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# OIL AND GAS IN AFRICA

## RESERVES, POTENTIAL AND PROSPECTS OF AFRICA

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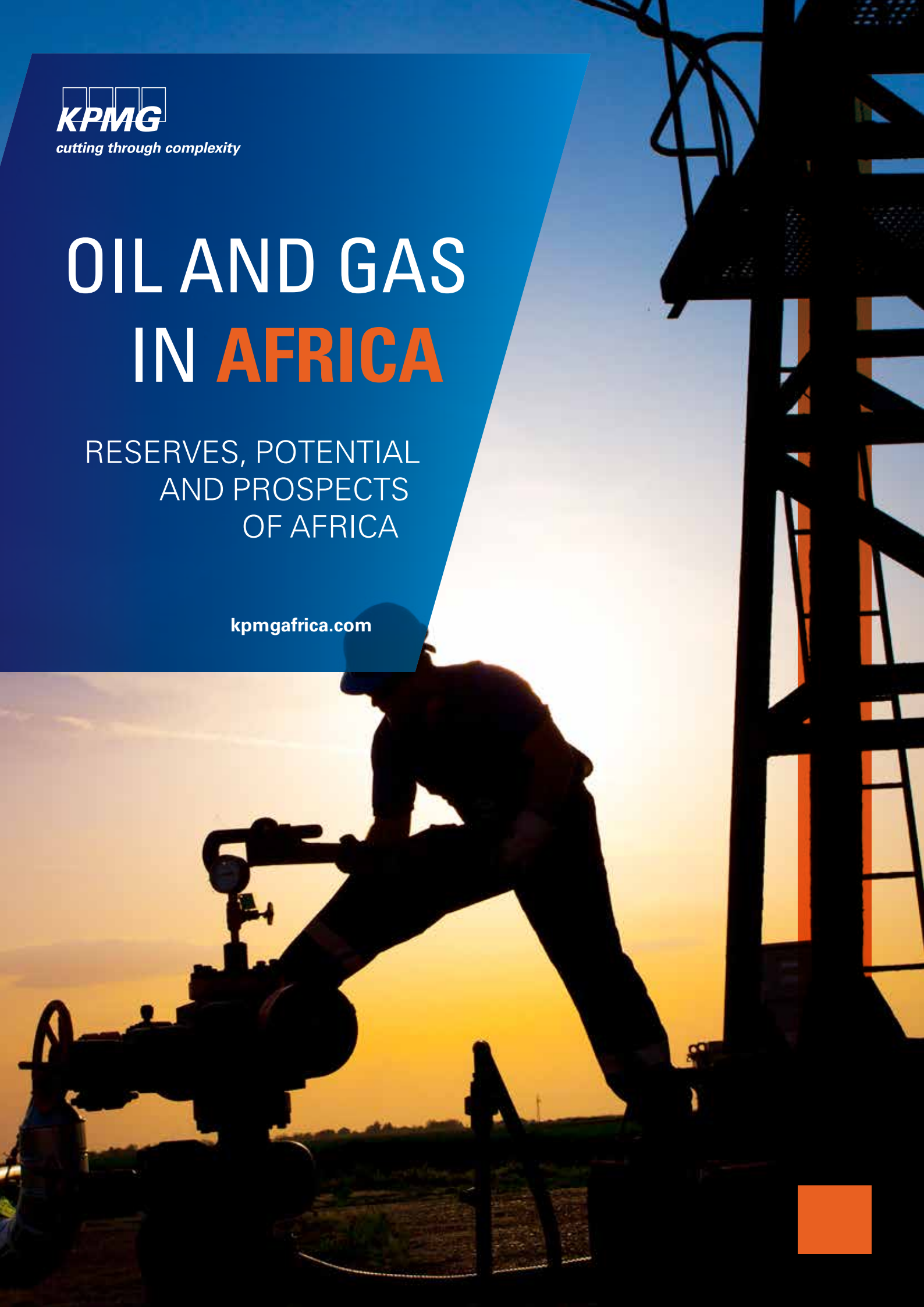

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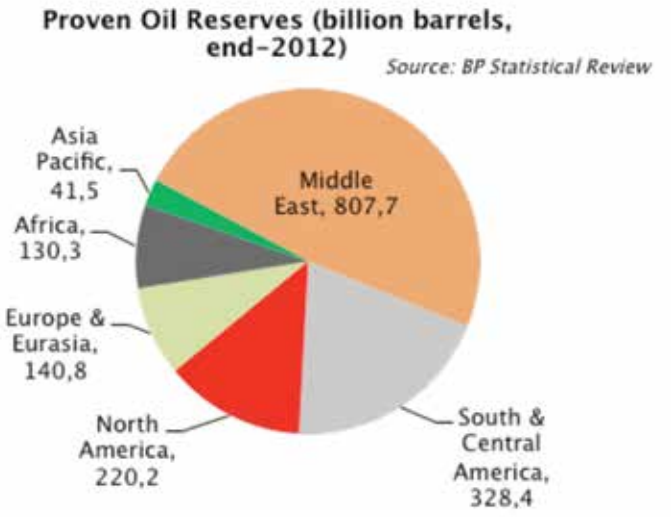
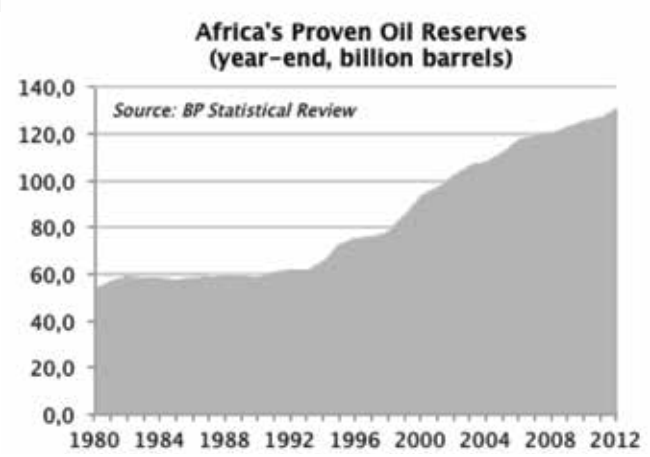
# Introduction and Overview

## Oil

Africa's oil history stretches over a period of several decades, in some places it is even a century old. Presently, there are about 500 oil companies that participate in African hydrocarbon exploration. According to the BP Statistical Review of Energy, Africa's proven oil reserves have grown by almost 150% since 1980 – increasing from 53.4 billion barrels at that stage to 130.3 billion barrels at the end of 2012. This is an average annual growth rate of 2.8%, which is the second highest continental growth rate in the world after South America over that period. Oil reserves have grown particularly quickly since the mid-1990s as improved political environments have made it more attractive for foreign oil companies to explore. Even so, there is massive scope for further exploration. According to some estimates, there are at least 100 billion barrels of oil offshore Africa, only waiting to be discovered. For now, Africa's proven oil reserves remain much lower than other regions; at the end of 2012, Africa accounted for 7.8% of global reserves.

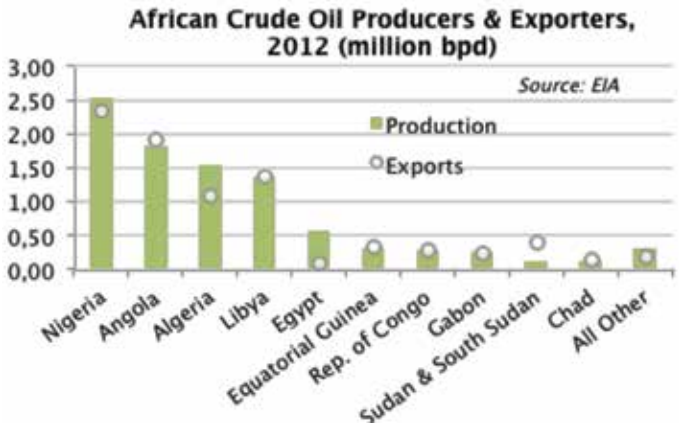
Africa's proven oil reserves are concentrated in the four members of the Organisation of the Petroleum Exporting Countries (OPEC). These are Libya (which has 48 billion barrels worth of reserves), Nigeria (37.2 billion barrels), Angola (12.7 billion barrels) and Algeria (12.2 billion barrels). In fact, these four countries held 84.5% of Africa's reserves at the end of 2012. Other countries with notable proven oil resources are Egypt, South Sudan and Gabon. A number of other countries are however emerging, with some of the most exciting prospects being Uganda, Kenya and Ghana. According to data from the U.S. Energy Information Administration (EIA), 12 African countries had proven oil reserves of more than 500 million barrels and four held more than 10 billion barrels at the start of 2013. Since then, however, Kenya's reserves have also risen to above 500 million barrels, according to Tullow Oil Plc, though this is only an estimate and not yet a proven number.

