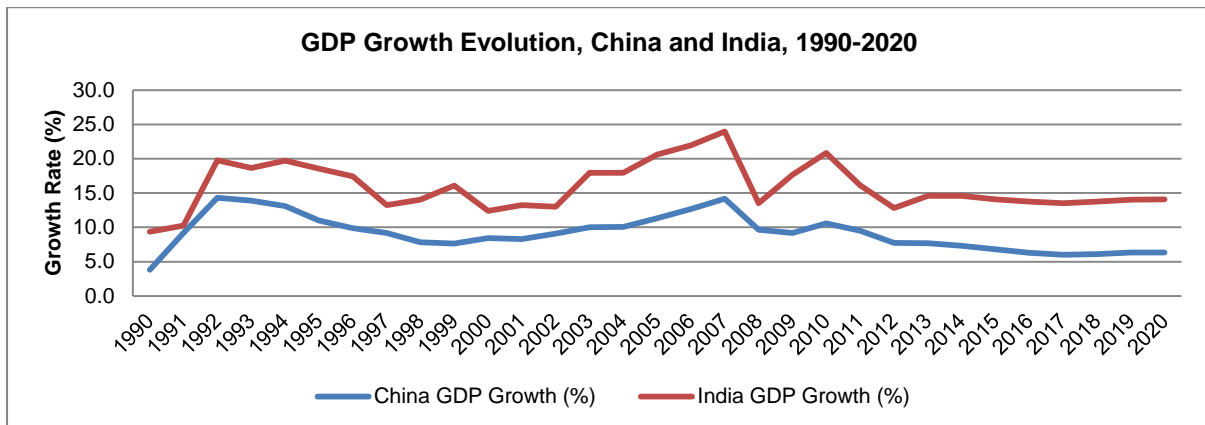
The global oil and gas supply glut is not expected to resorb quickly unless the OPEC, and more particularly Saudi Arabia, decides to change its strategy and reduce its oil production quotas. Many elements in the market are contributing to this assumption:

- Saudi Arabia which seemed not ready to reduce crude oil production quotas
- USA becoming a net exporter of oil & gas
- Many new LNG supply facilities planned to be commissioned in the next five years
- Slower economic growth of China and India
- Japan which might decide to restart some of its nuclear power stations, and thereby decrease its reliance on LNG
- Russia starting to look at supplying gas to Asia via pipeline
- Emergence of alternate sources of energy (renewables and biofuels)

Frost & Sullivan believes that crude oil and natural gas (LNG) prices will therefore remain under strong pressure in the short to medium term.

Also global oil & gas demand will be very much driven by the growth of the Chinese and Indian economies. As shown in the graph below, the IMF forecasts that GDP growth in both countries will stabilise in the next five years, and thereby will limit global growth opportunities.

Figure 9.1: GDP Growth Evolution, China and India, 1990-2020



Source: IMF – World Economic Outlook (October 2015)

Nevertheless, local and regional opportunities could flourish with appropriate regulatory frameworks, scalability and acceptable political risks. In sub-Saharan Africa, oil & gas consumption will be driven by sustained economic growth and increasing industrialisation.

The upgrade or the construction of new mega oil and gas exports facilities is expected to be delayed. Despite remaining bullish on their investments, the FID on Anadarko and Eni's LNG projects in Mozambique are constantly being postponed.

Nevertheless, investment opportunities will arise in countries that are trying to create a local oil & gas end-user market. The major oil refinery being built by Dangote is a good example of this strategy. Of course, projects economics must make sense and therefore, reforms will be required in the oil & gas industries of many countries such as Nigeria and South Africa (e.g. cuts in petroleum price subsidies, restructuring of NOCs, privatisation, and so forth).

Significant investments in oil & gas midstream infrastructure are required. However, these investments necessitate governments' involvement, which is often creating a stumbling block. A lack of regulatory certainty, combined with a lack of public funding capability, has resulted in subdued investments in the region.

The low-hanging fruit to develop gas economies will remain the power sector. Many countries are trying to diversify their electricity generation mix, and thereby increasingly looking at developing wind, solar photovoltaic, geothermal and gas-to-power projects. Significant gas-to-power projects will lead to increased investments in downstream and midstream gas infrastructure.

Nigeria and South Africa are expected to remain a hub in terms of oil midstream and downstream infrastructure given their more advanced industrialisation levels.

Considering Frost & Sullivan's assumption of low oil & gas prices in the next five years, the best investment opportunities are expected to be in South Africa, Nigeria, Ghana and Ivory Coast. Other countries which should also be closely watched are Senegal and Tanzania, and then followed by Kenya, Cameroon and Mozambique (and to a lesser extent Uganda).

As reported earlier, an interesting recent market trend is the emergence of offshore gas production facilities (FLNG and FSRU), globally but also in Africa. Projects which progressed lately or even reached FID were all offshore. In a current low oil & gas price environment, whilst many countries are facing budget cuts and do not have the financial strength to engage in megaprojects, the tendency is to rather use floating vessels to produce and store gas and /or oil. Also, with many oil & gas reserves still being unproven, certain countries prefer to engage themselves in short- to medium-term solutions for their oil & gas monetisation strategies rather than build large permanent (onshore) facilities. In current circumstances, investors are looking for **flexible and scalable solutions**. However, an exception to this rule is the mega oil refinery being built by the cash-rich Dangote Group in Nigeria.

10. Bibliography

Baker Hughes, *International Rig Counts*, October 2015

BP, *Energy Outlook 2035*

BP, *Statistical Review of World Energy 2015*

CITAC, *Oil Refining In Africa – Summary*, 2015 Edition

Deloitte, *Oil & Gas Reality Check*, 2015

Elsevier R&D Solutions, *2015 Exploration Trends in a Low Price Oil & Gas World: New Developments and Production Outlook*, June 2015

Golar LNG, *Second Quarter Results 2015*, 27 August 2015

IEA, *World Energy Outlook 2014/2015*

IMF, *Seven Questions About the Recent Oil Price Slump*, 22 December 2014

IMF, *World Economic Outlook*, October 2015

Interfax, *Global Gas Analytics*, October 2015

International Gas Union, *World LNG Report*, 2015 Edition

KPMG, *Oil & Gas in Africa*, 2015

PWC, *Africa Oil & Gas Review*, 2014/2015

Resources for Development Consulting, *An Introduction to LNG Economics – Mozambique LNG Project*, November 2015

Standard & Poor's – Platts, *The Shale Boom and Geopolitical Stress*, 2014

Teramar Group, *Oil & Gas Projects – The Transformation of East Africa*, March 2015

Trade Map, *Yearly Trade Data 2014*

US EIA, *International Energy Statistics*, 2014-2015

World Bank, *Commodities Price Forecast*, October 2015

World Bank, *World Development Indicators 2014*

World Economic Forum, *The Global Competitiveness Report*, 2015-2016