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East Africa: The Next Game-Changer for the Global Gas Markets?

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Summary

The geographical distribution of African natural gas resources is going through a period of profound change as new gas discoveries in East Africa emerge to reshape the continent's energy landscape. This region is rapidly establishing itself as a world-class natural gas province and two countries have already emerged as key-players of this new African natural gas renaissance: Mozambique and Tanzania. This paper provides a comprehensive analysis of the gas developments in the region, which could well become the next game-changer of the global gas market.

Keywords: Natural Gas, East Africa, Energy Geopolitics, Hydrocarbons, Exploration and Production

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EAST AFRICA: THE NEXT GAME-CHANGER FOR THE GLOBAL GAS MARKETS?

By

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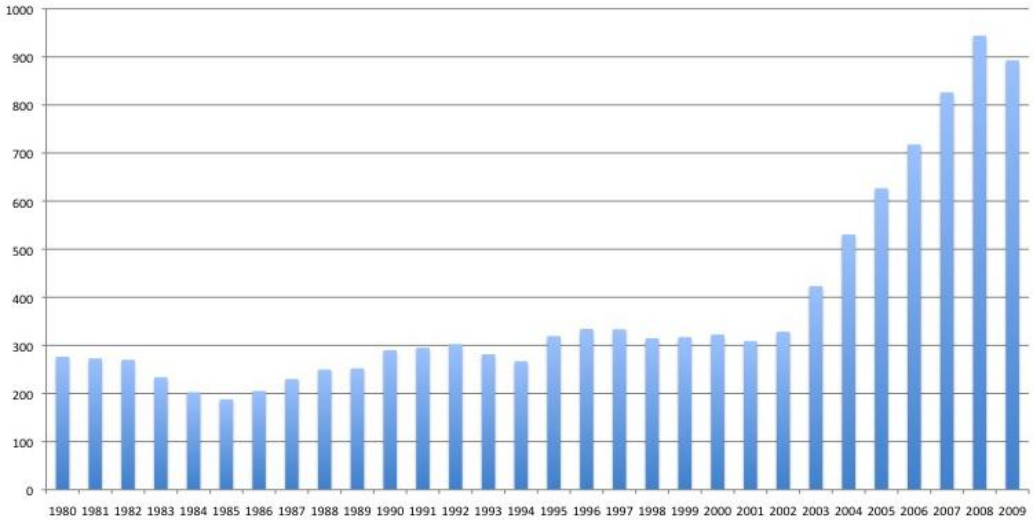
Introduction: lions on the move

Africa is currently placed among the most rapidly growing economic regions in the world. Despite the many challenges that still afflict the continent, African countries seem to face the dawn of a new era of development. After decades of inactivity, the economic engine of the continent seems to have started working properly. This figure is confirmed by the fact that between 2000 and 2010 Africa's real GDP has risen by an annual average growth rate of 5% (World Bank, 2011).

In particular, Sub-Saharan Africa continues to record strong economic growth. According to the IMF (2012) the regional output rose by 5% in 2011, helped by still-strong commodity prices, new resource exploitation, and the improved domestic conditions that have underpinned several years of solid trend growth in the region's low-income countries.

Sub-Saharan Africa: Real GDP between 1980 and 2009 (US$ billions)



Source: own elaboration on IMF World Economic Outlook

Africa's long-term economic prospects are strong and supported by endogenous factors, such as the improving political and macroeconomic conditions, and by exogenous factors, such as the global race for commodities. While the presence of minerals is quite widespread on the African continent, oil and gas resources have been traditionally considered more localized on its Western and Northern regions. This is particularly true for natural gas, since Nigeria, Algeria, Egypt and Libya together are considered to hold about 90% of the continent's reserves - Cedigaz (2011) and BP (2012)-.

However, this geographical distribution of African natural gas resources is going through a period of profound change over the present and the next decades as

new gas discoveries in East Africa emerge to reshape the continent's energy landscape. This region is rapidly establishing itself as a world-class natural gas province and two countries have already emerged as key-players of this new African natural gas renaissance: Mozambique and Tanzania.