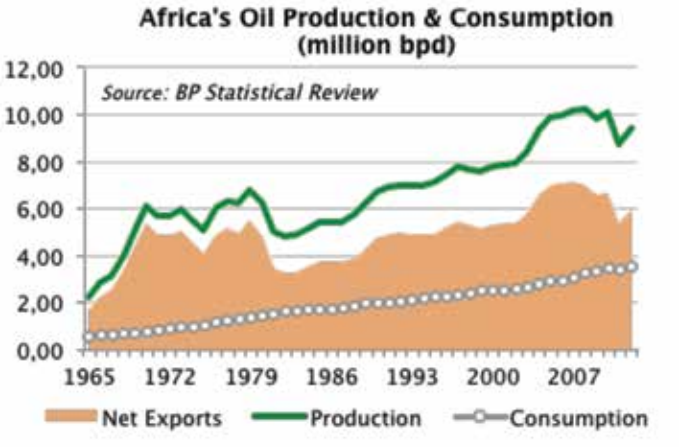


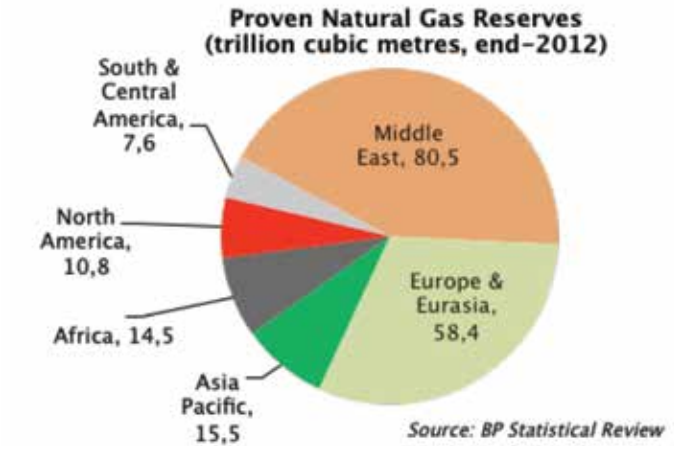




## Production & Exports

Africa already has a long list of oil producing countries. According to data from the EIA, 15 African countries exported oil in 2010, namely Nigeria, Angola, Libya, Algeria, Sudan (note that this was before the secession of South Sudan), Equatorial Guinea, Congo (Brazzaville), Gabon, Chad, Egypt, Tunisia, Cameroon, Côte d'Ivoire, Democratic Republic of Congo (DRC), and Mauritania. The continent as a whole produces significantly more oil than it consumes. Therefore, the region is a net exporter of oil. The vast majority of these exports are in the form of crude oil. In fact, according to the BP Statistical Review, Africa's gross exports of crude oil were 6.55 million bpd in 2012, while its fuel product exports equalled 0.71 million bpd. Almost two-thirds of crude exports came from West Africa, while almost one third came from North Africa. In contrast, 65% of product exports came from North Africa, while 33% of product exports came from West Africa.

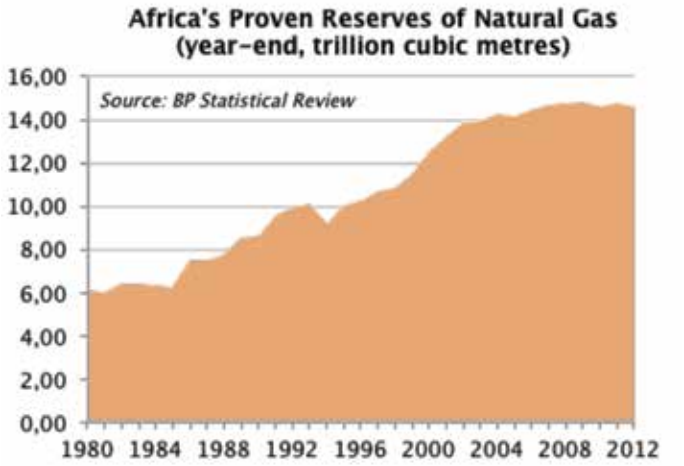





## Natural Gas

Africa's share of global natural gas reserves is almost identical to its share of oil reserves, namely 7.7% (compared to 7.8% for oil). Africa's proven reserves of natural gas have grown at roughly the same rate as its oil reserves over the past three decades – from six trillion $m^3$ in 1980 to 14.5 trillion $m^3$ in 2012, representing growth of over 140%, or 2.8% p.a. Disappointingly, though, reserves have all but stagnated over the past decade after having expanded at a robust pace during the 1980s, 1990s and early-2000s. This is mainly due to the slow expansion of reserves in Africa's top two gas producers – Nigeria and Algeria – over the past decade. In Algeria's case, this can be explained by a lack of investment due to unfavourable fiscal terms and a challenging business environment. Meanwhile in Nigeria, all of the country's current gas reserves were found while searching for oil. There has been little incentive for energy companies to explore specifically for gas due to a lack of fiscal incentives and the high set-up costs and time needed to develop liquefied natural gas (LNG) facilities in order to export gas. On top of this, the risk of attacks (mainly vandalism and banditry) on onshore gas infrastructure would also reduce the incentive to invest, while Nigeria's challenging business environment can also make investment a daunting task for many companies. If the government is able to make the investment environment more attractive, the country has massive prospects. Indeed, industry experts have said that Nigeria's gas reserves could potentially be as high as 16.8 trillion $m^3$ (compared to the current proven level of 5.2 trillion $m^3$) if deliberate steps are taken to explore for gas as opposed to coincidental discovery during oil exploration.




According to the EIA, seven African countries had more than 100 billion $m^3$ of proven natural gas reserves at the start of 2013, namely Nigeria, Algeria, Egypt, Libya, Angola, Cameroon, and Mozambique. Two of these countries – Angola and Cameroon – produced very little gas and were not exporters at that time, though as noted below, Angola has started exporting gas since then. Angola's gas reserves rose from less than 57 billion $m^3$ in 2007 to 366 billion $m^3$ at the start of 2013, meaning that the country now holds significant gas potential. The vast majority of its gas is not commercialised and is either re-injected into oilfields to help recovery or flared. However, the long-awaited completion of the $10bn LNG plant at Soyo in mid-2013 has significantly boosted the country's prospects as a gas exporter. According to the Oil and Gas Journal, the Soyo facility will be able to produce the equivalent of 7.1 billion $m^3$ of LNG per year once it reaches full capacity. This LNG facility will increase the incentive to produce marketable gas in Angola and should lift Angola to the fifth largest gas exporter in Africa in the near future. Meanwhile, in Cameroon, gas production was negligible until 2009 but grew more than 10-fold to 210 million $m^3$ in 2010, before dipping to 150 million $m^3$ in 2011, according to the EIA. All of this output is used domestically. The further development of the natural gas sector could provide a boost to the economy as it struggles with electricity shortages. Cameroon could also start exporting gas to

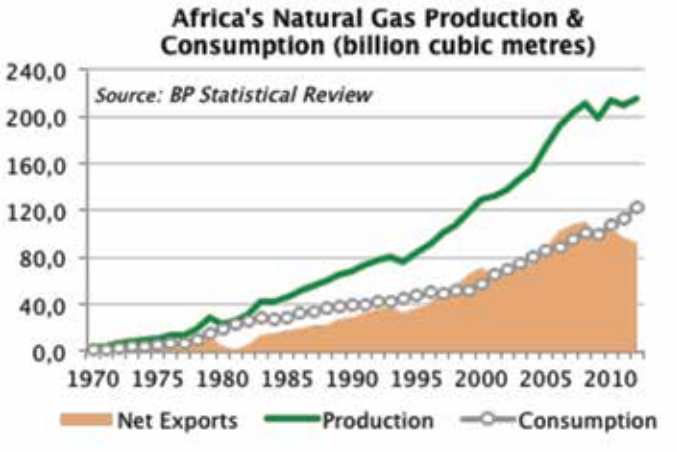
Equatorial Guinea in the medium term, where it will be liquefied. Although Equatorial Guinea has only 36.8 billion $m^3$ of gas reserves (which is less than Nigeria, Algeria and Egypt's annual production), it is the fifth largest gas producer on the continent. The country has one LNG facility and exported 5.3 billion $m^3$ of LNG in 2011. According to the EIA, there are plans to build another LNG train; however, there have been delays due to concerns over the availability of feedgas. The issue may be overcome by buying gas from Nigeria and Cameroon, as these countries' gas production outweighs their LNG processing capacity.

Although Africa's proven natural gas reserves have stagnated over the past decade, recent discoveries in Tanzania and Mozambique point to significant upward potential for these figures. There have been numerous gas finds in these two countries since 2010. In fact, finds in the Rovuma Basin around the border of the two countries (both onshore and offshore) have been large enough that the operators of the gas projects have decided to build LNG facilities. Estimates of possible gas reserves off the coast of East and South-Eastern Africa are in the region of 12.5 trillion $m^3$, according to the U.S. Geological Survey (USGS). (More details can be found in the East Africa discussion.)

