Natural gas in Africa
The frontiers of the Golden Age
Contents

Executive summary 3
Introduction 4
Current fundamentals and activity 6
Expectations and potential 12
Risks and challenges 16
How EY can help 18
Executive summary

The world may be poised at the beginning of the Golden Age of Gas, with natural gas being the only fossil fuel whose share of the global energy mix is expected to grow. That expected growth is to be driven by developments on both the demand side (e.g., energy demand growth in China, displacement of coal-fired and nuclear power, and the displacement of some oil products in transportation) and on the supply side (e.g., the unconventional gas boom and the growing role of liquefied natural gas (LNG)).

Africa is currently a small but growing part of the global gas picture, and its prospects are even brighter still. With relatively open access and generally attractive leasing terms, Africa’s oil and natural gas resources have long attracted a broad spectrum of investors – from the large integrated, international majors, to the large and small independent exploration and production (E&P) companies, as well as national oil companies (NOCs) from outside the region. North Africa has historically led the continent’s gas sector, but recent growth has come from the huge associated gas developments that have accompanied the West African offshore oil boom. With the huge recent discoveries in offshore East Africa (in particular, Mozambique and Tanzania), the future of African gas is, however, expected to shift eastward.

Development of Africa’s unconventional gas resources – largely in North Africa and South Africa – could substantially add to the potential new supply.

Natural gas development holds tremendous opportunity for Africa, and it can be a strong “prime mover” for broader economic and social development. But those opportunities come with risks and challenges – some that are beyond the control of local/regional industry and government, others that while daunting, can be managed, but will need resolute and dedicated attention. Most importantly though, the opportunities for Africa presented by the Golden Age of Gas are enormous and the challenges and risks can be addressed and mitigated, if not fully overcome.
Introduction

The Golden Age of Gas

In a thought-provoking report published in June 2011, the International Energy Agency (IEA) asked, “Are We Entering a Golden Age of Gas?” That report described a new positive outlook for the global future of natural gas – with that positive outlook a function of four factors: ambitious assumptions around natural gas use in China; greater use of natural gas in transportation; slower growth in global nuclear power; and most critically, a more optimistic outlook for natural gas supply, chiefly driven by the increasing availability of unconventional natural gas at competitive prices, and by the expansion of global supply capabilities for LNG. In their report, the IEA forecasted a growing role for natural gas in the world’s energy mix, with the natural gas share growing from 21% in 2010 to 25% in 2035, with natural gas the only fossil fuel whose share was growing.1 In replacing other fossil fuels, natural gas can lead to lower emissions of greenhouse gases and other localized pollutants; it can diversify the energy mix and thereby increase energy security; and it can provide the flexibility and the necessary back-up capacity in power generation.

The unconventional revolution

Relatively new, “unconventional” supplies of natural gas – including shale gas, tight gas and coalbed methane (also known as coal seam gas) – could transform the world’s energy markets. While global gas reserves have been growing steadily for decades, over the last decade, the so-called unconventional gas “bonanza” has roughly doubled the resource base that can be economically recovered. A decade ago, the world was estimated to have only 50 to 60 years worth of gas remaining; with the new unconventional supply, the estimated resource life has risen to more than 200 years.2 Currently, the unconventional boom has been centered in the United States, but parts of Europe, China, Argentina, Brazil, Mexico, Canada and several African countries are thought to hold yet unknown huge quantities of unconventional natural gas. Of the world’s estimated remaining technically recoverable natural gas resources, unconventional gas accounts for more than 331 trillion cubic meters (tcm) out of 752 tcm in total, or about 44% of the total. Shale gas accounts for an estimated 63% of the world’s technically recoverable unconventional gas resources.3 [Note that where original gas volumes are reported in cubic feet rather than cubic meters, the conversion factor of 1 cubic foot equals 0.028 cubic meters is used throughout this report.]

Globalizing gas markets – the growing role of LNG

Long seen as oil’s “poor relation” or simply a “niche” product, natural gas has nonetheless seen its share of the world’s energy mix grow steadily over the last 50 to 60 years. The main challenge for natural gas has historically been that it is relatively difficult and expensive to transport over long distances. (The same was historically true for oil, before the age of the supertankers in the 1960s.) As a result, natural gas was largely seen as a “regional” fuel, with transportation generally limited to pipelines. But there are limits to pipeline economics, and cross-border pipelines can engender significant geopolitical risks. But in the 1960s, the development of liquefied natural gas (LNG) technology allowed the competitive connection of so-called “stranded” natural gas reserves to long-distance markets.

The world’s first large-scale LNG liquefaction facility opened in Algeria in 1964, and by early 2012, 19 countries had liquefaction capacity and/or were exporting LNG. Global trade in LNG has grown from approximately 3 billion cubic meters (bcm) in 1970 to more than 330 bcm in 2011. In early 2012, LNG import capacity (i.e., import terminals/regasification plants) existed in 25 countries. Global LNG liquefaction capacity, as of early 2012, is approximately 300 metric tonnes per year (MT/yr). With the planned and proposed/possible additions to liquefaction capacity, global capacity could reach 750 MT/yr by 2020.