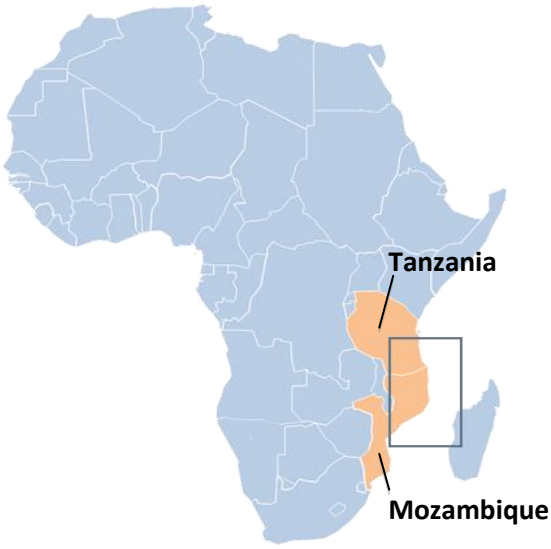
The purpose of this paper is to provide a first systematic and comprehensive analysis of the rapidly changing natural gas market in East Africa. Over the last two years, the issue of gas development in this region has entered into the energy-experts' debate, but a comprehensive study on the subject has not yet been carried out. Moreover, a very surprising element is that looking at the official statistics it seems that these countries could not yet find a place in the current world energy map.

Gas reserves in Mozambique and Tanzania according to various sources (2011/2012)

	Mozambique	Tanzania
Cedigaz - Natural Gas in the World	75 bcm	37 bcm
U.S. Energy Information Administration	140 bcm	n.a.

Starting from this peculiar situation and based on the limited data available, this paper therefore represents an attempt to bring to light the key aspects of what is generally described -perhaps really without knowing why- as the next game-changer of the world' gas market: East Africa.

The Rovuma Basin of Southern Tanzania and Northern Mozambique



General overview

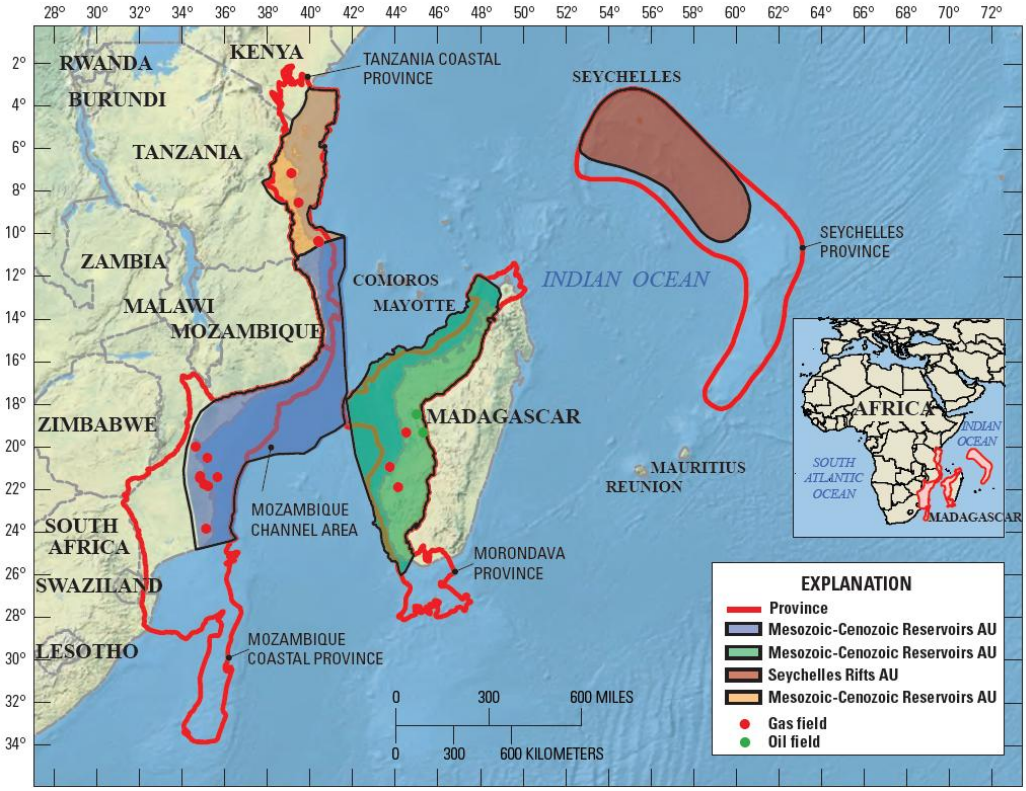
In April 2012 the U.S. Geological Survey (USGS) released the assessment of four East African geologic provinces carried out using a geology-based assessment methodology. An estimated 12300 bcm (mean estimate) of undiscovered, technically recoverable natural gas would be located in the area. The USGS further estimates these undiscovered gas resources at about 6600 bcm with a 95% probability and at 20200 bcm with a 5% probability of occurrence. The following table presents a breakdown of the USGS estimates by country.