## Production & Exports

The continent also has six natural gas exporters, namely Algeria, Nigeria, Egypt, Equatorial Guinea, Libya, and Mozambique. Around 55% of Africa's gas exports are made in the form of LNG, while the other 45% is exported via pipeline, mostly to Europe. Algeria was the first country in the world to export LNG following the construction of the Arzew LNG plant in 1964. Seven years later, Libya became the third country in the world to export LNG. According to data from BP, four African countries exported LNG in 2012, with Nigeria being the largest. In that year, Nigeria was also the fourth largest LNG exporter in the world, with 27.2 billion $m^3$ of exports. Algeria ranked seventh globally with 15.3 billion $m^3$, while Egypt and Equatorial Guinea were 13th and 15th largest, respectively. Egypt's exports are steadily declining, though, as more and more gas is directed towards the domestic market. Although Libya also exported some LNG in the past, damage to its LNG plant during the civil war has meant that it has not exported this product since 2011.

In 2013, Angola also started to export LNG at its newly built plant, while in the future; Mozambique and Tanzania are also set to export LNG. In terms of pipeline exports, Algeria is by far the biggest gas exporter in Africa, exporting 34.8 billion $m^3$ in 2012. Algeria is also the seventh largest gas exporter in the world by pipeline, with most going to Italy and Spain. Libya is the second largest exporter in Africa via pipeline, while Mozambique, Egypt and Nigeria also export some gas via pipeline. The accompanying graph shows the level of production and consumption for Africa as a whole, as well as the implied net exports. According to BP, actual gross gas exports by African countries totalled 100.5 billion $m^3$ in 2011 and 99.9 billion $m^3$ in 2012. Slightly more than half of this came from Algeria.




## Shale Oil & Gas

In a 2013 report studying shale oil and gas resources in 41 countries around the world, the EIA found that there are large deposits in South Africa and across North Africa. Algeria's shale gas potential is enormous; with a recent study by the EIA estimating that Algeria has 707 trillion cubic feet (almost 20 trillion $m^3$) of 'technically recoverable shale gas resources'. This is more than four times the country's proven conventional gas reserves. The study also shows that Algeria's potential shale gas resources are the third highest in the world after China and Argentina, and slightly more than the U.S. The commercial viability of these reserves is yet to be determined, though. However, before commercial viability can be proven, hundreds of test wells will have to be drilled over the next few years. The state oil company, Sonatrach, which was the 12th largest oil and gas company in the world in 2012, has extensive investment plans over the next five years to develop the sector. Production is unlikely to start within the next decade. Meanwhile, Libya and Egypt hold an estimated 122 trillion cubic feet and 100 trillion cubic feet of technically recoverable shale gas resources, respectively, with smaller amounts having also been found in Tunisia, Morocco and Western Sahara. Furthermore, Libya is estimated to hold the fifth most shale oil in the world, with the EIA estimating its technically recoverable shale oil resources at 26.1 billion barrels. Both Algeria and Egypt also have notable shale oil resources. South Africa is the major known holder of shale gas in sub-Saharan Africa (SSA): the EIA report estimates that South Africa has 390 trillion cubic feet (10.9 trillion $m^3$), which is the eighth highest in the world.

## Oil Refining

For all of Africa's oil resources, refining capacity on the continent remains limited and as a result, countries like Angola and Nigeria export crude oil, only to import refined oil later at an additional cost. As shown in the graph, refining

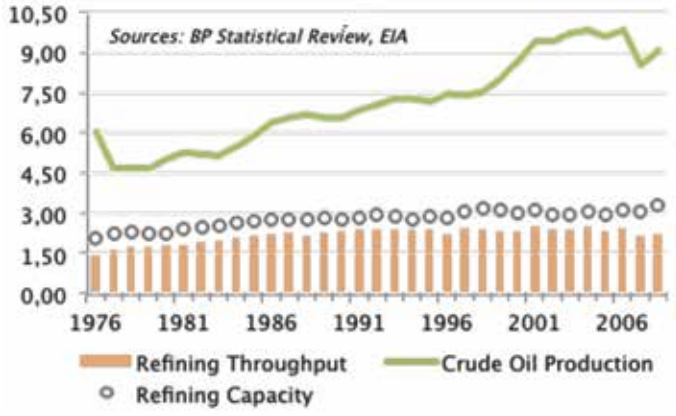
capacity has always been much lower than crude output, but this gap has widened significantly in recent decades. In 2012, Africa produced over 9.1 million bpd of crude oil, but refining capacity was only 3.3 million bpd. To make matters worse, existing refineries do not operate at full capacity; in fact, refinery throughput was only 2.2 million bpd in 2012, which is more than 6.9 million bpd below crude output.

Problems in the refining industry on the continent include corruption, poor maintenance, theft, and other operational problems. In some countries, conflicts have at times also interrupted the flow of crude into the refineries and forced them to shut down. Subsidies have also contributed to low capacity utilisation at refineries. In Nigeria, for example, current subsidy schemes lead producers to sell crude overseas rather than to local refineries and therefore add to increasing volumes of refined product imports, which present a large cost to the economy.

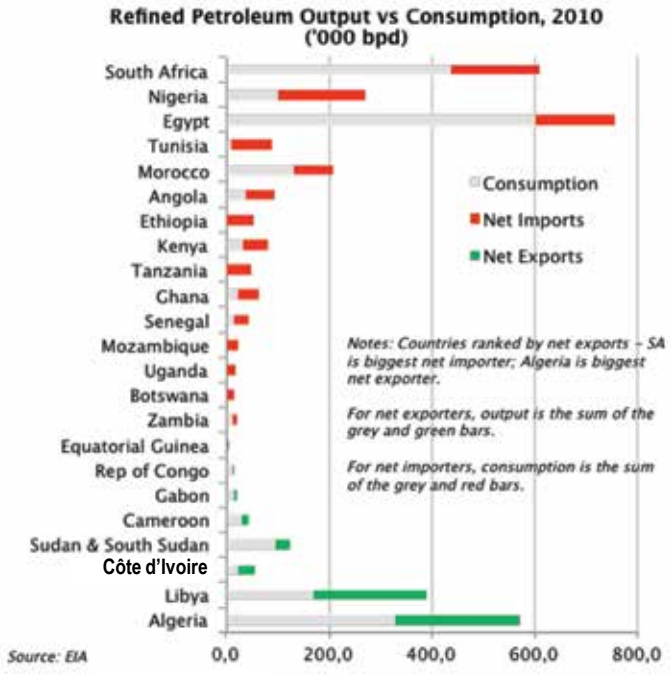
According to the EIA, 19 African countries produced refined petroleum in 2010, while seven countries produced more than 100,000 bpd. At 726,250 bpd, Egypt has the highest refinery capacity in Africa. According to the EIA, the country's actual refined oil output was 602,600 bpd in 2010. As it consumed 755,000 bpd in that year – the highest in Africa – it still had the third highest petroleum deficit in Africa despite its relatively high refinery output. The country with the highest petroleum import needs in 2010 was South Africa, followed closely by Nigeria. According to EIA data, eight African countries produced more refined oil than they consumed in 2010 – Algeria, Libya, Côte d'Ivoire, Sudan (united prior to secession), Cameroon, Gabon, Republic of Congo, and Equatorial Guinea. Algeria is the biggest net-exporter of petroleum products in Africa. According to OPEC, Algeria had a total refinery capacity of 652,500 bpd in 2011, though total output of petroleum products was significantly less, at 501,300 bpd (down from 631,500 bpd in 2010). Even so, this is well above the country's total oil consumption of 344,500 bpd. With Algeria's crude oil production being much higher than its refinery capacity, the country has scope to expand refinery production. Sonatrach stated in 2012 that it plans to invest $80bn in Algeria's oil and gas industry. These plans include the construction of four oil refineries.

In Nigeria, there have been a number of media reports about private companies stepping in to build and operate their own refineries and private interest in constructing new refineries continues to this date. However, previous efforts to build new refineries have often been delayed or cancelled, partly due to uncertainties around the government's plans to deregulate the downstream sector. Successive administrations have promised to revive the four state-owned refineries and improve their capacity utilisation, but none has succeeded to date. Most recently, the owner of Dangote Group, Aliko Dangote, stated that his company plans to construct a $9bn refinery and petrochemical & fertiliser plant, as well as a natural gas power plant in Nigeria. Dangote Group is reportedly also considering investing in oil blocks to secure feedstock for the refinery.

**Refining Capacity & Crude Output (million bpd)**




**Refined Petroleum Output vs Consumption, 2010 ('000 bpd)**



## Regional Overview and Outlook

Although North Africa holds the largest oil and gas reserves on the continent, political upheaval and uncertainty about political and economic policy changes make the region relatively unattractive for investors at present. In Egypt, economic decline since the Arab Spring uprisings left the government unable to pay oil and gas companies billions of dollars' worth of oil debts. Declining production, combined with increased domestic demand and social pressures on the government to provide the country's 86 million people with power, has led the government to direct more and more energy products to the domestic market rather than being exported. This has impacted energy companies. In a notable recent case, the UK's BG Group shocked the financial markets by declaring force majeure in Egypt as ongoing diversions of gas to the domestic market have made it impossible for the company to honour its exporting contracts. Apart from investments by some closely-allied Arab Gulf countries, investment into Egypt is expected to remain weak over the short to medium term, constrained by high political risk and uncertainty over economic policy.