What this might mean for Africa?

Natural resource development, oil and natural gas in particular, is a “foundational” element of economic growth and development. In developing countries, it typically accounts for a significant part of the state’s revenues and more importantly, it represents a “prime mover” for employment, infrastructure development and the improvement of the broader social well-being.

So, how might these global gas trends play out in Africa? What are the implications and prospects for the natural gas sector in Africa going forward? What are or will be the challenges and risks for industry and for governments? In the following sections of this report, we will look at current industry fundamentals and activity in Africa, and then at the expectations of and potential for natural gas in Africa. Lastly, we offer some of the key risks and challenges for the African natural gas sector.

4. Liquefaction capacity is typically expressed in metric tonnes per year (MT/yr), whereas gas production, consumption and trade are typically measured in terms of cubic meters or cubic feet. One MT of LNG is roughly the equivalent of 1.36 billion cubic meters (bcm) of natural gas.


Regional gas reserves, production and demand

According to the Oil & Gas Journal, proved reserves of natural gas in Africa are estimated at around 14 tcm, as of 1 January 2012. African gas reserves are about 7.5% of the world’s total. Technically recoverable reserves of natural gas in Africa are substantially higher, estimated to be about 74 tcm, almost 10% of the world’s total. African proved gas reserves are highly concentrated, with four countries – Nigeria, Algeria, Egypt and Libya – accounting for more than 92% of the continent’s total.

African gas production reached about 203 bcm in 2011, with production led by Algeria, Egypt and Nigeria, collectively accounting for more than 88% of the continent’s total. Gas production in Africa since 2000 has been growing by about 4% per year.

African natural gas consumption is estimated to have been about 110 bcm in 2011, with Egypt and Algeria leading consumption totals and accounting for more than 70% of the African total. Gas consumption in Africa has been growing at a rate of about 6% per year since 2000.
Natural gas in Africa: the frontiers of the Golden Age

According to monthly data collected by Baker Hughes, Inc., oil and gas drilling activity in Africa has been broadly increasing. While month-to-month data are volatile, total activity has picked up in recent years, particularly since the global recession in 2008 and 2009.

Drilling activity

Table 1. African natural gas

<table>
<thead>
<tr>
<th>Country</th>
<th>Reserves at 1 January 2012</th>
<th>2010 demand</th>
<th>2010 production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>4,452</td>
<td>28.5</td>
<td>83.7</td>
</tr>
<tr>
<td>Angola</td>
<td>307</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Benin</td>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Cameroun</td>
<td>134</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Congo (Brazzaville)</td>
<td>90</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Congo (Zaire)</td>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Egypt</td>
<td>2,162</td>
<td>45.6</td>
<td>60.6</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>36</td>
<td>1.6</td>
<td>6.7</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>25</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Gabon</td>
<td>28</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Ghana</td>
<td>22</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>28</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Libya</td>
<td>1,478</td>
<td>6.8</td>
<td>16.6</td>
</tr>
<tr>
<td>Mauritania</td>
<td>28</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Morocco</td>
<td>1</td>
<td>0.6</td>
<td>0.1</td>
</tr>
<tr>
<td>Mozambique</td>
<td>126</td>
<td>0.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Namibia</td>
<td>62</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Nigeria</td>
<td>5,053</td>
<td>4.9</td>
<td>28.7</td>
</tr>
<tr>
<td>Rwanda</td>
<td>56</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Senegal</td>
<td>0</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Somalia</td>
<td>6</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>South Africa</td>
<td>0</td>
<td>4.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Sudan</td>
<td>84</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Tanzania</td>
<td>6</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Tunisia</td>
<td>64</td>
<td>3.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Uganda</td>
<td>14</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,264</strong></td>
<td><strong>100</strong></td>
<td><strong>207</strong></td>
</tr>
</tbody>
</table>

*Less than 500 million cubic meters

Sources: Reserves — Oil & Gas Journal
Demand/production — U.S. Department of Energy

Note that the latest demand and production data are for 2010.

Note that the latest reserves data are at 1 January 2012.

African oil and gas drilling activity has historically been predominantly onshore and oil-directed. Looking at average annual totals, onshore drilling had been increasing in relative terms (i.e., as a percentage of the annual total) until 2009. But beginning in 2010, there has been a resurgence in offshore drilling activity. Similarly, African drilling for natural gas had been steadily increasing (again, as a percent of the annual total) through 2010, but it has dropped slightly in 2011 and so far in 2012.
African oil and gas drilling activity has historically been dominated by North Africa — primarily Egypt and Algeria. However, recent increases have largely been driven by the West Africans, notably, Nigeria and Angola, and even more recently, drilling activity has been picking up elsewhere in the region, notably in offshore East Africa in Mozambique and Tanzania.