Total undiscovered gas resources in East Africa

	95% probability	Mean estimate	5% probability
Mozambique	2 860 bcm	5 100 bcm	8 100 bcm
Tanzania	1 050 bcm	1 990 bcm	3 250 bcm
Madagascar	2 600 bcm	4 600 bcm	7 500 bcm
Seychelles	137 bcm	571 bcm	1 360 bcm
Overall region	6 600 bcm	12 300 bcm	20 200 bcm

Source: U.S. Geological Survey

Assessment of undiscovered oil and gas resource of four East Africa geologic provinces



Source: U.S. Geological Survey

Based on initial estimates up to date, international oil and gas companies have recently discovered 3400 - 4000 bcm of gas reserves in offshore Mozambique (a figure expected to grow up to 6000-7000 bcm in the very near future) and around 630 bcm in offshore Tanzania. If these figures are confirmed and given this huge bonanza, LNG projects are already rapidly advancing both in Mozambique and Tanzania, with a major target-market: Asia.

Gas discoveries in Mozambique

Key Operators	Fields	Reserves
Anadarko	Area 1	1400 - 2000 bcm
Eni	Area 4	2000 bcm
Total		**3400 - 4000 bcm**

Source: Energy Intelligence and companies' information

Gas discoveries in Tanzania

Key Operators	Fields	Reserves
BG - Ophir Energy	Blocks 1, 3 and 4	378 bcm
Statoil - Exxon	Block 2	252 bcm
Total		**630 bcm**

Source: Energy Intelligence and companies' information

Further up the coast, companies are getting interested in Kenya with US independent companies Apache and Anadarko, French company Total, and the British BG and Ophir Energy expected to start exploration drilling soon.

According the latest assessment of the USGS, there seems to be also a huge potential in Madagascar. But so far international oil and gas companies have shown little interest in that East African island.

Gas discoveries in Mozambique

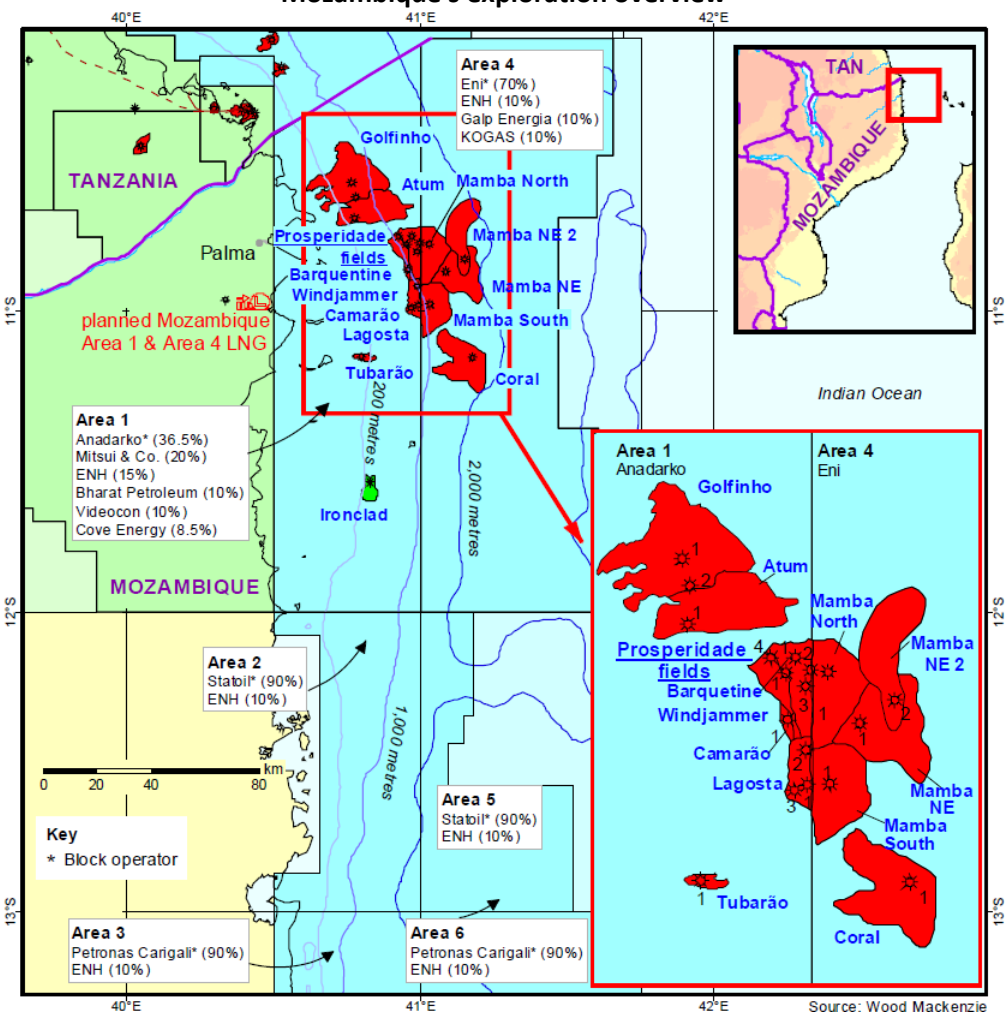
With an estimated amount of 3400 - 4000 bcm of recently discovered natural gas reserves, Mozambique is the major player of the new East African gas revolution. In fact, these gas reserves, if confirmed, are already above those of Algeria and are theoretically large enough to support an important gas development.