Though West Africa also has many challenges, it provides better prospects than North Africa. Currently, exploration in deep offshore blocks off the coast of Angola and offshore projects in Ghana seem to be the most noteworthy. In the longer term, Nigeria has substantial prospects; however serious challenges such as the signing of the Petroleum Industry Bill (PIB) and oil theft need to be sorted out. Arguably the most exciting prospects are to be found in East Africa – a region that has, up to now, been almost unknown in the oil and gas industry. From Mozambique in the south to South Sudan in the north, exciting discoveries have been made in recent years and could transform the region, which is still one of the poorest in the world.

### East Africa

### Natural Gas

As of 2013, the region's proven natural gas reserves were meagre, while production and exports were all but negligible. Tanzania and Mozambique are the only gas producing countries in the region. Tanzania produced 870 million $m^3$ in 2011, and all its output is currently commercialised for the domestic market. Meanwhile, Mozambique produced 3.8 billion $m^3$ worth of natural gas in 2011, all of which came from two onshore gas fields. About 87% of its 2011 output was exported to South Africa via the Sasol Petroleum International Gas Pipeline, making it the only country in the region to export natural gas. However, the region holds massive potential: estimates of possible gas reserves off the coast of East and South-Eastern Africa are in the region of 12.5 trillion $m^3$, according to the USGS. There have been numerous gas finds in these two countries since 2010. In fact, finds in the Rovuma Basin have provided the operators of the gas projects enough incentive to develop LNG facilities in both countries. The gas sector's potential is attracting large-scale investment to the region and is providing a boost to the respective economies. Gas strikes off East Africa's seaboard have led to predictions that the region could become the world's third-largest exporter of natural gas over the long term.

**Mozambique -** The two main international oil companies involved in exploration in Mozambique are Anadarko and Eni. Offshore drilling by Anadarko and its joint partners exploring this region has led to the discovery of an estimated one trillion $m^3$ - 1.8 trillion $m^3$ of recoverable natural gas. The other main international oil company involved in exploration in Mozambique, Eni, has also made large discoveries, with reserves at Mamba, Coral and Agulha combined estimated at 2.4 trillion $m^3$. With new discoveries continually being made, Mozambique could become a gas giant in Africa. A number of LNG trains are set to be built in the medium to long run to commercialise the country's gas deposits. Four LNG trains with a combined capacity of 27 billion $m^3$ p.a. are expected to be completed by 2020 with another few trains set to be built by the mid-2020s. The International Monetary Fund (IMF) estimates that in order to process the natural gas, a forecast $24bn will be needed by oil and gas companies for site preparation and other infrastructure requirements – of which it is assumed that "$4bn will be invested during each year between 2014 and 2019, with all contents assumed to be imported." The IMF estimates that LNG plant construction in Mozambique will commence in 2014, and ultimately conclude in 2019.

**Tanzania -** Prospects for Tanzania are also optimistic. Although Tanzania's proven reserves amounted to a mere 6.5 billion $m^3$ at the end of 2012, the Tanzanian government raised its estimate of recoverable natural gas reserves from 814 billion $m^3$ to 934 billion $m^3$ in October 2012, following big discoveries offshore by firms like Statoil ASA, Ophir Energy and BG Group. Following more discoveries in 2013 – including a find of between 56 billion $m^3$ and 85 billion $m^3$ by Statoil and ExxonMobil in December 2013 – total discoveries to date have risen to almost 1.3 trillion $m^3$. As at the end of 2012, the government had signed 26 production sharing agreements with 18 exploration companies, which illustrates the strong investor interest. The Tanzanian energy and minerals ministry noted in August 2013 that the country's natural gas reserves are expected to reach as much as 5.7 trillion $m^3$ "after the next two years".

It is reasonable to expect that the next five to 10 years would see continuing exploration. The reality, however, is that to commercialise Tanzania's offshore reserves of natural gas will take time; estimates are between seven years and a decade. According to the IMF, after commerciality has been declared, this would be followed by design and negotiation of investment proposals. If an LNG export project were to advance, the Fund projects that cumulative FDI into Tanzania could be in the $20bn - $30bn range. According to the IMF,

the peak level of investment could be concentrated in the 2017-20 period, with "LNG production starting between 2020 and 2025 and extending over perhaps two decades". The IMF projects that at a price of $10 per 1,000 cubic feet in the Far East export market, Tanzania's export earnings from gas could exceed $3bn annually (10% of 2012 GDP). According to a report by Reuters, BG Group, Ophir Energy, Statoil and Exxon Mobil have submitted proposals to build an onshore LNG plant in the southern region of Lindi. No new LNG project has won a final investment decision anywhere in the world outside of the U.S. for almost two years because of huge cost increases across the industry, a glut of LNG from places such as Australia, and a shale boom that has made the U.S. self-sufficient in natural gas. This makes the choice of the Lindi site an important sign of confidence in Tanzania's project, even though the final investment decision is not due until 2016. The LNG terminal is expected to cost around $15bn, and the government is expected to make a decision on the site by the end of the year. BG Group has stated that the proposed plant would have several LNG processing units, known as trains, with a total capacity of 10 million tonnes a year, and 2020 is expected to be the earliest date for production to start.

Apart from increased exports, the development of gas production is expected to provide a boost for the domestic economy by increasing Tanzania's power generating capacity. Construction of a 532 km pipeline that will carry gas from the southern region of Mtwara to the capital, Dar es Salaam, is underway. Construction is expected to be completed by December 2014, and should help to boost Tanzania's electricity supply, and importantly, reduce the need to import expensive diesel to fuel power plants.

## Oil

**Kenya** - As of the start of 2013, Kenya had no proven oil reserves, and hydrocarbon exploration dating back to the 1950s had had limited success. However, interest in the country's hydrocarbon industry has been stirred since March 2012, when Tullow Oil announced that it had discovered some oil in the Turkana region.

In mid-2013, Tullow stated that oil resources in Kenya were in the region of 300 million barrels of oil equivalent, which was higher than "the threshold for development studies to commence". Chief Operating Officer Paul McDade said in a telephonic interview with Bloomberg that the company has now "certainly reached the threshold for development". Combined, oil output from Kenya and **Uganda** could be in the region of 500,000 bpd, with a pipeline possibly being in place by 2018. "When you start to take into account the potential of Kenya, and Lokichar is just the first component of what Kenya could be, it could be much more material than 250,000 barrels a day. It could easily be 500,000 barrels a day or even beyond depending on the exploration success we continue to have in Kenya", according to Mr McDade.

In January 2014, Tullow announced that it had made two further oil discoveries in northern Kenya. These two discoveries, along with other recent discoveries, raise the company's estimate for discovered resources to 600 million barrels of oil. Tullow believes that the basin has an overall potential of more than one billion barrels of oil, and said that further exploration activities will be undertaken over the next two years. The company currently has a 100% success rate in the basin with all seven wells drilled discovering oil. Tullow has agreed with the Kenyan government to commence with development studies. Oil production is projected to start by 2015-16, while there are also plans for an export pipeline. Initially, though, oil could be exported via rail and road.

**Uganda -** The discovery of substantive oil reserves in Uganda since 2006 have sparked hopes among investors and large oil companies that the country could become a lucrative new player on the global oil stage. It is now believed that Uganda could be sitting on one of the biggest onshore oil reserves in SSA. Estimates of the country's petroleum reserves have grown from 300 million barrels in 2006 to 3.5 billion barrels of commercially viable oil by late-2012. There is significant scope for further exploration in Uganda's oil region, as only 40% of it has been explored so far.

Although exploration has been successful, progress towards commercial oil production has been slow, with political wrangling holding up the development of the sector. One problem has been that the government put a moratorium on the awarding of new licences until new legislation, specifically a revised Oil Bill, was passed. British oil firm Tullow Oil, which is the biggest player in Uganda's oil sector, has also been involved in a tax dispute with the government. In August 2010, the government went as far as to repossess one of Tullow's oil fields for not applying for a production licence in time. As a result of the tax dispute, the government also blocked the company from bringing in two partners – China's National Offshore Oil Corporation (CNOOC) and France's Total – to share the cost of further exploration and development. A landmark development in the oil sector was the government's approval of the $2.9bn farmdown partnership deal with the three oil companies in February 2012. The partnership was an important step towards unlocking $10bn worth of investment in vital infrastructure by the three oil companies. This infrastructure is set to include a 30,000 bpd oil refinery, as well as pipelines, both for transporting petroleum to Kampala, and for exportation.