**Competitive landscape**

By-and-large, with relatively open access and generally attractive leasing terms, the international majors, particularly the European-based companies, have done well in Africa. As elsewhere, their financial might and their deep technical capabilities and operational experience provides them a competitive advantage. But the region has traditionally attracted the large international E&P companies with extensive technical capabilities and experience, plus a typically sharper strategic focus and usually a sharper appetite for risk. The larger independents also have been joined by a growing group of smaller, more-nimble independents and regional “specialists,” like Addax (now part of Sinopec), Tullow Oil, Maurel & Prom, Afren, Kosmos Energy, Perenco, Cobalt International Energy, Cove Energy and Ophir Energy.

The private sector companies have been joined by a host of indigenous NOCs, some of which are very technically competent in their own right, others less so and often bogged down in bureaucratic inefficiencies and overwhelmed by the challenges of developing local technical, commercial and managerial capabilities. NOCs from outside Africa also have played an increasingly larger role in the oil and gas sector in Africa. In particular, the three big Chinese NOCs (CNPC, CNOOC and Sinopec), along with their counterparts from India (ONGC), South Korea (KNOC), Malaysia (PETRONAS), Russia (Gazprom), and most-recently, Thailand (PTTEP) have been actively investing in African assets, infrastructure and smaller private companies.
Natural gas in Africa: the frontiers of the Golden Age

Current sub-regional environment

North Africa

North Africa represents the “Old Guard” of the continent’s natural gas sector, with Algeria and Egypt the two largest gas producers and consumers. Algeria, Egypt and Libya represent three of the continent’s four largest gas reserve holders.

Algeria has long been a major player in global gas markets, and it has historically been the second-largest gas supplier into Europe. It is seen as a “reasonably open and mature market for oil and gas exploration and production.”11 Broadly open to international competition, with more than 35 foreign companies currently participating, E&P contracts are typically via Production Sharing Agreements (PSAs) with the national oil company, Sonatrach, holding at least a 51% interest in all new projects. Foreign participants are expected (but generally not required) to invest in social development, infrastructure and training. The government’s explicit energy strategy is to expand its gas reserves and infrastructure for exports and it has slated a new licensing round within the next few years that will open up new regions in the southwest and northern parts of the country, including offshore blocks for the first time.12 The government has also recently announced that special fiscal concessions for shale gas development are likely to be included in an amendment to Algeria’s hydrocarbon law.13

In the wake of last year’s overthrow of the Mubarak Government, natural gas has become an intensely politicized issue in Egypt. Egypt has long been Africa’s largest consumer of natural gas, and the focus of the gas industry in Egypt was originally to provide cheap domestic energy. But in recent years, exploration and development success has led to growing export temptations and to subsequent over-commitments of export supply, with resulting domestic shortages and high prices. Domestic fuel subsidies have long been an issue, and the new government will likely be very sensitive to public opinion. As a result, the new government is expected to scale back gas export ventures, via pipeline and LNG.

Egypt has generally been open to foreign participation, under PSAs with state NOC participation (EGPC or EGAS) generally up to 50%. Foreign players include many of the international majors, several large international E&Ps and a few international juniors. The country has two distinct gas plays – the deepwater offshore Nile delta, and the onshore Western Desert.14 Libya is focused on the restoration of oil and gas production, which had ground to a halt during last year’s revolution. Natural gas is still secondary to oil in the country and is relatively underdeveloped. As a result of the US sanctions over recent decades, foreign participation had been dominated by the European majors. But with the lifting of the sanctions, US majors have again reentered the country. The government is offering some increasingly flexible PSAs for foreign partners, but there remains some underlying uncertainty around the contracts signed in the Muammar Qaddafi era.

Shale gas resources have been identified across much of North Africa. The majority of the resources are concentrated in Algeria, Libya and Tunisia in four formations in the Ghadames and Sirte Basins. Risked gas in place has been estimated at more than 52 tcf, with recoverable gas estimated to be around 14 tcf. Some preliminary exploration and drilling activity has been conducted in the Ghadames Basin, but with no reported production. No activity has been reported in the Sirte Basin.15 Smaller concentrations of shale gas have been identified in western North Africa, primarily in Morocco in the Tindouf and Tadla Basins. Risked gas in place has been estimated at more than 7 tcf, with recoverable gas estimated at more than 1 tcf. Some preliminary assessments have been conducted by the Moroccan NOC, ONHYM, and some exploratory drilling is slated for the near-term in conjunction with some smaller international companies.16

16. Ibid.
West Africa

West Africa has predominantly been an oil story and over the last decade or so, the sub-region has largely become one of the global industry’s major success stories – in particular, the deepwater oil frontier. Natural gas production has been dominated by associated gas, and with fairly limited domestic markets for gas, much if not most of the sub-region’s gas output has been flared; only relatively recently have we seen a dedicated focus on capturing the gas for export as LNG. Importantly, the World Bank’s Global Gas Flaring Reduction initiative has had a major focus on the sub-region, with those efforts tied in with the export projects and with the development of the local infrastructure to support domestic gas use.