According to the USGS there are still some 5100 bcm to be found (mean estimate) and it estimates these additional reserves to be found still at 2860 bcm with a high probability (95%) of occurrence and 8100 bcm with a low probability (5%). It is not completely clear, if this potential is to be seen as additional to the recent finds or if there is some overlap.

Considering this unprecedented opportunity, Mozambique's government is speeding-up the drafting of a master plan for the gas sector. The plan will cover

the whole value chain, with the aim to maximize the economic and social benefits that the gas could bring to the country. Designed by the National Oil Institute, the plan will cover the various uses to which the gas can be put and it will also cover institutional reforms in the public and private sector, and the development of gas infrastructure.

Mozambique's exploration overview



Source: Wood Mackenzie

The Mozambique's offshore Rovuma Basin has been divided into four concession areas, operated by different international oil and gas companies and the country's national hydrocarbon company (Empresa Nacional de Hidrocarbonetos), which by law must have a stake in all fields.

Mozambique's offshore concession areas

	Area 1	Area 4	Area 2/5	Area 3/6
Operators	Anadarko Petroleum *(90%)* Empresa Nacional de Hidrocarbonetos *(10%)*	Eni *(50%)* CNPC *(20%)* Galp Energia *(10%)* KOGAS *(10%)* Empresa Nacional de Hidrocarbonetos *(10%)*	Statoil *(65%)* Tullow Oil *(25%)* Empresa Nacional de Hidrocarbonetos *(10%)*	Petronas *(54%)* Total *(36%)* Empresa Nacional de Hidrocarbonetos *(10%)*
License awarded	2010	2006	2006	2008
Gas discoveries	1400 - 2000 bcm	2000 bcm	Almost completely unexplored	Almost completely unexplored

Source: own elaboration

The two key-players in the country -Italy's Eni and the US independent Anadarko- have found several large gas fields in the deepwater Rovuma basin since 2010. Eni's finds include the giant Mamba North and South fields, with total gas in place estimated at around 2000 bcm. Anadarko's discoveries are estimated to hold up to 1400 - 2000 bcm.

In March 2013 Eni and China National Petroleum Corporation (CNPC) have signed an agreement for the sale of 28% of Eni East Africa's shares. With this operation China has acquired a 20% stake in Mozambique Area 4, stepping into the East African gas bonanza.

