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Oil and gas business opportunities in East Africa - February 25, 2019, London

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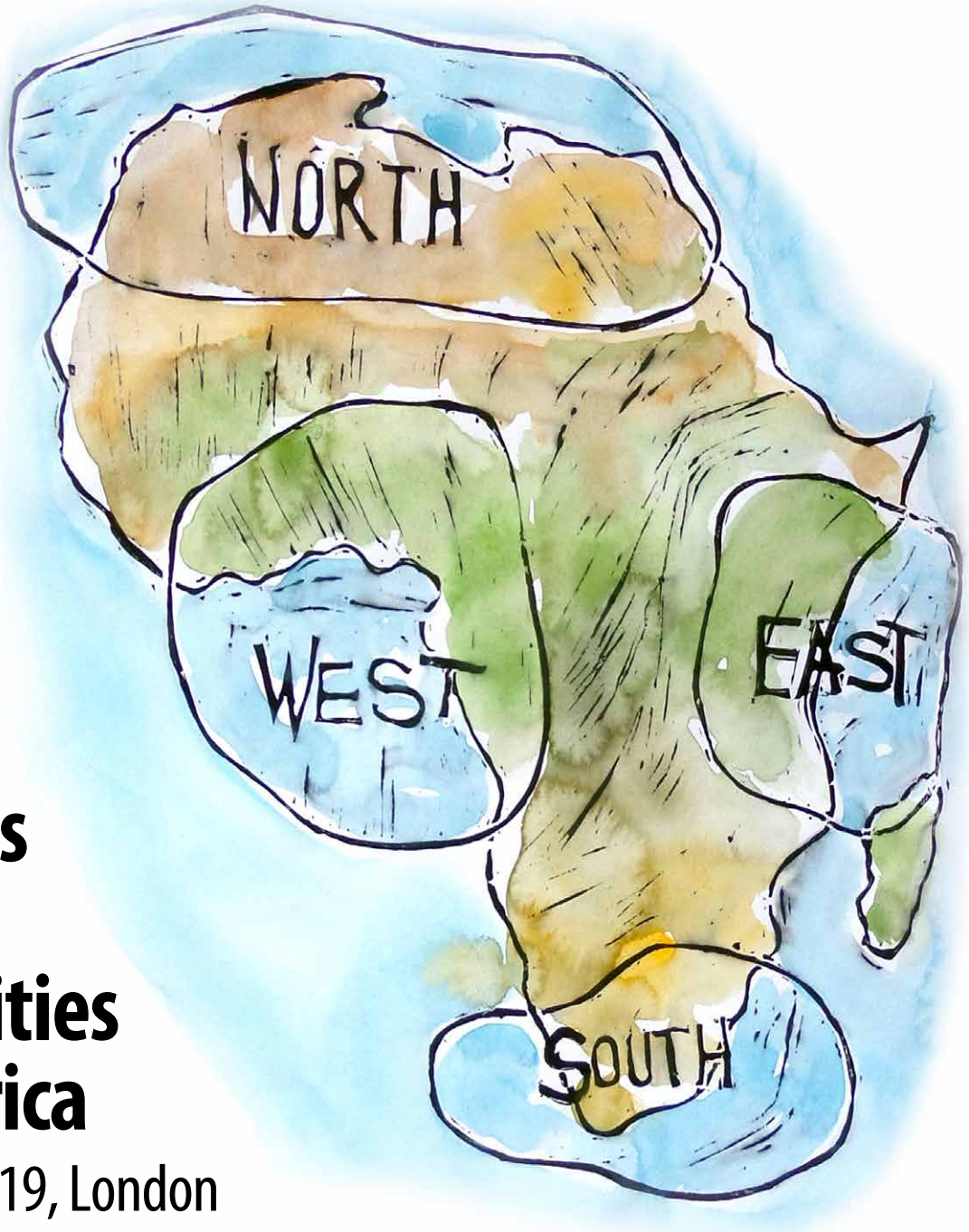

Special report

Oil and gas business opportunities in East Africa

February 25, 2019, London

Oil and gas business opportunities in East Africa

Finding Petroleum's Feb 25 London forum, "Finding Petroleum in East Africa", reviewed oil and gas business potential and opportunities in the region. There's a lot of money being invested, but how does it translate to business opportunities?

Finding Petroleum's Feb 25 London forum, "Finding Petroleum in East Africa" explored business opportunities in the oil and gas industry in East Africa.

Greg Coleman of oil and gas consultancy Petromall, a director of Virtual University of Uganda and former senior BP executive, introducing the event, said there could be $25bn invested in oil and gas developments in Western Uganda over the next 3-4 years, equivalent to one year's entire GDP (currently 26.4bn). Similar amounts in Tanzania and Kenya. But working out how to make a business is still very hard.

Greg Coleman of oil and gas consultancy Petromall

To give a rough summary of major oil and gas projects in the region - Total and CNOOC have projects in Uganda, Tullow is leading a consortium for oil developments in Kenya, there is an offshore LNG project in Tanzania, and there is an offshore LNG project in Mozambique. SASOL is very active in Southern Mozambique.

There have been several billion barrels of oil discovered in Uganda, offshore Mozambique and Kenya.

There is enthusiasm for gas, which can be used to develop power, and plenty of natural gas in Ethiopia, Kenya, Tanzania, and Mozambique. There is a big shortage of power in the continent.

"But as those of us in the industry know, developing natural gas is not as simple as developing a crude oil project," Mr Coleman said.

There are a number of licensing rounds, one recently in Madagascar (which has been delayed), and one announced for this year in Uganda.