The size and complexity of the deepwater projects and more recently the LNG projects has favored the deep pockets and technical capabilities of the large international majors, but the international E&Ps, both large and relatively small, also have played key roles, as have the “regional specialists” and a few small local companies, with the latter focused primarily onshore.

While Nigeria dominates the sub-region in terms of reserves and production of oil and gas, the country and its NOC, Nigerian National Petroleum Company (NNPC), has struggled to translate its vast resources into consistent, efficient revenue generation. Tribal and ethnic violence has frequently curtailed production and threatened foreign investment, while the development of a consistent government energy policy has often been seemingly compromised by corruption and mismanagement.17

NNPC is being reconstructed to transform it into a competitive international company and the government is pursuing an aggressive policy to increase local participation and returns from upstream investment, and in particular, increase and optimize domestic gas supply and usage. The latest draft of Nigeria’s long-delayed Petroleum Industry Bill (PIB) is reported to be very pro-industry, but is still expected to be subject to heated debate in the National Assembly, and could trigger a new wave of attacks on industry facilities.

Angola has delivered Africa’s strongest increases in oil production over the last decade and has seen its associated gas production rise dramatically as well. And like much of the sub-region, until recently most of that gas was flared. Earlier this year, Angola joined the ranks of global LNG exporters with the commissioning of the Chevron-led Angola LNG project. Angolan oil and gas development has largely remained open, but foreign participation is weighted towards the international heavyweights, both IOCs and NOCs, with the Chinese NOCs particularly active.

Africa’s first regional gas transmission system – the long-planned West African Gas Pipeline (WAGP) – was opened in 2010, running from Nigeria through Benin and Togo, and feeding into two power stations in Ghana. The project had been plagued by cost overruns and then by security concerns in Nigeria.

Elsewhere in the sub-region, the rather substantial gas resources are generally under-utilized as commercial value is limited by insufficient infrastructure. As in Nigeria and Angola, flaring reductions and associated gas capture are a strategic focus in Cameroon, Gabon, Ghana and Equatorial Guinea. Notably, with the opening of Marathon’s big gas monetization project, EGLNG, in 2007, oil’s dominance has given way to gas. Ghana’s massive Jubilee development, while primarily oil-focused, is also generating lots of associated gas. As in Nigeria and Angola, foreign participation is relatively open, albeit typically dominated by the large international majors and the larger international E&Ps.

East Africa

The most dynamic recent developments in the African natural gas sector have been in East Africa. Ten years ago, East Africa was a “non-story” as far as oil and gas were concerned, with complex geology, poor seismic data and difficult political factors resulting in only a few local coastal explorations with little consequence. No longer a non-story, East Africa is now seen as the “new promised land” or the “next epicenter” for global natural gas, the newest “new frontier.”18

While small-scale exploration and production had been going on for decades in the sub-region, US independent E&P, Anadarko, essentially opened the new frontier in 2010 with its massive Windjammer discovery in Area 1 of the Rovuma Basin in offshore northern Mozambique. Four subsequent discoveries in the area by Anadarko, along with major discoveries in nearby Area 4 by ENI in the Mamba prospect, have boosted recoverable reserve estimates for Mozambique to as high as 3 tcm. In the adjoining Tanzanian portion of the Rovuma Basin, BG Group and Ophir Energy have also hit major gas deposits, as has Statoil and its partner ExxonMobil.

Interest in neighboring offshore Kenya and Madagascar is increasing, based on the belief that similar geological compositions will be found. The regional gas boom has attracted a long list of players including supermajors (ExxonMobil, Total and Royal Dutch Shell), large international E&Ps (Anadarko and BG Group), hybrid IOC/NOCs (Statoil, Petrobras and Galp Energia) and smaller regional specialists (Tullow, Ophir Energy/Dominion, Cove Energy, Pancontinental Oil & Gas NL and Premier Oil). And with very limited local gas demand apart from South Africa, the new discoveries will largely be targeted for export as LNG, principally for the booming markets of Asia. Because of this there has been increased participation by several Asian oil companies including privately-held companies and NOCs (Mitsui, Videocon, KOGAS, PETRONAS and PTTEP).

Watched with great interest was the recent bidding war between global supermajor, Royal Dutch Shell and the Thai NOC, PTTEP, for Cove Energy's 8.5% interest in the big Anadarko play in offshore Mozambique (along with a 10% interest in a smaller onshore Mozambique play). After several bids and counterbids, surprising many observers, Shell decided to drop its bid, leaving PTTEP with the "prize."

Gas activity elsewhere in the East African sub-region (e.g., Sudan, South Sudan, Ethiopia and Uganda) has generally been limited to date, struggling with a lack of infrastructure and political issues. Associated gas is currently mainly re-injected or flared, but governments are keen to target gas for domestic use. We are nonetheless seeing increasing interest in the wake of the big Mozambique/Tanzania discoveries.