Another important step was to approve the Oil Bill, which was finally approved by Parliament in December 2012, and then by the President in April 2013. This new legislation will regulate oil licensing, exploration and development, and revokes the moratorium placed on the issuing of new licences by Kampala in 2007. It also opens up the door for at least six blocks and 10,000 km² of acreage to be made available for licensing. The development of the oil sector made further progress in 2013 H1. By early June, the government concluded drawing up

plans for a national energy company to steer the industry. The energy ministry stated that production-sharing agreements provide for state participation of between 20% and 50% during production, and that the national oil company will forward state participation. The company will start operations after the president names the board and the directors are approved by Parliament. In addition, the government is currently negotiating with participating oil companies to build an export pipeline to Kenya's northern coast, as well as a refinery. Funding for the plant is expected to be 60% private and 40% public. While an agreement for a 30,000 bpd refinery was reached in April, the government is promoting the construction of a 60,000 bpd refinery, possibly in two phases. It had originally wanted a much larger refinery, but the oil companies argued that this would not be commercially viable. Another project agreed to by the presidents of Uganda, Kenya and Rwanda will involve extending an existing pipeline running from Kenya's Mombasa port – that now stops inside Kenya – to Uganda and Rwanda.

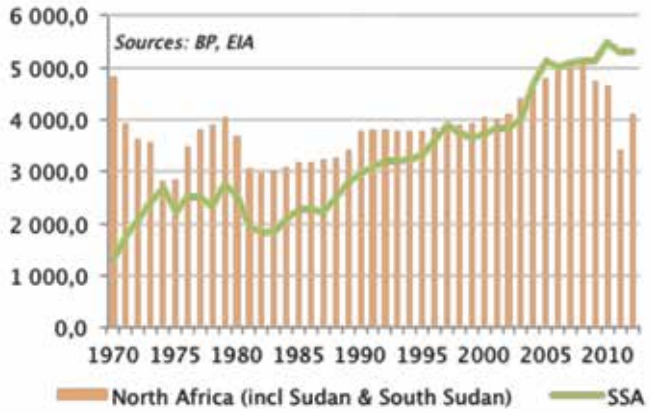
A further positive development came in February 2014 when the government signed a memorandum of understanding with the three oil companies. The memorandum sets out a framework for planned production, as well as details for the amount of crude oil that will be sent to the planned refinery and pipelines. By formally stating the details, the memorandum reduces some uncertainty that investors might have. It therefore seems that progress is now being made in terms of policy to allow oil companies to develop the oil sector. As things stand, the country is still a few years away from commercial oil production.

## North Africa

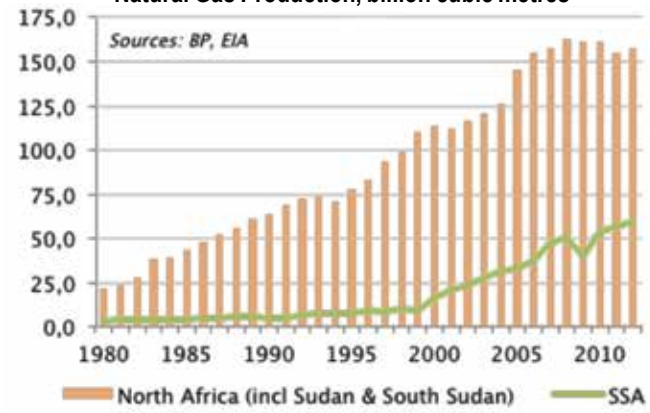
North Africa has traditionally been the most prominent oil and gas producing region on the continent. The region accounts for slightly more than half of Africa's proven oil reserves and over 57% of natural gas reserves. These shares are however down from as high as 70% in the mid-1980s, as reserves in SSA countries like Nigeria have grown more rapidly in recent decades. North Africa's share in the continent's total production has also declined as its own production has all but stagnated while that of SSA countries has surged. North Africa's share in total African output fell from over 80% in the 1960s to around 50% since the late 1990s and 2000s. As shown in the accompanying graph, there has been a marked decline in the region's oil production since 2009. In turn, this is due to declining output in the region's two major producers, Algeria and Libya. Although a cut in production quotas by OPEC in 2009 explains some of this, domestic developments have also played a significant role.

**Algeria -** Investment in the hydrocarbon sector has been very weak in recent years, largely due to unfavourabletax laws, a corruption scandal at the national oil company Sonatrach, and a challenging business environment.

**Refining Breakdown of Oil Production, '000 bpd**




**Natural Gas Production, billion cubic metres**




A law that Sonatrach must have a majority share in all projects has also made investing less attractive. To make matters worse, a high-profile terrorist attack on a gas plant near In Amenas in January 2013, showed just how vulnerable the region is to terrorist attacks. The direct impact of the event was a large decline in natural gas production at the gas plant in 2013, but the indirect impact could be just as serious, with some oil companies delaying investments due to security concerns.

There was also a positive development regarding Algeria's hydrocarbon sector in 2013: the adoption of a new hydrocarbons law in March. The law changes the tax regime applicable to energy operations, removing the windfall tax that previously applied, and replacing it with a 'tax on petroleum revenues' and a 'complementary revenues tax'. The new law also taxes companies' profits rather than revenues. The law maintains the '51-49' rule in terms of which energy parastatal Sonatrach owns the majority of any energy operation in the country. Potentially interesting is the fact that the new law authorises shale gas exploitation for the first time, subject to the permission in each case of the Council of Ministers. It charges the Hydrocarbons Regulatory Authority (ARH) with conducting environmental supervision at shale gas operations. Although the law change is good, the fact that the minority ownership law remains, and that the business environment is still extremely challenging, will

continue to deter many investors. The In Amenas terror attack has also made the security risk more apparent than before.

With a new hydrocarbon law having been put in place, the government launched a hydrocarbons licencing round in January 2014, with 31 oil and gas fields on offer, including opportunities to prospect for shale oil and gas. According to the energy minister, there were 32 hydrocarbon discoveries in 2013, 29 of which were made by Sonatrach. Reportedly, Sonatrach will continue with its exploration efforts and aim to drill over 1,200 wells over the 2014-18 period. The minister believes that the new finds could lead to a 100% increase in gas production and a 50% increase in oil production over the next decade, though these projections seem overly optimistic.

There are also a number of oil and gas projects currently in progress. Indeed, according to the EIA, production at three oilfields is scheduled to start in 2014, though each project is quite small. In the gas sector, production at the Menzel Ledjimet East (MLE) project commenced in January 2013 and was producing roughly 3.3 billion $m^3$ p.a. as of early 2014, while production at the Gassi Touil gasfield started in November 2013. The EIA lists another eight projects that are scheduled to start producing natural gas over the next four years, most of which are part of the large Southwest Gas Project that is only set to come on-stream in 2016 or later. This project consists of the following components: gas extraction facilities at three fields; a gas treatment plant; and, a pipeline taking gas to the Hassi R'Mel gas hub, from where it is transported elsewhere via existing infrastructure. This infrastructure will connect this remote region to Hassi R'Mel and therefore allow for the commercialisation of these fields, as well as other fields in the southwest. For example, the development of the Ahnet gas project, which is also planned to begin production in 2016, is dependent on the development of this infrastructure. According to the EIA, the development of a number of gas fields, including those mentioned above, "could bring on stream over 1 trillion cubic feet per year [29 billion $m^3$] after 2018. However, these projects are contingent on attracting investors and filling infrastructure gaps." The medium- to long-term potential is therefore massive, but the conditions for investment need to be sufficiently good in order to realise this potential.

**Libya -** Libya's problems are significantly worse. Although the country is endowed with massive amounts of oil reserves, the sector has been severely damaged since the country's civil war in 2011. During that year, oil production declined by an average of 71%, having completely stopped at times during the war. Although there was a quick recovery in oil production after the civil war, the EIA issued a warning in June 2012 that "the drive to ramp-up production as fast as possible has deferred routine and non-routine maintenance, which could cause production to stagnate or even fall slightly in the coming months." Political challenges have also re-emerged since then. Protests and operations by militias have had a marked impact on Libya's oil production since mid-2013, with armed groups having shut in export terminals across most of the country during the second half of last year. Since this has made it impossible for the National Oil Corporation (NOC) to export oil, most oilfields also stopped production. It also seems that the central government is largely unable to do anything about the militias. According to OPEC, Libya produced only 261,000 bpd of crude oil during November - December 2013, compared to 1.4 million bpd - 1.5 million bpd one year earlier. Although oil production has improved somewhat at the start of 2014, the problems illustrate the weakness of the government's strategy of co-opting militias by offering them patronage: it now has no effective national military to bring them in line. As a result, oil production could continue to be disrupted for some time to come. Given the high level of political risk, there is also little hope for Libya of attracting foreign investment over the foreseeable future. This, in turn, will constrain the economy's medium- to long-run prospects given its considerable reliance on the oil industry. That said, the government could pick up the slack by using its massive stock of foreign exchange reserves to invest domestically. Arguably, though, this will not be as productive as investment by private oil companies.