Mr Coleman said he has personally visited Uganda 6 times in the past 18 months, in connection with his role as a director of the Virtual University of Uganda (VUU). "I find it has the most pleasant and friendly people, and is relatively secure," he said.

The big challenge is developing the resources, rather than finding it. It is very expensive and returns are uncertain. For example, Tullow and its partners have already spent $3.5bn appraising the Albertine Graben in Uganda, and still made no final investment decision.

In order to have a sustainable investment, it is essential to build local capacity and create jobs for local people. Some companies have pumped in "many billions of dollars" only to discover "the unions get going, the communities don't like what's happening to their land, environmentalists are unhappy about the way the development is being done," he said.

Big expenditure

The lack of infrastructure is a constraint on development. Across the African continent, pipelines and terminals are limited "pretty much" to Northern Africa – Egypt, Algeria and Libya. There are some in Western Africa, mainly Nigeria.

In Eastern Africa there is one pipeline that takes gas from Southern Tanzania to Dar es Salaam (the commercial capital of Tanzania). There's a gas development project in Southern Mozambique with gas piped to South Africa for power generation. But, "there's not much else."

The lack of infrastructure makes inland oil and gas projects a big company game, because only large companies have the capacity to invest money before the infrastructure has been built, he said.

For example Tullow has been very successful with exploration, but they are not large enough to have access to billions of dollars which are needed to develop fields in Uganda or Kenya, so they need to sell their discoveries to companies like Total and CNOOC.

This is a report from the the Oil and gas business opportunities in East Africa event - February 25, 2019, London

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It is in the interests of government to get the infrastructure built, so they can keep more companies active in the region, he said. For example Tullow also has activity in Guyana, across the other side of the Atlantic. "It's a very competitive world and East Africa needs to compete successfully, in cost and talent, in order to attract this foreign investment," he said.

The number of oil and gas projects happening in the region is tiny compared to the number of projects in the US and the North Sea. This indicates the enormous caution companies have in deploying money on projects in East Africa, he said.

There are infrastructure construction plans. Uganda is planning an oil pipeline to the port of Tanga on the Ethiopian coast. Tullow has a project to build a pipeline from its Northern Kenya development to Lamu.

Ethiopia is reported to be planning a major infrastructure development, with a 300,000 to 400,000 bopd refinery. But it is an interesting question where it will be located, considering that Ethiopia does not have a coastline for tanker shipments, and is receiving crude oil from international markets, by tanker, to distribute the refinery products for use in the continent, Mr Coleman said.

For LNG developments, Mozambique may have two LNG projects his year, one from Anadarko and the other from Exxon and ENI, he said. There could be more news coming from Tanzania. This compares to 8 projects in North America. Elsewhere in the world, the projects expected for FID in 2019 are in Mauritania / Senegal, Qatar, Russia and Papua New Guinea, he said, citing research by investment advisory firm Evercore.

LNG projects need to be competitive in a global market, and the unit cost of LNG in North America is currently about half the cost of most projects in other parts of the world, he said.

Expectations

Altogether, it could all add up to $200bn of investment commitment in the next 12-24 months in Eastern Africa. There may be a problem with so much money being invested, overwhelming local populations.

"The continent is just starting to equip itself to handle this mega investment phase which it is about to go through," he said. The population in East Africa "is still learning how to deal with us."

Managing expectations is critical. Consider the discovery Total announced in South Africa in early 2019. "The South Africans, and anybody who is on the periphery of their world, thinks this is going to completely change the South African economy next year," he said. "People are looking forward to gas displacing coal."

But there is just one well drilled so far in 1800m of water. "They've got probably several years before they are going to finish appraising and coming up with a development concept, never mind the billions of dollars it's going to take to bring it onstream," he said. Perhaps it would be fortunate if the gas came onstream before 2030.

And the number of people expected to be employed in Uganda oil and gas industry at the peak is 1,200 people. But very few of them are "in the professional ranks" – such as geologist, engineers, and business people, and there is a challenge to African countries as to how they will develop professionals. "If all you do is develop truck drivers and caterers it will be a pretty sad economy in 20 years," he said.

Hazardous waste

The oil and gas industry needs to develop facilities and competence for handling hazardous waste, including from drill cuttings and processing chemicals. It is critical that this is handled to the satisfaction of people who might be affected by it, Mr Coleman said.

"My own experience in Uganda is that the people that are working on hazardous waste management are still learning. They haven't got that much experience. The temptation is just to put it in landfill, but that's not sustainable in the long term", especially as the rate of drilling and length of the wells intensifies, he said.

People

"The key thing is to make sure the 'local content' [local capability] is being developed. That's one of the most important thing that Uganda and Kenya are doing. The worst thing [would be] to do it like we [US and European companies] did it in like Nigeria and Venezuela," he said.

"It requires [local] education," he said. "There's no reason British and American Universities aren't' present in East Africa working with [local] universities to develop staff. The online medium now makes it much easier to train people in a much more sophisticated way.

For international staff, security remains a big concern in East Africa. As an illustration, Anadarko recently purchased armoured personnel carriers to carry staff to the worksite due to attacks. "That's not a good sign of how a project might go," he said.

Tullow in Kenya

Tullow anticipates a final investment decision on its Kenyan project by the end of 2019, "a few billion dollars", Mr Coleman said.

One benefit of the project is that it is all within Kenya, so there are no other countries to worry about. Although it is close to the Somalian border, where there are potential terrorism problems.

With good partners in Total and Africa Oil, "I think the project is set up for success" he said.

Ugandan projects

In Uganda, there are projects being developed by Tullow Oil, Total and CNOOC, and some smaller projects.