Substantial shale gas resources have also been identified in South Africa – in three formations in the Karoo Basin. Risked gas in place has been estimated at more than 51 tcf, with recoverable gas estimated at almost 14 tcm. Some Technical Cooperation Permits (TCPs) for exploration have been signed, including with Royal Dutch Shell and the Sasol/Chesapeake/Statoil joint venture. Notably, early exploratory drilling has been led by the smaller international E&P company, Falcon Oil & Gas.19 At present, shale gas exploration and development activity in South Africa is constrained by the moratorium on hydraulic fracturing.

---

Regional supply/demand forecasts

While short-term risks from the global economy are still quite high, longer-term economic prospects for Africa are seen as very bright — in its last World Energy Outlook, the IEA assumes that Africa’s GDP will grow at between 3.4% to 4.5% per year until 2035. A young, growing and urbanizing population should enjoy a “demographic dividend” and support an emerging, consuming middle class.

In its most recent report, the IEA forecasts that African natural gas production will expand to almost 400 bcm by 2035, with regional natural gas consumption growing to almost 170 bcm. Gas production in Africa is expected to almost double by 2035, increasing at an average rate of about 2.7% per year. Gas consumption is expected to grow at about 2% per year. Net exports of natural gas from Africa are expected to more than double, reaching more than 230 bcm by 2035.

Sub-regional expectations and prospects

As noted earlier, natural resource development can be a prime mover for the broader economic and social development of a country. However, the expectations and prospects for natural gas are quite different in each of the three sub-regions in Africa.

North Africa

Two of the three leaders of Africa’s “Old Guard” — Libya and Egypt — will struggle, at least in the short-term, to restore political stability and to achieve public acceptance of the new political order. Egypt in particular faces an uncertain political transition in the face of intense social pressures. The new government faces rather bleak economic prospects and could come under significant pressure to change the fiscal regimes for oil and gas development. At the same time, it will be challenged to offer sufficient incentives to lure foreign investment. Once seen as having much less nationalistic sentiment than either Libya or Algeria, Egypt could well change. It will be difficult for the new government to dismantle the current fuel subsidies, and expansion of LNG export capacity and of gas exports in general looks unlikely, particularly the controversial gas exports to Israel, without significant new discoveries.

While any expansion of Egypt’s natural gas sector is likely to be domestically focused, in contrast, Algeria’s expansion will be export-focused, specifically targeting new reserves and infrastructure, specifically in the southwest and northern parts of the country, including offshore. Major expansions to the country’s LNG export capacity are currently under construction. As noted earlier, the government also intends to modify the fiscal terms in order to encourage shale gas development. In the near-to-medium-term, however, shale exploration and development is expected to be modest, at best.


Chart 6. Forecast African natural gas production and disposition (total production = demand + net exports)

West Africa

The underlying theme of West Africa’s future gas development is the monetization of the underutilized resource base through dramatically reduced flaring and the capture of associated gas for export, and more importantly, for domestic use. Throughout the sub-region, two critical components of the gas development theme are downstream gas infrastructure development (e.g., “integrated” gas development that could include power generation and/or industrial development) and increasing local content focus – again, using gas development as a broader prime mover.

Most notably, the sub-region’s largest producer, Nigeria, could see its long-awaited PIB finalized later this year or early next year, with a major focus on the optimal development of domestic gas supplies, and on stronger local content requirements for all future oil and gas development. Whether or not the PIB can resolve the controversy over fuel subsidies will be one of Nigeria's greatest challenges.

There are big plans for substantial additions to LNG export capacity in the West African sub-region. Many of these are, however, seen as very speculative, particularly many of the proposed Nigerian projects. Expansions of throughput on the West African Gas Pipeline are being discussed, but are largely being postponed due to growing Nigerian domestic gas requirements.

East Africa

As noted earlier, East Africa is the newest frontier – with the recent massive discoveries, it represents the growth engine for Africa’s natural gas sector. While it may not be the next Qatar or Australia, it certainly has the potential to be an LNG heavyweight on par with Nigeria.

The Anadarko and ENI discoveries in Areas 1 and 4 in Mozambique could hold more than 3 tcm of gas (more than 100 tcf) and could theoretically support as much as 50 MT/yr of LNG exports. The discoveries could hold as much potential value as 30 to 40 times the current GDP of Mozambique.

After backing away from the battle for the Cove Energy stake in the Anadarko play, Shell is unlikely to walk away from the sub-region. Rather, it is expected to farm-in to either the Anadarko or ENI plays (or possibly to both). In particular, deepwater-specialist Anadarko is expected to need an LNG-specialist like Shell to make the project work. Shell is also reported to be considering numerous opportunities in the sub-region.