### Central & West Africa

Central and West Africa has a long list of oil producers, with almost all countries from Mauritania in the northwest to Angola in the south producing at least some oil. As of end-2012, this broad region had oil reserves of 55 billion barrels, or 43% of Africa's total. The vast majority of the oil produced in this region comes from Nigeria and Angola, with notable amounts also produced in Equatorial Guinea, the Republic of Congo and Gabon.

### Nigeria

The country has the second largest oil reserves in Africa after Libya and is the continent's primary oil producer. Nigeria's 37.2 billion barrels of oil reserves is also the 10th highest in the world. Over the past few decades, the oil industry in Nigeria has been characterised by a number of advantages, including the high quality of the oil, meaning it sells at a premium to the North Sea benchmark crude price (Brent); relatively low production costs; and, a favourable location for supplying oil to markets in North America. The relevance of this final advantage has diminished in recent years due to higher oil production in the U.S., Nigeria's largest market. Other important export destinations for Nigerian oil include India, Brazil, and the Netherlands. Nigeria is the largest producer of sweet oil in OPEC.

Current exploration activities are mostly focused in the deep and ultra-deep offshore areas with some activities planned in the Chad basin, located in the northeast of the country. Nigeria's onshore oil reserves are gradually declining as these fields age, while new development is concentrated at offshore oil fields. Although the Niger Delta remains home to

most of the country's oil production at around 60%, the future for expanding oil reserves is likely to be in deep offshore fields.

In the period from 2005 up to 2009, Nigeria experienced annual oil output declines, owing to an increase in pipeline vandalism, kidnappings and militant takeovers of oil facilities in the Niger Delta. However, the country's oil production increased strongly after the signing of an amnesty agreement with the Movement for the Emancipation of the Niger Delta (MEND) in mid-2009, as this led to a substantial decline in attacks and some companies have been able to repair damaged oil infrastructure. However, since 2012, oil production has struggled to increase further. The sector is plagued with oil theft and corruption, while the delay in signing the PIB into law has meant that investment into the sector has stagnated. The PIB aims to reform Nigeria's notoriously corrupt oil sector and to combine the country's voluminous laws and regulations into a single piece of legislation, but powerful vested interests have repeatedly hindered progress. The original PIB drafted in 2008 was revised and consolidated and submitted to the National Assembly in July 2012. It has been a challenge to get ministers and parliamentarians to agree on the fine print of the bill. Possible changes include the partial privatisation of the state oil firm, changes in tax rates, measures to improve transparency and accountability, and deregulating the downstream sector.

The Nigerian government hopes to increase proven oil reserves from a current level of 37.2 billion barrels to 40 billion barrels over the next few years and crude oil production from the current 1.9 million bpd to four million bpd. However, the reality is that the post-conflict catch up in production has now been made and the challenge is to create the necessary incentives for developing new oil fields, while there also seems to have been a shift from blatant vandalism for political purposes to increased levels of theft of crude from pipelines. Output disruptions continue to plague the oil sector, with some of the challenges including damage to pipelines, vandalism, piracy, as well as 'white collar crime' entrenched in the oil sector. The minister of petroleum resources, Diezani Alison-Madueke, disclosed in May 2012 that, as a result of theft via illegal bunkering, Nigeria was losing an estimated 180,000 bpd of oil, which is equivalent to about $7bn p.a. based on a crude oil price of $100/bbl.

Uncertainty about fiscal terms in the oil sector will persist, with the PIB not likely to be approved before the elections in 2015. As a result, investment in the oil sector will continue to stagnate. Companies such as Chevron and Shell have also been looking to sell some of their blocks to other investors. A number of challenges will keep Nigeria's oil output below its actual potential, especially over the short term. The delay in passing the PIB, will also keep oil output below potential until it is finalised. According to the EIA, exploration activities are currently at their lowest in a decade, with only three exploratory wells drilled in 2011, compared to 20 wells in 2005. The EIA added that although Nigeria's production of oil and condensate is likely to be hampered in the short term by conflict and infrastructure difficulties, a high level of known resources will enable its liquids production to reach 3.4 million bpd in 2035.

### Angola

Oil has long been synonymous with the Angolan economy, with the first oil well drilled in 1915. The discovery of oil in the Kwanza Valley in 1953 was the industry's defining moment however by 1974, oil was Angola's principal export, with the country producing 173,400 bpd. Production then declined for about a decade, but gradually increased from 1983 to 2003. This was followed by a boom period, when production increased from 870 bpd in 2003 to a peak of 1.9 million bpd in 2008. Deep water exploration, which is now the main form of exploration, began in 1991, and over the past 10 - 15 years, it has been the main focus of new oil exploration off the country's coast. The coming on-stream of production at various deep water fields is also the main reason for the boom in 2003-08. Apart from deep water blocks, exploration is also done in shallow and ultra-deep blocks. Once oil is extracted off Angola's coast, tankers are loaded up directly and the oil shipped straight to their destinations.

From 2009-13, oil production has stagnated despite some new fields coming online. According to the EIA, this was due to "persistent technical problems related to water injection systems, gas cooling, and floating, production, storage, and offloading (FPSO) units." Although such problems may well continue, the outlook for oil production is positive. Indeed, the EIA lists 10 projects that are scheduled to start oil production by 2017. These projects could add as much as 1.2 million bpd over the next four - five years in a best-case scenario, though at least some delays and setbacks should be expected.

At the end of October 2013, the oil minister stated that the country has delayed bidding for new licences to explore for oil in 10 new blocks in the Kwanza and Lower Congo basins to the first quarter of 2014. Without giving details as to why the bidding has been delayed, the minister continued to state that Angola plans to offer a total of 15 blocks in 2014. It remains to be seen whether operating companies will have a local partner imposed on them. As concessionaire, Sonangol retains an equity share in every block, typically of around 10% - 20%, with the operating company holding around 40% of the block and several other firms sharing the remaining amount. However, operating companies have in the past been obliged to enter into block partnerships with entities chosen for them by Sonangol. This has created a number of compliance concerns because many of the small Angolan oil firms who bid for equity are owned by politicians or businessmen close to the ruling party, which heightens transparency issues. Although Sonangol describes the tender

process as public, no details on bid values have ever been shared.

Despite having the second-largest amount of proved natural gas reserves in SSA, Angola is a small natural gas producer, ranking eighth in the region in dry natural gas production in 2012. The vast majority of Angola's natural gas production is associated gas at oil fields, and it is vented, flared, or re-injected into oil wells. Currently, Angola does not have enough infrastructure (LNG plants and/or pipelines) to commercialise the gas and therefore there is little incentive for companies to use it in any other way than to re-inject it into oil wells. Angola's first LNG plant, which is located at Soyo, started operations in 2013 to commercialise the country's natural gas resources. However, the LNG plant is currently producing well below its capacity of 5.2 million tonnes per year because of technical problems and therefore LNG exports have been infrequent. The plant also produces some other petroleum products and at the end of January 2014, the operator of the plant, Angola LNG, sold its first shipment of propane, butane, and condensates. According to the EIA, initial plans were to ship LNG to the U.S., but due to the increase in U.S. gas production, Angola LNG has been forced to look for different partners. The EIA has also noted that since offshore exploration is continuing rapidly, associated gas output is likely to continue rising and therefore Angola's capacity for processing gas will need to be increased significantly. As of yet, there are no clear plans to make use of the unused natural gas potential to overcome electricity shortages.

### Ghana

Ghana discovered its first large-scale, commercially viable oil field in June 2007. U.S. energy firm Kosmos discovered the Jubilee oil field following the drilling of the Mahogany-1 exploration well in Ghana's deep waters. A string of discoveries in the Jubilee offshore field from 2007 onwards resulted in total reserves estimates of around 1.5 billion barrels, with a potential upside of two billion barrels. (Proved reserves are currently estimated at 0.66 billion barrels.) The Jubilee field is considered the largest find offshore West Africa in the last decade. It took Ghana a relatively short time – three and a half years – to move from the discovery of oil in June 2007 to the commencement of production in December 2010. The Jubilee field produces light sweet crude, much of which is used by refiners in Europe. The state-owned Ghana National Petroleum Corporation (GNPC) is responsible for overseeing the exploration, development, production, and export of petroleum in the country. Major private sector companies that operate in the sector include UK-listed operator Tullow Oil, U.S.-producer Anadarko Petroleum, and Kosmos.