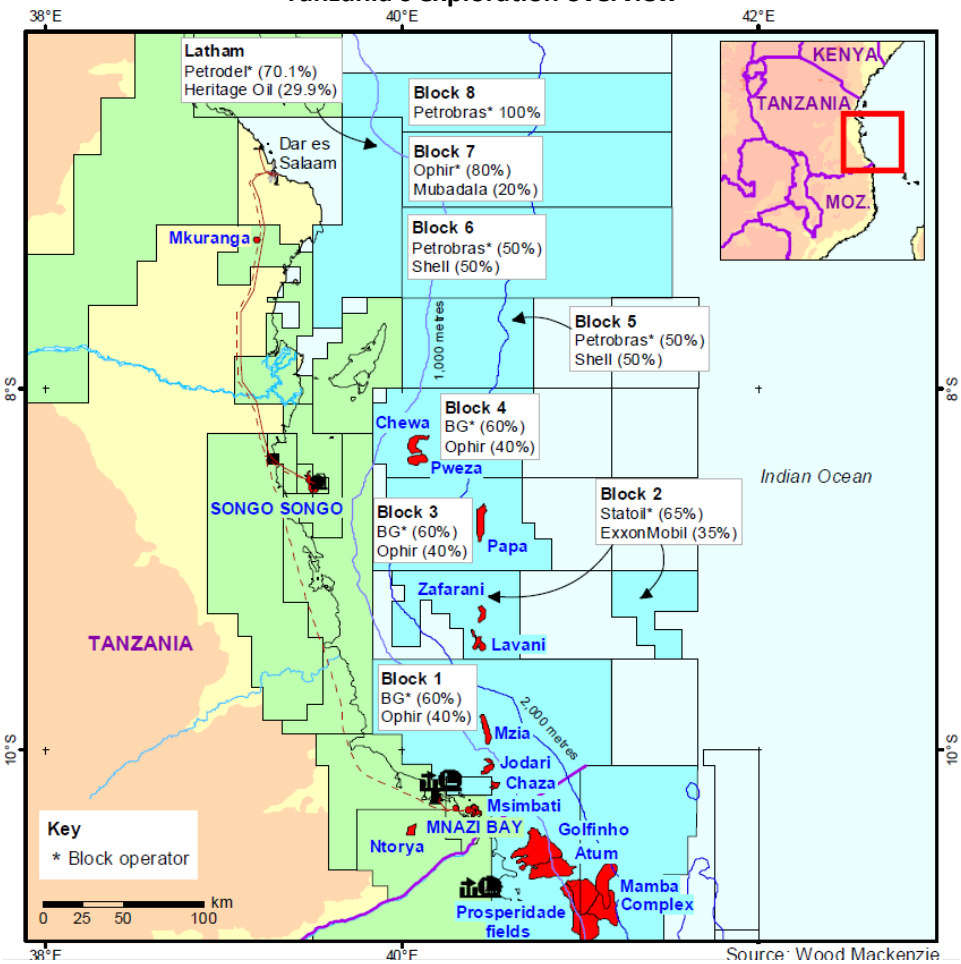
Mozambique will grant more natural gas concessions off its northern coast following the major discoveries just presented. Companies will start applying by the end of 2012, and the bidding will be effective from December until the middle of 2013. Exxon Mobil, Royal Dutch Shell, BP and Chevron had expressed an interest in bidding for potentially highly lucrative concessions to explore for gas off the country's Indian Ocean coast, while up to date no Chinese company has shown interest in this regional gas development.

Gas discoveries in Tanzania

The latest estimate of Tanzania's offshore gas reserves, by the international oil and gas companies active in the country, amounts to 630 bcm. According to the USGS there are still some 1990 bcm to be found (mean estimate) and USGS estimates this figure still at 1050 bcm with a 95% probability, though there might be some overlap with the very recent gas finds.

Deepwater exploration in Tanzania began in 2010 and the BG-Ophir partnership made the first discoveries. The partners made six gas discoveries on their Blocks 1, 3 and 4 discovering a total of 378 bcm of gas reserves. Statoil operates Block 2 on behalf of the Tanzania Petroleum Development Corp. and has a 65% stake in the field, with Exxon owning the remaining 35%. Statoil and Exxon have made two large gas discoveries in the area, discovering 252 bcm of gas reserves.

Tanzania's exploration overview



Source: Wood Mackenzie

Commercial frameworks to allow LNG exports have been agreed and the operators are evaluating options for such a development. However, it seems that more gas needs to be discovered to support a separate two-train onshore LNG development for both partnerships (BG-Ophir; Statoil-Exxon). Given that both partnerships do not currently have sufficient gas volume to justify individual projects, a joint LNG project could be an alternative development option. However, a decision is yet to be taken on a joint project and further drilling is planned by both the partnerships. In conclusion, it is possible to expect Tanzania's offshore exploration activity to increase over the next years. BG and Statoil's success has generated interest in the deep-water plays and other operators are expected to fast-track drilling campaigns.