East African LNG is expected to be very competitive into Asian gas markets; consultants at Wood Mackenzie estimate that the break – even for East African gas – is around US$7 per million BTUs, in contrast to around US$10 per million BTUs for Australian LNG. The main questions are concerned with the number of LNG projects that will go forward, and whether or not they will be unitized or combined. The proposed projects present enormous opportunities not just for the upstream companies, but also for the other participants in the oil and gas value chain – the drilling companies, the service providers and the equipment manufacturers, along with local construction and service and supply companies. In addition, there are prospects for the development of ancillary or related industries that could utilize competitively priced feedstocks, industries such as chemicals or fertilizer.

Development of the sub-region’s large shale gas resources in South Africa remains possible, but is challenged by water concerns, some land ownership issues and by a lack of sufficient infrastructure. Hydraulic fracturing, which is key to shale gas development, is currently banned, but there have been some discussions of ending the moratorium. A recent report by a South African consultancy, Econometrix, noted that large-scale shale gas development could be “transformational” for the country. The report estimated that conservatively more than 56 bcm of gas could be produced over a 20-year period, adding an average of 80 billion rand (US$9.5 billion) per year to the South African economy. A more productive scenario could see production of as much as 1.4 tcm of gas, bringing in more than 200 billion rand (US$23.8 billion) per year.27

South Africa, the most advanced developing country in Africa, could also be a lever for regional gas development through the demand side, should the country look to aggressively back out coal for power generation.

Table 2. African LNG capacity

<table>
<thead>
<tr>
<th>Country</th>
<th>Project</th>
<th>Start*</th>
<th>Capacity (MT/yr)</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing/operating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algeria</td>
<td>Arzew (3 trains)</td>
<td>1964</td>
<td>1.1</td>
<td>Sonatrach</td>
</tr>
<tr>
<td></td>
<td>Skikda (4 trains)</td>
<td>1972</td>
<td>7.6</td>
<td>Sonatrach</td>
</tr>
<tr>
<td></td>
<td>Bethoua (12 trains)</td>
<td>1978</td>
<td>16.5</td>
<td>Sonatrach</td>
</tr>
<tr>
<td>Egypt</td>
<td>Damletta (1 train)</td>
<td>2005</td>
<td>5.0</td>
<td>ENI</td>
</tr>
<tr>
<td></td>
<td>ELNG (2 trains)</td>
<td>2005</td>
<td>7.2</td>
<td>BG Group</td>
</tr>
<tr>
<td>Libya</td>
<td>Marsa El Brega (2 trains)</td>
<td>1971</td>
<td>3.2</td>
<td>Sirte Oil</td>
</tr>
<tr>
<td>Nigeria</td>
<td>NLNG (6 trains)</td>
<td>1999</td>
<td>22.2</td>
<td>NNPC</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>Punta Eur (1 train)</td>
<td>2007</td>
<td>3.7</td>
<td>Marathon</td>
</tr>
<tr>
<td>Angola</td>
<td>Angola LNG (1 train)</td>
<td>2012</td>
<td>5.2</td>
<td>Chevron</td>
</tr>
<tr>
<td>Planned/possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algeria</td>
<td>Arzew GL3Z</td>
<td>2013</td>
<td>4.7</td>
<td>Sonatrach</td>
</tr>
<tr>
<td>Algeria</td>
<td>Skikda LNG</td>
<td>2013</td>
<td>4.5</td>
<td>Sonatrach</td>
</tr>
<tr>
<td>Libya</td>
<td>Marsa El Brega T3</td>
<td>2016</td>
<td>2.6</td>
<td>Sirte Oil</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Progress FLNG</td>
<td>2017</td>
<td>1.5</td>
<td>NNPC</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Kribi LNG</td>
<td>2018</td>
<td>3.5</td>
<td>GDF Suez</td>
</tr>
<tr>
<td>Egypt</td>
<td>Damletta T2</td>
<td>2018</td>
<td>4.8</td>
<td>ENI</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>Punta Eur T2</td>
<td>2018</td>
<td>4.4</td>
<td>Marathon</td>
</tr>
<tr>
<td>Mozambique</td>
<td>Mozambique T1</td>
<td>2018</td>
<td>5.0</td>
<td>Anadarko</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Brass LNG T1</td>
<td>2018</td>
<td>5.0</td>
<td>NNPC</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Tanzania LNG T1</td>
<td>2018</td>
<td>6.6</td>
<td>BG Group</td>
</tr>
<tr>
<td>Mozambique</td>
<td>Mozambique T2</td>
<td>2019</td>
<td>5.0</td>
<td>Anadarko</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Brass LNG T2</td>
<td>2019</td>
<td>5.0</td>
<td>NNPC</td>
</tr>
<tr>
<td>Nigeria</td>
<td>NLNG T7</td>
<td>2019</td>
<td>5.0</td>
<td>NNPC</td>
</tr>
<tr>
<td>Nigeria</td>
<td>NLNG T8</td>
<td>2020</td>
<td>8.5</td>
<td>NNPC</td>
</tr>
<tr>
<td>Nigeria</td>
<td>OK LNG</td>
<td>2020</td>
<td>12.6</td>
<td>NNPC</td>
</tr>
<tr>
<td>Mozambique</td>
<td>Mamba</td>
<td>2020</td>
<td>10.0</td>
<td>ENI</td>
</tr>
</tbody>
</table>

*For existing projects, start date is for first train; for planned/possible projects, start dates are nominal and subject to delay/cancellation.