A big issue is delays on confirming plans to build a pipeline to carry oil to the coast. No oil can be produced until the pipeline is available. Mr Coleman's personal opinion is that the June 2019 target date for final investment decision on the oil and gas developments and pipeline is "challenging"

"There's a lot of things that need to be done there. Not only host government agreements but the pipeline agreements, a lot of tendering for construction projects."

The delays could lead Total and Tullow Oil to transfer their attention to other parts of the world. The CEO of Total has stated in press interviews that he is proud how diligently the company is focussing on returns, not just investing on wherever it sees an opportunity. "They are selective in how they invest and deploy their money," he said. "I think they are one of the leaders in investing in Africa."

The pipeline is going to cost $3.5bn. A lending consortium has been put together, including the European Bank for Reconstruction and Development (EBRD) and the World Bank. But their conditions for lending are "extremely onerous", requiring environmental, social impact assessments, and management plans, community engagement, Mr Coleman said.

A further consideration is that part of the area being developed for oil is in Murchison Falls National Park, which might mean these institutions set an even higher environmental bar on their lending.

Ugandan government

The Uganda National Oil company is "taking the lead" on oil and gas development in the country, he said. "They are building capacity, which I think is a good thing. There's not that many people in the national oil companies. They are very reliant on transfer of technology and knowledge. They are going about it in a very structured and systematic way."

The government is developing a National Supplier Database in Uganda, which all oil and gas industry suppliers must be registered with. There are several hundred companies on it so far, and "probably several hundred more required," he said.

The next initiative will be a kind of register of talent, a database of the capability of people working in the industry. "I think that's also a good thing," he said. "It will allow companies to understand who is available and what training and development they need."

In terms of the regulatory regime, "Uganda has probably the most comprehensive regime in the area," he said. "The Norwegian government has a program of educating, and transferring their approach to [oil and gas] regulation." Although it has been offered to all East African countries, "I think the Ugandans so far are the only ones who've taken that onboard."

"It does mean things are going a lot slower than if they'd gone hell for leather and [planned to] worry about the regulations later."

Uganda announced in February 2019 that it would join the Extractive Industry Transparency Initiative (EITI), an international effort to make countries more transparent about the money they receive from oil and gas companies and how they spend it. "The more industry does that, the more likely it is that it will be able to attract investment," he said.

The EITI sets "a very challenging set of commitments. Every country that signs up, finds [them] difficult to adhere to," he said. "It becomes quite difficult to explain where the money came from and where it's going to." [But] "It's a very important step forward for the country. I hope they can influence the rest of the countries in Eastern Africa to do the same."

One strength of Uganda (and also Kenya) is that all of its oil and gas publications are in English language. Mozambique, formerly ruled by Portugal, publishes all of its oil and gas government information in Portuguese. "The language of our industry is mostly English, maybe a bit of French and Chinese. Portuguese is not a mainstream language. So if all their regulations are in Portuguese, you have that other challenge," he said.

Ugandan services

Ugandan companies struggle to get equipment and local services. For example, one operator, Armour Energy, is looking to do a "relatively small" seismic survey, and are finding it hard to find a geophysical crew to do the work, he said. "Another company with a license, Oranto Petroleum, is also finding hard to find local contractors," he said.

There are contractors from the Far East that would love to do that kind of work for reasons beyond the commercial attractiveness, just to have a presence in the country," he said.

There are some cross border difficulties, for example the Democratic Republic of Congo (DRC) has argued that some reserves being developed in Uganda are in their country, in that some of the wells from the Ugandan side go under the Lake Albert, and the border with DRC runs through the middle of the lake.

"I don't think they have a very strong case, but of course, the rule of law in some of these counties isn't as strong. Gunboat diplomacy is one of these issues to be worried about," he said.

Refinery and product

An oil refinery is planned to be built in Hoima, close to the oil production sites. It will be one of the first inland refineries in Africa. There are plans for storage terminals and pipelines for the refined product. The industrial plant will also include a petrochemical plant, warehousing, and staff housing.

There will be an international airport next to the refinery, providing a market for jet fuel. The airport is expected to carry mainly industrial traffic rather than tourists, which might mean a more predictable revenue stream, Mr Coleman said. The runway is already under construction, expected to be operational next year.

"Being a cautious engineer I wonder whether having an airport near a refinery is such a good thing," he said.

Virtual University of Uganda

Mr Coleman is a director and investor in the Virtual University of Uganda, based in Kampala. It offers Masters Programs in oil and gas management, and managing upstream companies. An Msc course, currently in the process of being accredited by Ugandan education authorities, will focus on training people in engineering and management disciplines. It serves the wider East Africa region, not just Uganda.

There is scope for people based in the US and Europe to be lecturers, because the teaching is done online, it does not require travel to Uganda.

Perspectives from Uganda's UK High Commissioner

Uganda's High Commissioner to the UK, Julius Peter Moto, gave his perspective on how the oil and gas industry is developing in Uganda and where the opportunities are

For the Ugandan oil and gas industry, there is a "beehive of activities that is taking place," said Uganda's High Commissioner to the UK, Julius Peter Moto.

There are two pipelines being built to take crude oil from Kingfisher and Tilenga oilfields to a refinery planned to be built in nearby Hoima, which will cost around $200m to construct.

The Albertine Graben Refinery Consortium is led by GE (US), Yaatra Ventures LLC (US), Intracontinent Asset Holdings (Mauritius), and Saipem SPA (Italy), together with 60 per cent holding. Total has 10 per cent, the Kenya government has 2.5 per cent, and Tanzania government has 8 per cent. The Uganda government, via Uganda Refinery Holding Ltd, has 19.5 per cent.

There is also a 1445km pipeline planned from Hoima to the port of Tanga, on the Tanzanian coast where there will be a terminal.