The infrastructure challenge

The previous section showed that East Africa is rapidly becoming a world-class natural gas province, and that it has a real potential to become the next game-changer in the global gas market. However, the region will first need to develop the appropriate infrastructure to transport natural gas to final consumers. Considering the extremely low domestic gas demand and the distance from major regional markets such as South Africa, developing these gas resources will mainly depend on LNG exports, which would most likely target Asian markets due to the higher gas prices in this region.

- *Mozambique*

Since 2004 Mozambique exports about 2-3 bcm/y of natural gas to South Africa through a 865-km transport pipeline, which Sasol Petroleum International, the South African government, and the government of Mozambique own through a joint venture. The pipeline has a peak capacity of 5 bcm/y of natural gas and was part of a $1.2-billion natural gas project started in 2004. It is designed eventually to be able to transport double its current capacity. Today, this natural gas is extracted from minor fields (Pande and Temane) located in the Inhambane province, which are not expected to increase their gas production in the future (these fields are likely to continue to provide some 3 bcm/y of gas to feed the pipeline to South Africa up to 2020). For this reason, it is possible to expect that part of the new offshore gas reserves in offshore Mozambique could target the South African market in the future. In fact, this represents the only consistent export option in the Sub-Saharan region, considering that South Africa's gas consumption is set to increase from 5 bcm in 2011 to 10 bcm in 2020 and to 50 bcm in 2030.

However, it is estimated that the bulk of the newly discovered natural gas reserves in offshore Mozambique will feed some large-scale LNG projects. The

following table shows an estimate by Wood Mackenzie of Mozambique's gas production and demand evolution over the next two decades. Mozambique would thus reach a gas export potential of about 26 bcm in 2025 and 51 bcm in 2030.

Mozambique – Gas development scenario (bcm)

	2000	2005	2010	2015	2020	2025	2030
Gas production	0	2	3	3	4	30	60
Gas demand	0	0	0	0	1	4	9
Gas export	0	2	3	3	3	26	51

Source: Wood Mackenzie and own elaborations

LNG exports are already planned from the Area 1 block, operated by Anadarko, and the Area 4 block, operated by Eni. The projects operators target Asian markets for their future LNG exports.

Anadarko and Eni will work together to develop a single LNG facility for their huge gas discoveries in Mozambique. In fact, the two upstream operators announced in December 2012 that they will jointly plan and build an onshore liquefaction complex in Cabo Delgado province and coordinate their separate offshore development activities with the aim of shipping first LNG cargoes in 2018. This choice was mainly taken in order to save time and costs by enabling enhanced economies of scale through shared infrastructure and facilities.

The project as it is currently envisaged calls for the eventual development of a 50 million tons/year LNG complex with 10 trains. In the first phase, two trains with a combined capacity of 10 million tons/year will be built, with the initial 5 million tons/year coming on stream in 2018.

Eni is also considering other commercialization options for its natural gas. The main amount of reserves is likely to be produced through an onshore LNG facility, but a floating LNG solution for the non-unitized gas resource in Area 4 could also proceed in parallel with the development of the onshore LNG plant, being fed by gas from the resources straddling Areas 4 and 1.

Eni has also hinted that it would be open to potential joint ventures in this area. Shell, for example, would represent a potential partner, as it is the world's biggest shipper of LNG and it also has experience in developing floating LNG. However, Eni is also studying other possibilities such as the potential application of compressed natural gas (CNG) technologies to serve neighboring countries. Eni is finally evaluating to use some of the gas for domestic power generation, building a power plant jointly with the government of Mozambique. In any case,

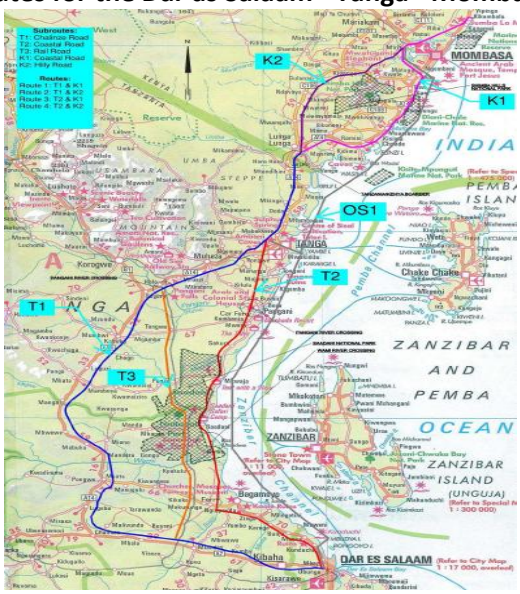
given the high level of gas reserves and the very low level of gas demand, such a domestic development would not represent a limit to the huge gas export potential.