Source: EY compilations from various analyst/investment reports.

Summary conclusions: commercial opportunities in Africa’s Golden Age of Gas

Africa’s Golden Age of Gas will be more than just headline opportunities for the NOCs, the deep-pocketed oil and gas majors, their big international E&P counterparts and the well-known African oil and gas specialists. Opportunities will extend in most areas to the smaller, local E&P players as well, most often in partnerships with the larger, more-experienced players.

The ramp-up in E&P activity of course brings opportunity for the Oilfield Services (OFS) segment, but again, not necessarily just for the big international OFS players, but also for local and regional companies that can contribute to the supply chains and to the associated upstream support infrastructure build-out. The broader infrastructure build-out may also include massive export facilities, as in the case of LNG, but also smaller projects such as pipelines and gas distribution networks to support local/regional domestic gas demand. All of this build-out can bring substantial local/regional opportunities. And certainly the associated development or expansion of a domestic gas demand sector could bring substantial commercial opportunities in the power generation, industrial and even transportation sectors. Indeed, many of the gas flaring reduction efforts are tied to domestic gas use projects.

African governments and local/regional NGOs will of course have critical roles to play. Their first and foremost role will be developing a meaningful and practical master gas development plan, one that addresses the upstream tax and licensing models. Secondly will be the necessary infrastructure issues and investments, and local training and job creation issues. Collaboration and partnerships with the IOCs, big and small, will also be critical.
The potential Golden Age of Gas for Africa will clearly come with risks and challenges. The most important of these will include:

- A possible global economic recession, with resulting restrained energy demand growth and reduced energy investment; in particular, a significant slowdown in China, a crucial economic partner in much of Africa, could adversely impact trade flows, aid and investment flows

- Slippage on global commitment to “greener” energy; coal stays strong

- Increasing gas-on-gas competition from new supplies (conventional; unconventional; LNG; GTL)

- Societal acceptance of unconventional gas development, particularly as related to hydraulic fracturing and the potential environmental impacts on water (i.e., water supply, potential ground-water contamination and waste-water disposal) and/or the possible causal relationship to seismic activity (i.e., earthquakes)

- Capturing flared gas for export and/or domestic use

- Domestic gas demand growth; building local/regional gas distribution infrastructure; integrated local/regional economic and industrial development must be thoughtfully planned and coordinated

- Technological breakthrough for alternative/renewable energy – cost-competitive non-fossil fuels

- Political instability; failure to develop stable, fair fiscal/legal regimes and systems; corruption perceptions/business culture/ease of doing business

- Lack of existing gas production/supply infrastructure in some frontier regions – increased investment requirements

- Mega-project investment requirements may limit opportunities for smaller players; mega-projects also frequently subject to delays and cost over-runs

- Gas contracting pressures – need for long-term contracts to underpin massive investment in an LNG project, but increasing reluctance of buyers to do so – related pressures to move away from reliance on oil-indexed gas pricing

- Potential supply chain issues with local content requirements, especially in human capital terms

A country risk-rating system developed by IHS Global Insight examines the investment climate in specific countries, across six “risk dimensions” – the political, economic, legal, tax, operational and security environments are separately rated in each country – providing a comprehensive picture of the quality of conditions and level of stability encountered by investors in each country. The principal quality these ratings are measuring is stability. It is stability that businesses need most to make secure investments and to plan ahead. In addition to stability, however, businesses require adequate conditions in the first place; governments must ensure the right policies and safeguards are in place to allow businesses to operate effectively. A country with a high risk rating is one where businesses face continual threats to their operations, either from direct physical intervention or because of the poor underlying conditions and stability.

The risks of encountering instability or poor investment conditions span six factors:

- **Political risk** – an assessment of the overall framework of the country’s political situation – whether the institutions are stable and democratic, whether the government is able to pursue its policy program without continual political deadlock and whether the political life of the country is sufficiently settled and secure

- **Economic risk** – looks at conditions and stability at the macro level – whether the economy provides a secure market and base for investors, and whether the government’s policies are beneficial or harmful

- **Legislative risk** – assessments of the degree to which investors might encounter legal hindrances

- **Taxation risk** – assessments of the degree to which investors might encounter punitive and/or unpredictable taxation

- **Operations risk** – looks directly at the conditions on the ground for businesses, assessing the bureaucratic obstacles that businesses and their staff face in going about their work

- **Security risk** – also looks directly at the conditions on the ground for businesses, assessing the physical obstacles that businesses and their staff face in going about their work, whether these are poor infrastructure and/or the threat of terrorism
The combined or overall risk rating then weights these individual ratings: Political – 25%; Economic – 25%; Tax – 15%; Legal – 15%; Operational – 10%; and Safety – 10%. The risk rankings for key African countries are summarized in the adjacent sidebar table.