There is a lot of associated administrative work, including compensating farmers and settlers along the route, and doing environmental, social and impact assessment, and geotechnical / geophysical surveys, he said.

Most of the roads to the sites in the Albertine region are now tarmacked, and are known as the "oil roads".

An international airport is being built in Hoima next to the oil refinery, planned to be in operation mid next year. A new hospital is being built, and other infrastructure such as warehousing and a geothermal power plant.

The refinery is expected to trigger a new wave of industries working with its products, including petroleum, sulphur, asphalts, petrochemicals, lubricants, wax and kerosene. There will also be a power generation. "There's a lot of opportunities," he said.

The Ugandan government has established a school of petroleum in Hoima.

Uganda has been developing its oil and gas laws since 2000, with a Petroleum Act and a Petroleum Supply Act, with accompanying regulations and rules about production sharing and joint operating agreements. "Without the laws, government couldn't allow exploration, production of oil and gas," he said. "We want to prepare the ground fast before we start doing the exploitation," he said.

Uganda's High Commissioner to the UK, Julius Peter Moto

When asked why the Ugandan pipeline was routed via Tanzania not Kenya, he said that the decision was made by the East African community. The cost differences turned out to be very small, but it was more a political decision, and around land ownership. "I think it is easier for the pipeline to pass through Tanzania than elsewhere," he said.

Young people and local content

Uganda has a large young population - with 21 per cent of the 45m population aged 15 to 24. There is a local content bill in parliament, guiding how companies need to employ local people, and purchase from local suppliers, to help build the local industry, he said.

Uganda has government regulations saying that companies in Uganda can bring in foreign staff if local people are not available.

"Local people need jobs. They don't need to come to Europe, jobs can be created for them in Africa," he said.

For example, Tullow Oil, one of the first foreign direct investors in the region, has "trained hundreds if not thousands of Ugandans," he said.

Background to Uganda

Uganda is bordered by five countries, Kenya to the East, DRC in West, South Sudan in North, Tanzania in South and Rwanda in South West. It is a landlocked country. It was formerly a protectorate of the UK (not a colony).

Basins where oil and gas have been found include the Albertine Graben, Hoima Basin, Lake Kyoga Basin, Lake Wamala Basin, Kadam-Moroto Basin, and Lake Victoria Basin. Most of the prospects are in the Albertine Graben. There are 6.5bn barrels of oil in place (STOIIP) and 1.4bn barrels of recoverable reserves, he said.

Lake Victoria is the largest freshwater lake in the world. The White Nile passes through the graben between Lake Albert and the North, a 15m narrow straight.

Uganda formed the Uganda National Oil Company to manage its commercial interests. It has a regulatory authority, the Petroleum Authority of Uganda. It also has the Ministry of Energy and Mineral Development.

The first discoveries were made around 2000, and there was much increase in foreign direct investment from around 2005. There has been $3bn invested in the oil and gas sector in total up to the end of 2016.

There are "hundreds of wells" in the Albertine Graben, the biggest of which being the Kingfisher field. This is operated by CNOOC Uganda.

Invest in Africa – supporting business development

Invest in Africa is a non-governmental organisation (NGO) supporting the development of businesses and skills in Africa

"In oil and gas, one vital missing ingredient is people, "said Michael Amaning, business development manager of non-governmental organisation Invest in Africa. "People are messy, they have expectations and they have emotions. [But] When it comes to oil and gas they want to be involved."

So Invest in Africa looks at how to have a "people centred approach" to investment in oil and gas.

Invest in Africa is a non-profit organisation founded in 2012, originally working in Ghana, with a purpose of "creating prospering African economies". It has a target of creating a billion dollars worth of contracts and finance for African small and medium sized enterprises by 2027 – and also creating 100,000 jobs. So far 32,000 jobs have been created.

Michael Amaning, business development manager of non-governmental organisation Invest in Africa

The organisation employs 22 people, of which only 3 are in the UK, the rest in Africa.
It is looking at working in Uganda and Mauritania.

As well as oil and gas, it works with companies in construction, mining, telecoms and banks. It was initially founded by Tullow Oil.

One core idea is to have a "co-ordinated approach to local content [the requirements that foreign oil and gas companies work with local companies]", he said. "It is too difficult to do for any one company."

"Local content can be seen as a tax or a great opportunity," he said.

Connecting

One pathway is to help connect African smaller companies to market and business opportunities.
It also helps provide access to training, mentors, consultants and finance. "We try to create an ecosystem," he said.

For small and medium sized companies, getting access to big oil and gas companies seems quite daunting.

Big companies see that there can be cost advantages to getting the services they need from local companies rather than international ones. But they have a challenge finding "good, credible" SMEs to work with, so often ending up working with the same small group of companies. This creates a perception among others that it is something of a cabal, which other companies cannot enter.

Big companies also need to work with local companies to maintain their "social license to operate".

But smaller companies don't have the awareness of what it takes to compete in oil and gas, what requirements are to operate successfully, and have limited ability to scale up. They don't have the skills, the finance, the awareness of what it takes to compete in oil and gas "We try to be the bridge between both sides," he said.

The company provides a platform called "Africa Partner Pool", an online marketplace, which could be described as "LinkedIn meets Yellow Pages meets elements of Facebook," he said.

The company "validates" SMEs, including to check if they pay tax, and what their governance structure is. This can help "fast-track the conversation" as they aim to build business relationships in oil and gas.

Then it can help SME's "showcase" what they do, demonstrating their skills, education and accounts, "all the things that help showcase their credibility to the oil and gas sector."