- *Tanzania*

BG Group and Ophir estimate the level of discovered natural gas reserves for Block 1, 3 and 4 offshore Tanzania enough to justify volumes for a two-train LNG facility. The joint venture is now designing a floating LNG plant and has recently kicked off talks with Statoil to cooperate on this LNG project. For this reason, both companies ramp up their exploration campaigns, to prove up commercial volumes. Additional gas discoveries will be crucial to the economics of a Tanzania's LNG project.

In March 2009 the East African Community (EAC) Sectorial Council on Energy launched the process for a feasibility study for a natural gas pipeline connecting Dar es Salaam (Tanzania) to Tanga (Tanzania) and Mombasa (Kenya). The study, carried out by COWI and Runji&Partners was submitted in June 2011. The Dar es Salaam-Tanga-Mombasa pipeline project is designed to facilitate a supply of natural gas to Tanga and Mombasa from Tanzania (Songo Songo Island). These gas fields and the Mnazi Bay gas fields in southern Tanzania comprise proven gas reserves that exceed the expected domestic demand. The feasibility study -that comprises various demand scenarios and routing options- has shown that there is an attractive market for selling the gas at Mombasa and that a pipeline between Ubungo and Mombasa for transporting the gas is a financial and economic viable project.

Alternatives routes for the Dar as Salaam - Tanga - Mombasa Gas Pipeline



Source: COWI

The regulatory regime

- Mozambique

A relatively sound regulatory regime is in place in Mozambique since 2001. In fact, the country has pursued a trajectory of incremental regulatory change and adaptation with the helping hand of the IMF and the World Bank. Mozambique's basic regulatory framework is anchored in the 2001 Petroleum Law, which has been followed by supplementary laws and regulations (covering fiscal laws and tax incentives).

In 2012 the country has drafted a petroleum amendment law, which envisages no drastic changes to the hydrocarbons regime. It includes no changes to taxes or the participation of the Empresa Nacional de Hidrocarbonetos in oil and gas ventures. Changes do focus on infrastructure and the provision that 1% of gas extracted must be channelled to local communities near the production site.

New fiscal laws are being drafted in the country by the tax authorities and moderate tax increases may be implemented over the next couple of years.

- Tanzania

The petroleum exploration and development in Tanzania is governed by the Petroleum Act made in 1980. The upstream industry in the country is overseen by Tanzania Petroleum Development Corporation (TPDC). Its objectives include: to explore and produce petroleum; to carry out standard activities of an oil company including, distribution and storage facilities; to hold exploration and production rights; to contract, hold equity or participate in oil concessions, franchises and licenses.

The type of licence on offer in Tanzania takes the form of a production sharing agreement (PSA). Under these arrangements, TPDC is granted the licence under the Petroleum Act. TPDC then enters into PSAs with the oil companies. The terms of the PSAs form the basis of the licences and are negotiable.

The Model Production Sharing Agreement (2008) is the most recent PSA arrangement in Tanzania. The initial exploration period is valid for four years. Operators may renew this for another fours years and an additional phase of three years (total exploration period is typically 11 years). The development period is typically 25 years, but can be extended for an additional period of up to 20 years.

East Africa gas developments: what's next? Challenges and opportunities

East Africa has undeniably a huge gas export potential which is underpinned by the significant discoveries which have been made recently mainly in Mozambique but also in Tanzania. Both countries have still a considerable upside potential as exploration in these countries continues. Also Kenya and Madagascar, where exploration has not yet started, are expected to have an important potential.

Mozambique and Tanzania, after having confirmed the gas finds, will need to implement an appropriate regulatory framework for gas exploration, production, development and export. Such a progress is likely to take time, thus potentially slowing down the development plans of international investors.