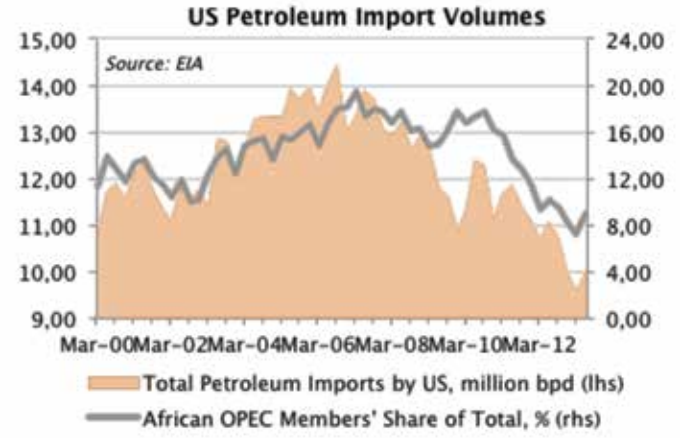
Although the development of the Jubilee field from the exploration to production stage was very quick, there have been some delays in boosting output to potential levels. In 2012, oil production reached an average of 78,355 bpd, up 2.4% from the average achieved in the previous year. Output rose by a further 27.6% to roughly 100,000 bpd in 2013. Tullow expects around the same level of production from the field in 2014 (100,000 bpd), which makes provision for a potential two-week shutdown for regular maintenance at the FPSO vessel. In Q4 of 2013, a third gas injection well was completed at the Jubilee field, but according to Tullow, this "brought only limited relief and further gas disposal options are being discussed with the authorities in Ghana". The GNPC's onshore gas processing plant will only be ready to receive gas from the Jubilee field by the second half of this year. Tullow believes that once the onshore gas processing facility becomes operational, "the Jubilee field will be able to produce to its full potential". We expect the Jubilee field to reach its peak production level of 120,000 bpd in 2015.

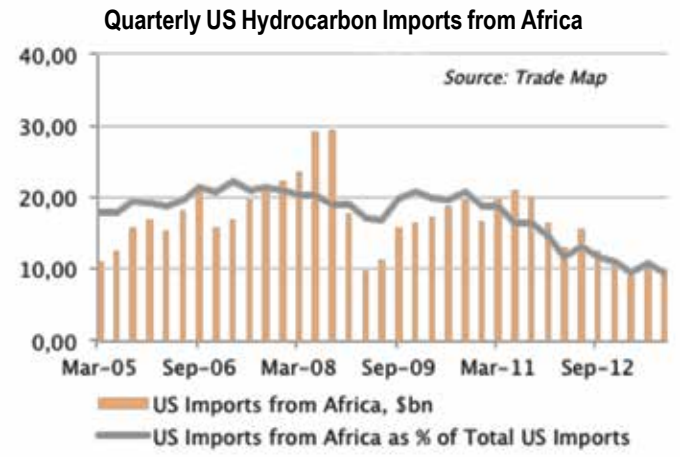
According to Tullow, the Tweneboa-Enyenra-Ntomme (TEN) project remains on track for oil production to start by mid-2016. The TEN fields are estimated to contain 245 million barrels of recoverable oil reserves and 10.2 billion $m^3$ of gas. Oil production from this project is expected to peak at 76,000 bpd. Ghana's third major oil asset is the Sankofa-Gye project, which holds an estimated 116 million barrels of oil and 31.1 billion $m^3$ of gas. The government expects first oil from this project by early 2017. Meanwhile, Hess Corporation drilled its seventh consecutive successful exploratory well in 2013, and has submitted appraisal programmes to the government. A string of other discoveries has been made that are still in the exploration/appraisal stage. Although the discoveries have not been huge, the fact that discoveries continue to be made and that drilling is so successful shows the country's potential. This is also illustrated by the GNPC's CEO, Alex Mould, stating that he expects investment of at least $20bn in Ghana's oil industry over the next five years. Investments will mainly be targeted at developing three offshore blocks, namely the Deepwater Tano/Cape Three block, the TEN block, and the Sankofa block. In 2014, investment will mainly be directed at developing the TEN fields, with spending on this block projected at $1.4bn for this year. Over the past five years, $6bn has been invested in the Jubilee field. The GNPC projects that Ghana's total oil production will more than double to 250,000 bpd by 2021.

## Key Challenge: U.S. Reducing Energy Imports from Africa

Due to the increase in oil production in the U.S. in recent years, combined with a decline in its domestic oil consumption since peaking in late 2007, the U.S. has reduced its energy imports over the past few years. As shown in the accompanying graph, gross petroleum imports by the U.S. declined from over 14 million bpd in mid-2006 to below 10 million bpd in 2013. During this period, the U.S. also changed the composition of its fuel imports: the share of its imports from Canada and Persian Gulf countries (especially Saudi

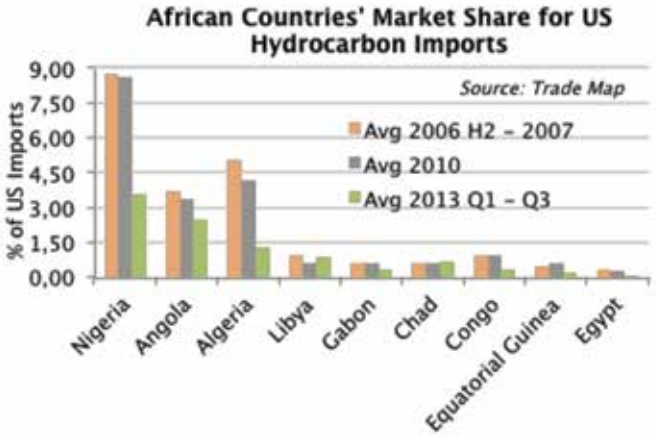
Arabia and Kuwait) increased notably, while its fuel imports from many other countries – most notably African countries – declined. As shown in the graph on the left, the share of U.S. petroleum imports coming from Africa's four OPEC countries (which account for around 77% of Africa's oil output) decreased from over 17% in mid-2010 to only 8% in 2013. Interestingly, the decline has not really come from Libya – the U.S. has never imported much oil from there. Rather, it has mainly been due to sharp declines in imports from Algeria and Nigeria, with a smaller decline from Angola.

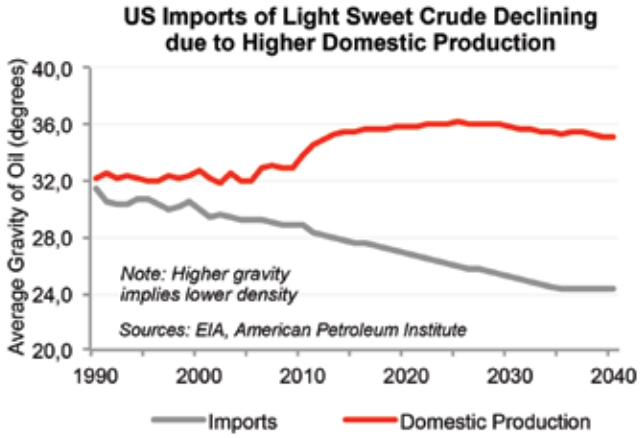


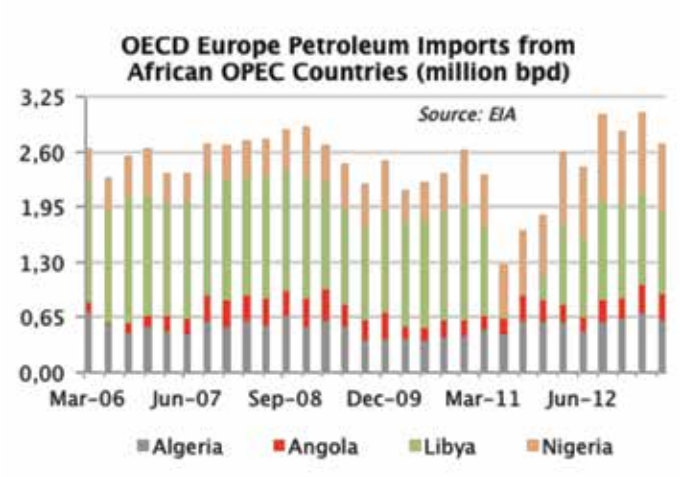




Data from Trade Map confirms this trend, showing that the value of hydrocarbon exports from Africa to the U.S. declined from over $20bn per quarter in mid-2011 to around $10bn per quarter in mid-2013 despite the fact that oil prices were similar over the two periods. The graph also shows that Africa's share in the U.S.'s hydrocarbon import bill declined from roughly 20% in 2010 to 10% in 2013. The next graph shows each country's share in U.S. hydrocarbon imports, illustrating the large declines in Nigeria and Algeria's market share since 2010. Nigeria's hydrocarbon exports to the U.S. declined by $14.8bn in 2012, while Algeria's exports to the U.S. declined by $4.7bn. Over the first three quarters of 2013, Nigeria's exports to the U.S. declined by another $4.2bn compared to the same period in 2012, while Algeria's exports declined by $4.4bn over the same period. According to the EIA, U.S. imports from Nigeria declined from as high as 1,200 bpd in 2007 H2 and 1,100 bpd in mid-2010 to only 386,000 bpd in 2013 H1. Meanwhile, its imports from Algeria declined from 750,000 bpd in mid-2007 and 500,000 bpd in 2010 to as little as 118,000 bpd in 2013 H1.