On the other side, buyers can post all their tenders, such as for scaffolding, construction, power, IT and printing. "It saves a lot of time. SMEs have to look at a lot of newspapers," he said.

Invest In Africa also tries to give SMEs feedback on why they did or didn't win a contract, such as whether it was due to price, low technical standards, governance not transparent enough.

Then it can provide tailored training, at levels from the CEO down to the factory worker, on how to improve governance, financial accounting, and technical capability.

The result is that oil companies and big contractors get SMEs who are "able to deliver to time, quality, and scale," he said.

The process saves oil companies money, because they don't have to spend their own time doing due diligence on African companies, and they can demonstrate to governments that they are contributing to the country.

Capacity building

Invest in Africa had a "capacity building program" in Turkana, Northern Kenya, where Tullow's operations are, trying to help develop local business. It works together with Shell, Tullow Oil, the UK's Department for International Development (DFID) and the equivalent German agency GZID.

It provided a capacity building program for 30 SMEs in the construction sector, looking at marketing, governance, business skills, health and safety.

All of the services oil companies use can be graded as to how many years it takes to develop the necessary skills. For example some technical oil and gas skills can take 25-30 years to develop a company. But other skills, such as recruitment, can be more "entry level" skills.

Finance

One of the biggest challenges proved to be access to finance. Companies with no financial history struggle to get a bank loan to get started. Companies compete for investors' funds with treasury bills, which can get 28 per cent returns in some countries, and SMEs are seen as very risky.

Invest in Africa developed a credit guarantee scheme together with DFID, where the bank is guaranteed to get paid if the supplier is unable to. It also launched an app so people can apply for funding on their phone, with sums typically around $10k.

"We are looking for innovative ways SMEs can meet banking criteria and reduce risk with better data" he said.

So far Invest in Africa has connected businesses with about $1bn of finance.

Tanzania oil and gas – opportunities for partners and investors

The Tanzania Petroleum Development Corporation is looking for a 3D Seismic Acquisition Contractor, 3D seismic quality control and Drilling Management Consultant to acquire and monitor the drilling operations in several petroleum projects in Tanzania.

The Tanzania Petroleum Development Corporation is looking for a 3D Seismic Acquisition Contractor, 3D seismic quality control and Drilling Management Consultant to acquire and monitor the drilling operations in several petroleum projects, in a number of areas of Tanzania, said Lucas Mahushi Luhaga, geophysicist with Tanzania Petroleum Development Corporation (TPDC).

Exploration in Tanzania began in the 1950s, and since then there have been 49 dry wells, 25 discoveries, 16 appraisal wells and 4 development wells, he said.

The region is seen as having three categories of sedimentary basins 'regions', onshore /shallow offshore, and deepwater. About 56 per cent of the country coverage area is considered potential for hydrocarbons but only 30% of the basins have been explored, he said.

TPDC carries out its own hydrocarbon exploration in the country, and is focussing on three offshore areas, Mnazi Bay North, West Songo Songo, Block 4/1B and 4/1C, and one onshore area, Eyasi-Wembere, a frontier block.

For the Mnazi Bay North project, TPDC conducted 2D and a portion of 3D seismic surveys in this area, with data processed during 2019, leading to some prospects being identified. More 3D surveys are planned.

The block is offshore, in water depths of 1000m, east of the Chaza-1 gas field, south of the Jodari-1 gas field and North of the Mnazi Bay gas field. All of the fields are in the lower Miocene. There is a gas pipeline infrastructure close to the block.

TPDC is looking for a strategic partner to develop the projects together, he said. It is currently making plans for drilling, expecting to start in the end of 2019.

For the West Songo Songo project, an offshore block in water depths of 35m to 100m, some prospects have been identified based on 2D seismic. A tender has been advertised for a company to do a 3D survey, with data to qualify the geological studies and see if there are attractive geological formations in the area. Also to see if the faults in the area are safe for exploration.

TPDC will also be looking for a joint venture partner to do drilling together, sharing the cost of drilling.

The 4/1B and 4/1C project is in the deep offshore area close to the Mozambique border. To the south there is a huge gas field in Mozambique. It is close to the gas discovery in Tanzania's Block 1, operated by Shell/BG. The area has 2D seismic data, and interpretation shows some good geological structures in the area.

Lucas Mahushi Luhaga, geophysicist with Tanzania Petroleum Development Corporation (TPDC)

TPDC has decided to acquire 600km2 of 3D seismic data in the area, to do more qualitative interpretation, leading to drilling. It has posted a tender for a geophysical company to acquire the data, funded by government. By the end of 2020 it expects to be looking for a joint partner to drill in that area.

The Eyasi-Wembere Project is onshore, in Northern Tanzania, along the Eastern branch of the East Africa rift system. It is close to the planned pipeline from Uganda to Tanga in Tanzania. Analysis of the airborne gravity data suggests that sediment thickness ranges from 3 to 5km.

TDPC plans to drill stratigraphic boreholes to identify stratigraphic formations in the area. It is preparing to ask a geophysical company to survey for 2D data.

Investment

Tanzania wants to encourage international companies to invest in the region, because "first of all we have attractive geology," which is only 30 per cent explored. And in that 30 per cent, "more than 57 TCF of gas has been discovered," he said. There are "attractive fiscal terms", from the Tanzania 2015 Petroleum Act.

"TPDC, as the national oil company, has an open hand to work with any registered entity or company to carry on with petroleum exploration in the country," he said. TPC is looking for companies or consultants with recognised capacity, technical knowledge and financial capability, to form a joint operation with the national oil company.

CGG – finding and understanding Indian Ocean microcontinents

Geoscience company CGG is trying to better understand microcontinents (small fragments of continental plate) in the West Indian Ocean – because there could be sediment and oil reservoirs around them

Geoscience company CGG is trying to better understand oil prospectivity around microcontinents (small fragments of continental plate) in the West Indian Ocean.