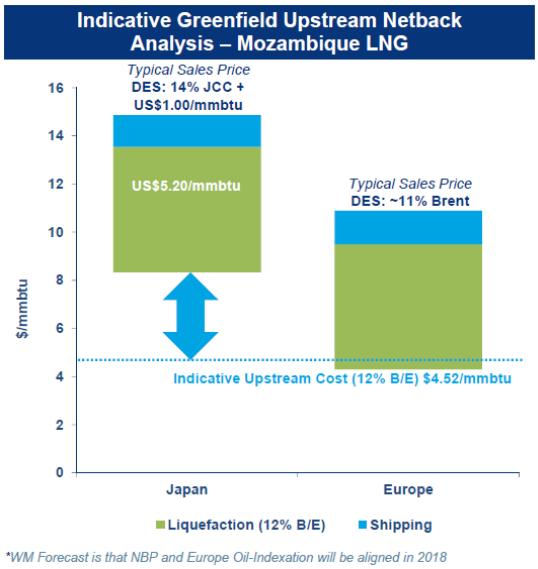
Other challenges to a fast natural gas development in East Africa relate to the lack of infrastructure and services in the region, as well as the country risk. In fact, both Mozambique and Tanzania lack infrastructure and local capacity to service potentially vast LNG projects, likely to cost from $12 billion-$20 billion. Doubts over financing, LNG pricing and markets could also temper fast-track ambitions, such as Anadarko's target of first LNG in 2018.

Up to date, the political situation in these countries seems to be stable. Both in Mozambique and Tanzania the ruling political parties are expected to dominate the political landscape up to 2017. The main risks to social and political stability in both countries are related to inflation and unemployment, which could lead to violent disorders. However, the Economist Intelligence Unit (2012) estimates an economic growth of 8% a year up to 2017 for both Mozambique and Tanzania. If this economic growth will materialize, it would be easier for these countries to ensure stability and a favorable investment environment. Otherwise it is possible to expect periods of high political instability.

Considering all these limits (regulatory framework, lack of infrastructure and services, country risk), it is possible to expect the development of natural gas in East Africa to take time and to be gradual.

East African gas has various commercialization possibilities. A part could be used for domestic power generation, a part for regional export (through compressed natural gas technologies and/or pipeline) and a part for export to far markets, such as Asia. In this case, East Africa will compete with other LNG project operators, such as Qatar and Australia, who are also targeting Asia-Pacific markets. In making their choices, Asian buyers will look at factors such as gas quality and political risks, while security of supply will be an absolute key, as will

economics. Many forecasts assume that there will be a relatively tight LNG market in the Asia-Pacific region up to the end of the present decade; with prices remaining high but easing off towards and after 2020, as more projects come on stream, including those in East Africa. Sales into Asia are expected to generate the most attractive netbacks.



Source: Wood Mackenzie

Conclusions: East Africa's gas export potential

East Africa has indeed the potential to become the next game-changer of the global gas market. Still largely unexplored, the recent offshore gas finds have demonstrated that the region could well represent a world-class natural gas province. As most developments are very recent and have happened mainly over the last two years, there is very little publicly available information available and therefore great uncertainty about the real export potential and its timeframe.

In the regional landscape, Mozambique has so far experienced by far the largest gas finds (3400 - 4000 bcm), followed by Tanzania (630 bcm). The Rovuma Basin in Mozambique is the most prolific and is currently the hottest conventional gas exploration region in the world. Several companies see also a potential in the deep-waters off Kenya, though exploration has not yet started. According to the USGS, Madagascar holds a potential similar to Mozambique, but so far the island has attracted little interest by the oil and gas companies.

The huge gas export potential of East Africa will, however, only fully materialize if the oil and gas companies operating in the region will be able to develop -also through a joint effort- the infrastructure necessary for such a development. The region's remoteness and lack of development presents serious technical

obstacles. Also, developing a large scale gas infrastructure and export projects will be possible only if local governments will be able to create a favourable investment climate by strengthening their governance and by creating a stable and reliable regulatory framework. The speed by which East African countries will be able to implement such a framework will determine how quickly the region will emerge as the next game-changer on the global gas scene.

As putting in place all the different elements needed to provide a favourable framework will take time and will not be easy, we expect LNG exports to start only early next decade and potentially reaching some 10-15 bcm by 2025 and some 25-30 bcm by 2030. All proposed LNG projects in the region target Asian markets due to their higher gas prices. According to the preliminary elements we have at our disposal, LNG delivery cost from East Africa to Asian markets is expected to be competitive compared to the new Australian and other new LNG projects targeting the same markets.

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