One of the main reasons why countries from North and West Africa have been affected so severely is because they mainly export light crude (a high quality crude oil), while the supply of this type of oil in the U.S. itself has increased. This trend whereby the U.S. is importing less of Africa's light crude oil is likely to continue over the medium to long term. The EIA explains that the average density of U.S. domestic crude oil production has decreased notably since 2010 (i.e. they are producing more light crude) and adds that this trend is forecast to continue for at least another decade. Since oil refiners generally use a mix of crude oils to optimise operations, and as American refiners can now buy more light crude domestically, the U.S.'s import needs have shifted towards a heavier type of crude oil. Putting further pressure on North and West African oil producers is the fact that refiners around the world are increasingly able to refine larger volumes of sour crude oil, which is cheaper.






This presents a dilemma for African oil producers – Algeria and Nigeria in particular – since the U.S. has traditionally been their largest export market. For Nigeria, the U.S. is still the country's main export market, though for Algeria, the U.S. was surpassed by Italy in 2012. However, Italy is also looking to cut imports from Algeria. El Watan reported in May 2013 that the two countries' state oil companies – Sonatrach and Eni – reached an agreement that Algeria would reduce the amount of natural gas delivered to Italy. This is partially due to weak demand for energy products in Italy. In fact, according to the EIA, Italy's total primary energy consumption has fallen from 8.17 quadrillion Btu in 2004 to 7.12 quadrillion Btu in 2012. Its oil demand has declined from around 1.7 million bpd in 2007 to below 1.3 million bpd in 2013. Furthermore, the country is still in recession (its real GDP contracted by 2.3% y-o-y over the first three quarters of 2013 after having contracted by 2.5% in 2012), which means that energy demand is likely to continue declining. Another reason for cutting Algerian imports is political risk: the head of the energy department at Italy's Ministry of Economic Development, Leonardo Senni, told Reuters that "[w]e need new supply sources." He added that "Italy is trying to diversify away [from Algeria] with the likes of LNG and the [Trans Adriatic Pipeline (TAP)]." Similarly, Spain is also concerned about the stability of Algerian supplies. One Spanish importer told Reuters: "There is a trend in which our African gas imports are becoming more unreliable and our biggest concern is Algeria. So we are looking for new import sources." France, which is also an important export destination for Algeria, has also seen a drop in oil demand in recent years, so it might also decide to import less from Algeria.

The U.S. is also a very important export market for Angola, but the country is much less exposed to Europe than Algeria. In contrast, the other big African energy exporter, Libya, exports almost all its oil and gas to Italy, France and Spain. Italy and Spain are also big export destinations for Nigeria. Some of the smaller oil exporters are also affected by these developments: Gabon, in particular, has traditionally exported about two-thirds of its oil to the U.S..

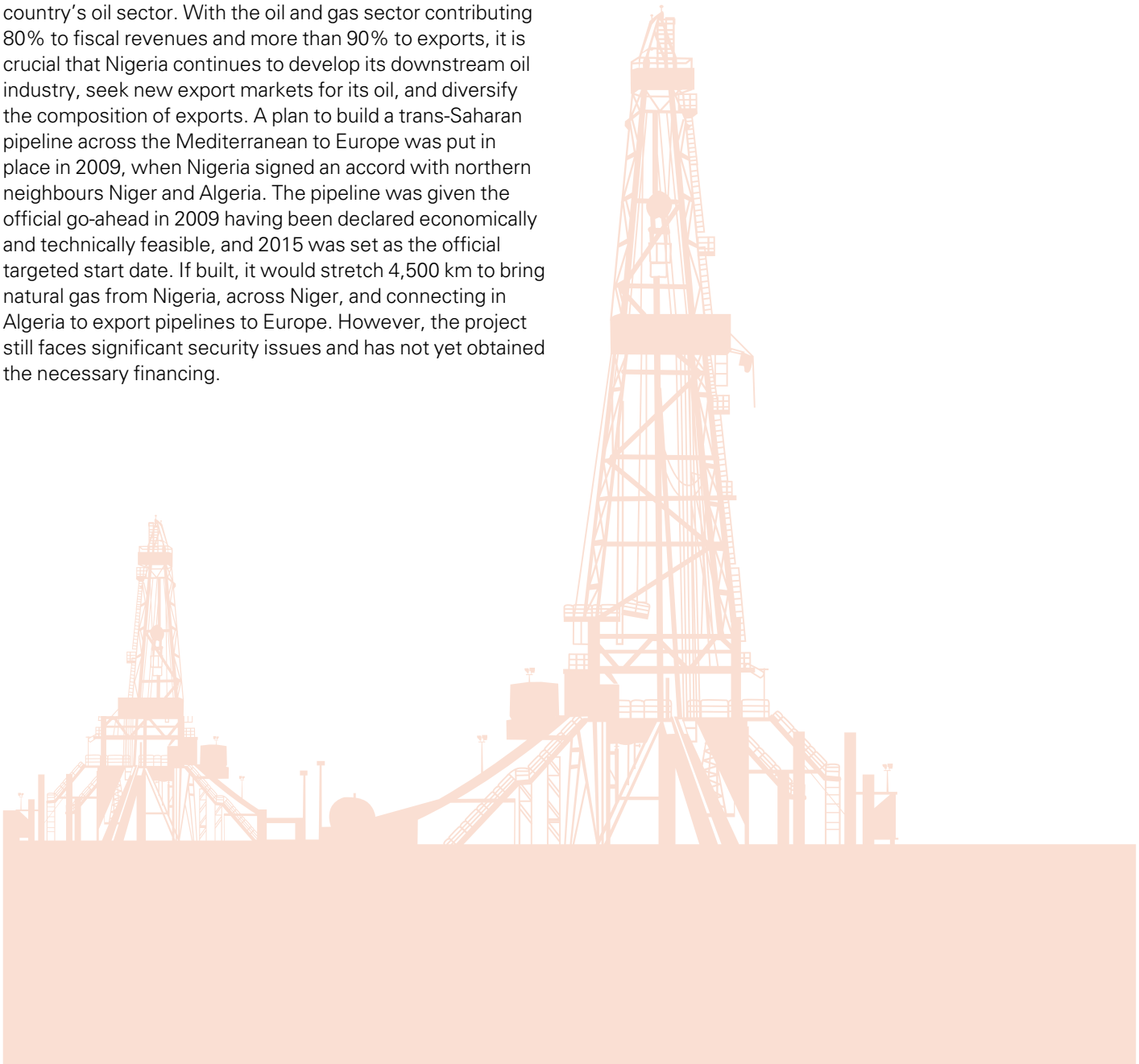
Despite concerns about European demand, up to now, advanced European economies have not reduced their oil imports from Africa. In fact, as shown in the accompanying graph, European OECD members' oil imports from African OPEC members reached record levels in 2013 Q1, with imports from Nigeria and Algeria increasing markedly in recent years. (The drop in 2011 was due to Libya's civil war.) Thus, for now, the drop in imports from the U.S. has been offset by higher imports by Europe.

Nevertheless, in light of concerns that European demand will weaken further, and with the clear downward trend in U.S. imports of light sweet crude, African countries will need to find new destinations for its hydrocarbon products, presumably in emerging economies in Asia, Africa, and South America. In this regard, Angola is in the relatively favourable position that it already exports almost half of its oil to China. Up to 60% of the country's oil exports are destined for the so-called BRICS countries. Sudan is another African country that tends to export to Asian countries, mainly China, though political problems in the country mean that oil production is currently low and volatile. In general, though, African hydrocarbon exports to major Asian nations like China, Japan and South Korea have not increased over the last few years. China, for instance, has mainly increased its imports from Russia and the Middle East, which are closer to it geographically than Africa.

Whether new destinations fill the gap left by traditional export destinations remains to be seen. For Algeria, the issue might be particularly tricky. Algeria's political risk might make the

country less attractive than other gas producers. Moreover, if Italy is reducing its demand for Algerian natural gas, then it seems doubtful that the planned Galsi gas pipeline, which would export gas to Italy, will go ahead in the near future, except if other countries beyond Italy want additional gas from Algeria. Relatively high levels of political risk and poor economic policy making (especially with regard to investment freedom) is beginning to haunt Algeria, and will continue to affect hydrocarbon production if not addressed.

In an environment where the global oil market is turning more in favour of the consumer, Nigeria should not rest on its laurels, especially considering that up-and-coming energy producers in the East African region have relative proximity to Asia in its favour. Ongoing delays in finalising the PIB have put on hold billions of dollars in potential investment in the country's oil sector. With the oil and gas sector contributing 80% to fiscal revenues and more than 90% to exports, it is crucial that Nigeria continues to develop its downstream oil industry, seek new export markets for its oil, and diversify the composition of exports. A plan to build a trans-Saharan pipeline across the Mediterranean to Europe was put in place in 2009, when Nigeria signed an accord with northern neighbours Niger and Algeria. The pipeline was given the official go-ahead in 2009 having been declared economically and technically feasible, and 2015 was set as the official targeted start date. If built, it would stretch 4,500 km to bring natural gas from Nigeria, across Niger, and connecting in Algeria to export pipelines to Europe. However, the project still faces significant security issues and has not yet obtained the necessary financing.



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