The Seychelles and Comoros Islands are themselves micro continents, said Gregor Duval, senior technical manager, Multi-Client & New Ventures at CGG. But maybe there are more, buried under sediment.

The hydrocarbon source would have been originally deposited when the fragments were part of a larger continental plate, which was then broken up by plate tectonics.

In the Early Jurassic, the region was part of the mega continent of Gondwana, with Africa, Madagascar, India and Antarctic all stuck together. Rifting with drifting apart starting in the Turonian (Upper Cretaceous), a very complex splitting up of continents.

One way to look for them is to try to identify whether the crust – the layer of rock beneath any sediment or other deposits – is continental or oceanic.

CGG has looked at a very large area, covering the Comoros Islands, the Seychelles, out to Madagascar and Mauritius, and up to the Mozambique coast line.

It took information from a wide range of sources, including refraction and reflection seismic, and gravity and magnetics regional maps. There had been some onshore field studies.

There was data available from a number of research wells, under the Deep Sea Drilling Project (DSDP) and the Ocean Drilling Program (ODP), both international scientific ocean drilling programs. The research DSDP wells drilled through between 202 and 1174m thick layers of sediment, he said.

CGG proposes a more detailed study to understand where these pieces of continental crust may be located, where the plate boundaries are, and what the plate kinematics are. This could involve a new 2D seismic study. There could also be detailed studies of the Comoros Islands, involving broadband seismic, integrating wells, satellite imagery, gravity / magnetic data, with field work.

Seychelles model

The Seychelles study used data from three wells drilled on the west flank of the platform in 1981 by Amoco. They all show proof of a continental crust, with a sedimentary basin on top of it. Two of the wells proved the presence of source rock in the Jurassic. All three wells had hydrocarbon shows, with two having reservoirs in the Cretaceous. The drilling also revealed gas shows in the shallower part of the segment.

It provides proof of the petroleum system, he said.

The seismic data also revealed sedimentary rock, and rifted fault blocks from the Jurassic.

Another seismic line going a bit further to the middle of the Seychelles bank shows the extent of the sedimentary basin, with about 3km of sediment.

A 1995 seepage study did a geochemical analysis of tar balls collected on the beach. These could be tied back to Jurassic source rock in the area, he said.

Mascarene Ridge

CGG also did a study of the Mascarene Ridge, a submarine plateau in the Indian Ocean, north and east of Madagascar. This is "still an enigma", he said.

The modelling shows that when Madagascar plate is put together with India, there may be some fragments missing, and it could be on the Mascarene Ridge.

There were two wells drilled in the south of the plateau, Saya de Mala and Nazareth. They both ended up drilling into volcanic rocks. But there could be more sediments below, he said.

More detailed analysis, done in 2017, looked at the rifting of India and Madagascar. It showed a volcanic plume. As the plate moved, the plume moved south, pouring out volcanic rock. This could be the source of the volcanic rock found in the drilling, he said.

Amirante Ridge

Another area studied was the Amirante Ridge, on the west extension of the Seychelles bank, using data from some refraction seismic and gravity measurements published by Hammond et al in 2013.

The seismic showed the crust around the Amirante Ridge was up to 25km thick. If it was oceanic crust it would be 10km max, he said. So it must be continental crust. Also, only a "pretty thick continental crust" would fit the higher gravity reading for the region.

There could be a subduction zone (where two plates collide together and one pushes under the other – in this case an oceanic plate which subducts continental crust). But it would need better seismic to understand it, he said.

Mauritius

In Mauritius, a paper was published in 2013 about finding Zircons on the beach (a rock ubiquitous in the earth's crust), and dating them. It found some were up to 2bn years old, and others from 660 to 840 million years old, older than any oceanic crust.

These could have been sourced from deep in the earth, transported by magma onto a continental plate, and found their way to the beach from there. So this could be "proof that there's continental origin to Mauritius," he said.

Comoros

On the Comoros islands, some big sandstone xenoliths have been found. These are foreign rocks which become enveloped in a larger rock. Some were kilometres by several hundred metres in size. They could have been transported by magma to the surface, he said.

There is continental crust very close by, and zircons found in the area dated to 533 mya. There have been tar balls in the area traced to Jurassic source rock.

There is some interesting seismic data, of the region showing fault blocks.

Madagascar

The Davie Fracture zone, formed from the movement of Madagascar away from Africa, just runs south from Madagascar, but does not extend any further north. So there could be a continental plateau to the North extending to the Comoros Islands (North West of Madagascar), he said.

Spectrum – Somalia and Mozambique license opportunities

Neil Hodgson of Spectrum presented an overview of opportunities for explorers linked to the upcoming license rounds in Somalia and Mozambique

Neil Hodgson, executive VP geoscience with seismic company Spectrum, presented an overview of opportunities to explorers based around the upcoming license rounds in Somalia and Mozambique.

For an explorer, East Africa is "such an exciting area," he said. "You get to see seismic over these areas where no-one knows what's going on. You get to tackle these problems before everyone else," he said.

Mr Hodgson had planned to include Madagascar in his talk but said its licence round "appears indefinitely suspended as of last week." South Africa is also interesting for explorers but does not have the same kind of licensing system.

An area of particular interest is the so-called "Joint Management Area (JMA) between Mauritius and the Seychelles. The Mascarene Plateau, North and East of Madagascar, in the same area, is "a perfect basin – a little micro-continent sitting underneath some basalts related to the Réunion plume, and associated with oil slicks you can see on satellite data," he said.