Overall, risk rankings for Africa are quite high, but in many countries the “risk trend” is improving. Most importantly though, the opportunities for Africa presented by the Golden Age of Gas are enormous and the challenges and risks can be addressed and mitigated, if not fully overcome.

Table 3. African risk dashboard
(countries with natural gas potential and/or production)

<table>
<thead>
<tr>
<th>Country</th>
<th>Current overall risk</th>
<th>Risk trend</th>
<th>Political risk</th>
<th>Economic risk</th>
<th>Legislative risk</th>
<th>Taxation risk</th>
<th>Operations risk</th>
<th>Security risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angola</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cameroon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congo (Brazzaville)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congo (Zaire)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gabon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ghana</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Libya</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mozambique</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Namibia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rwanda</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somalia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key
- Low risk
- Moderate risk
- High risk

Source: EY analysis from IHS Global Insight.
Our dedication to oil and gas

The technological, managerial and logistical challenges of the new energy frontiers are as significant as their potential. Companies and their partners will face a business and operational environment with increasing demands for adopting leading management, planning and control practices.

EY can assist in overcoming key logistical challenges, such as:

- Navigating and complying with a complex tax system
- Raising and managing capital
- Identifying, evaluating and completing a successful transaction
- Making the most effective use of working capital
- Assessing and managing human capital requirements

To address these challenges, EY has established a Global Oil & Gas Center, with more than 9,000 oil and gas professionals in over 100 countries. EY Africa has a presence in 33 countries and provides support in the remaining African continent. In addition, we can provide support from our London Africa Desk and Paris African Center. Our network throughout the region helps to ensure that we are responsive to the needs of our clients.

EY’s integration across Africa means our clients benefit from:

- Consistent quality standards everywhere
- Utilization of a “single point of contact” service
- The right EY resource irrespective of country location

We draw upon our global and local knowledge to help you retain the confidence of investors, manage your risk, strengthen your controls, grasp opportunities and achieve your potential.

We understand your business

Our oil and gas professionals are organized within four service lines: assurance, tax, transactions and advisory. Working in conjunction with local EY staff, they bring broad and deep oil and gas industry experience to the table, and offer extensive experience with the major industry players, including national oil companies. Our experience and service offerings particularly relevant to the oil and gas sector include:

- Assurance services:
  - Statutory audit
  - Internal audit
  - Sustainability audit
  - Fraud investigation and dispute services
- Tax services:
  - Domestic tax compliance
  - International tax/transfer pricing
  - Tax planning
  - Human capital
- Transaction services:
  - Transaction due diligence/support
  - Transaction tax
  - Capital transformation (including, valuation, restructuring, merger integration)
- Advisory services:
  - Risk advisory
  - Supply chain
  - Sustainability
Our presence in Africa
EY Africa contacts

Elias Pungong
Africa Oil & Gas Sector Leader
Regional Leader – Francophone Sub-Saharan Africa
T: +237 33 42 51 09
C: +237 75 24 31 72
E: elias.pungong@cm.ey.com

James Newlands
Regional Leader – Southern Africa Partner, Assurance
T: +27 21 443 0489
C: +27 83 286 3461
E: james.newlands@za.ey.com

Edem Andah
Regional Leader – West Africa
T: +234 146 304 7980
C: +234 708 768 1113
E: edem.andah@ng.ey.com

Geoffrey Byamugisha
Regional Leader – East Africa
T: +256 414 343 520
C: +256 75769 965
E: geoffrey.byamugisha@ug.ey.com

Laurent Miannay
North Africa Contact
T: +44 207 951 9718
C: +44 782 520 2051
E: lmiannay@uk.ey.com

James Deiotte
Partner, Tax
T: +27 11 772 3307
C: +27 71 355 9499
E: james.deiotte@za.ey.com

Norman Ndaba
Partner, Advisory
T: +27 11 772 3294
C: +27 82 335 0511
E: norman.ndaba@za.ey.com

Steve Alt
Partner, Transaction Advisory Services
T: +27 21 443 0413
C: +27 83 456 2411
E: stephen.alt@za.ey.com

How EY’s Global Oil & Gas Center can help your business
The oil and gas sector is constantly changing. Increasingly uncertain energy policies, geopolitical complexities, cost management and climate change all present significant challenges. EY’s Global Oil & Gas Center supports a global practice of over 9,000 oil and gas professionals with technical experience in providing assurance, tax, transaction and advisory services across the upstream, midstream, downstream and oilfield service sub-sectors. The Center works to anticipate market trends, execute the mobility of our global resources and articulate points of view on relevant key sector issues. With our deep sector focus, we can help your organization drive down costs and compete more effectively to achieve its potential.