Somalia

Somalia launched its license round with an event in London on February 7 2019, with bids due on Nov 7 2019, so providing plenty of time to evaluate the acreage. It does not cover any blocks in land disputed by Kenya.

All the blocks are coastal, running from what is called the Obbia Basin in the North, the Coriole Basin in the central area, and the Juba Lamu Basin in the South. Mr Hodgson looked at each of them in turn.

Each basin has a different kind of crust, so they need to be looked at as separate petroleum systems. But temperature modelling shows that the source rocks cannot fit into the gas window, so they are all a search for oil.

Spectrum put a study together as part of Somalia's promotion of the region. This included an integration of all the leads which can be seen on seismic data. The seismic was acquired by Spectrum in 2015, and Soma Gas & Oil in 2014.

In terms of piracy, Mr Hodgson said that the company has "acquired 2D data offshore Somalia without even a single questionable incident of security from pirates." And consider that a seismic boat is travelling really slowly, he said.

"If you compare with offshore Nigeria [for piracy] it is looking at lot better for Somalia," he said. "Can you operate a drilling unit out there? I imagine that you can."

Obbia Basin

Starting with the Obbia Basin, looking at a seismic line running West to East offshore the shelf, you can see firstly a relatively narrow shelf, he said. There is one well drilled which tells you what the stratigraphy is, showing some Jurassic carbonates.

Going deeper, there is a synrift section (formed by deposition and rifting at the same time), then a thick continental section which thins dramatically going to the East. It thins so much you have exhumed (exposed) mantle which would have been on the seabed at the time of the rifting. This sort of "hyper extended continental crust" is also seen offshore Portugal, he said.

Coriole area

Looking at the Coriole area, you can see late Jurassic / early Cretaceous carbonate buildups, sitting on top of a synrift section, which will have source rock in it. That sits on the "Karoo", a name for an extensive sequence of sedimentary and igneous rock in Southern Africa, formed 180 to 310mya.

There are two plays, one charging the carbonate buildups with source rock just below, and also the source rock charging the tilted fault blocks in the Karoo, which is largely clastics (broken pieces of older rock), he said.

Technology to try to detect source rocks from seismic has been much improved in recent years. Seismic technology has been around for 70 years, but was mainly used to look for structures, and reservoir spaces, and fluids in those reservoirs. But recently effort has gone into understanding the seismic response of source rock, and it has proven not too difficult to do, particularly looking at the amplitude vs offset response.

"We've done this offshore Somalia in the Obbia basin and found a really strong candidate for a source rock," he said. "We think this is really low risk, and low risk for oil."

In the Coriole Basin, the structural style has changes, with lots of compression antiforms (sedimentary layers in a convex formation). They are "caused, I think, by the moving of India as it separates from Madagascar and moves up to Asia," he said. "These are enormous, some of the biggest structures that we've seen anywhere."

Juba Lamu

In the Juba Lamu North, you can see the decollement surface (where one rock layer slides over another one beneath it) in the early tertiary, then carbonate buildups sitting above an early cretaceous source rock.

The prospect which would probably be drilled first is a coastal series of anticlines, running all the way along the coast. "They create beautiful traps, four way dip closed," he said. The hydrocarbons would come out of the source rock and get trapped in them.

The antiforms can also provide traps.

In the South Juba Lamu, you can see one gravity slide (movement of rock due to gravity) which is the same age, and a cretaceous gravity slide, associated with all sorts of direct hydrocarbon indicators sitting above the source rock.

"So on the seismic data, lots of excitement, lots of potential, predominantly oil prone," he said.

The source rocks are not deep enough to make a gas play, for most of Somalia.

Looking at satellite images, you see oil slicks along the coast of Somalia where they would be expected. The slicks are repeated, suggesting that they are not from ships, but from a working oil system.

Mozambique

In Mozambique, specific plans for a license round have not been officially announced, just a stated intent, he said. Blocks are anticipated to be available in the Zambezi Delta and the Angoche Basin.

Eni and Exxon were awarded blocks in the Angoche Basin in Mozambique's 5th License

Round in 2017. In 2017-18, Spectrum acquired 2D seismic data in the region, along with WesternGeco.

Nobody is looking for gas in Mozambique, just oil. Around 200 TCF of gas has already been discovered in the Rovuma Delta to the north, (on the border with Mozambique and Tanzania). "You don't want to behind 200 TCF of gas looking for a market," he said.

Mr Hodgson showed a seismic line from Mozambique out to Madagascar, running across the Davie Ridge.

On the Mozambique side there is oceanic crust, covered with a thick sequence of sediment. But across the Davie Ridge there is continental crust, and the "hyper extended margins of Madagascar", he said. "How far the hyper extended crust goes to the North is a matter of debate," he said. "[That's why we need more seismic there."

"As you go to north, I imagine fragments of continental crust have broken up, and lying under the Comoros and other sites," he said. "These continental fragments are always associated with oil slicks. If you can get them big enough to generate oil, there will be traps, and oil to be found in future.

"Under the Mascarene Plateau there is, for sure, [a trap] big enough to generate big fields."

Mr Hodgson showed some 2017 de-ghosted broadband seismic data, designed for looking at the sedimentology. "When you look at this at first there's not a lot of structure," he said. "[But] if you're looking for traps you have to understand the sedimentology of deposition of that unit. That is key to understanding the areas."

There are trap structures in it, which can be as big as 500km2 in area. "You probably need good quality data to try to pick them out," he said. Other plays are stratigraphic, which are "always more difficult."

By comparing seismic reflection amplitudes, it is possible to differentiate silt / mud with sandstone, and so map out the structures, and see where there could be a reservoir, structure and trap. The question is where the source rocks are.

Mr Hodgson showed some structures 400 – 500km2 in size, just South and West of blocks acquired by Eni / Exxon, in the Angoche Basin, which is tight with the Davie Fracture Zone. There are sands coming down slop and turbidites onlapping against the Davie Ridge, with compressional structures. So there's a reservoir, structure and trap. The question is whether there are source rocks.

In a plate reconstruction, there is evidence for source rock from the late Jurassic / early Cretaceous. But the source rock may have been overcooked, leading to gas rather than oil.

The critical number is the geothermal gradient, how much temperature rises with depth. In the Rovuma Delta, offshore Mozambique, the gradient is 41-46 degrees C per kilometre, whereas normal continental crust is 30-35. This means that at 5km depth, the temperature will be 250 degrees C, too hot for oil.

In the Zambezi Basin, the gradient is 20 to 21 degrees C, so a source rock at 5km is only 100 degrees C, so in the oil window.

Midway between the two, where the Davie Fracture Zone starts, is a "Goldilocks Zone," or not too cold and not too hot, with source rocks from early Cretaceous / late Jurassic, still in the oil zone.

"You have to ask, why did ENI and Exxon pick up these blocks. I think they did it to find oil, not gas," he said.

There are oil slicks all along the coastal margin, "turning up exactly where you'd expect them to turn up," he said.

The onshore oil slicks had been known about for many years, and match the location of the Angoche basin. People were probably "waiting for quality seismic data – to really understand what the geology was telling us," he said.

Spectrum understands that Mozambique plans to make the area available to explorers in its next license round in the second half of 2019, he said.

Finding Petroleum

CGG – prospectivity analysis of offshore Mozambique

CGG has done a detailed hydrocarbon prospectivity analysis of the Zambezi Basin, offshore Mozambique, gathering together seismic, well data, gravmag and satellite imagery

CGG has done a detailed hydrocarbon prospectivity analysis of the Zambezi Basin, 70km offshore Mozambique, gathering together seismic, well data, gravity / magnetics and satellite imagery.

The Zambezi Basin faces the mouth of the River Zambezi, the 4th longest river in Africa, flowing into the Indian Ocean in Mozambique. The seismic survey targets the area where the sediment is thickest, on the westernmost part of the Beira High, a geological feature of crustal fabric.

The total area of the survey is 15,400km2. It covers two commercial blocks.

CGG has done an integrated geological study of the region, starting with Pre Stack Time Migration (PSTM) seismic, adding in well data, carefully calibrated and analysed, then adding any other available survey and research data. It also used gravity and magnetic data, and developed attribute maps and filter maps from it. Satellite imagery is used to gather data about slicks and see if they are persistent.

The ultimate aim was to look for prospects at the scale of individual reservoirs, said Javier Martin, senior geoscientist with the Multi-Client and New Ventures division of CGG.

The study took input from specialists in many domains, including biostratigraphers, sedimentologists and petroleum system modellers, many of which were working for Robertson, part of CGG's Geoscience Division which provides specialist geological services.

The data was used to understand distribution of key sediments of the basin – in regional terms and within specific areas.

An important part of the work was trying to characterise the Beira High, and work out whether the origin of the crust is oceanic, continental or transitional basement.

There are a number of wells already in the Zambezi Basin, mainly on the continental shelf, with some next to the survey area. Some of the wells showed gas or oil, indicating a proven petroleum system in the early to late Cretaceous, Mr Martin said.

Field development so far has been limited to onshore or just offshore, on the continental shelf.

Seismic survey

The seismic survey was completed in May 2018, with 8.5km long streamers with 100m separation, recording with a 25m x 25m bin size. It made 11 second recordings with a 4ms sample rate. The aim was to reach all the way to the oceanic basement.

Shooting seismic was complicated because of the oceanic currents, up to 3.5 knots. The streamers were set up in a slightly different way depending on the current, he said.

The tertiary section (ERA) will be characterised using the PSTM seismic, which will be available in the third or fourth quarter of 2019.

Analysis

The well data was analysed by stratigraphers and sedimentologists and cross-correlated with the seismic.

The first step was to make a picture of the basic formation and ages of the different layers. The next step is to work out where the sediments are. There were 2 or 3 wells adjacent to the survey which were helpful here.

Petrophysical analysis was performed to try to understand the porosity and permeability of the formations, from integrating wells with seismic. Calculations can be made to work out water saturations, how much sand could eventually work as a reservoir.

A "proto Zambezi" river can be seen in the Cretaceous. The Beira High, which would have been present in the Cretaceous, could act as a barrier for the sediment flowing out with the river, he said.

The satellite imagery work is still ongoing, analysing slicks and seeps data. It is possible to differentiate seeps from vessel pollution with a high degree of confidence. Then the seepages could be correlated with the seismic to see if they relate to any structure in the seismic. The seepages were ranked in several grades.

There is sophisticated attribute analysis, including gravity and magnetic data.
The research work has looked at anomalies, when data shows something different to what would be expected.

JumpStart

CGG has developed what it calls "JumpStart" projects along similar lines in many parts of the world, including Brazil, Mexico, Norway, Gabon, Mozambique, Banda Arc (between Australia and Indonesia), and NW Shelf of Australia. These projects integrate a wide range of geoscience data with new seismic acquisition to provide a better understanding of these basins.

Over the last few years, the oil and gas industry has been increasingly demanding seismic surveys of more complex environments – very deep / ultra-deep structural traps, or stratigraphic traps defined at the limit of seismic resolution or below. "In CGG we feel very comfortable in this environment," he said.

The company has decided not to outsource any of the technical work, because it believes that it increases the risk by doing that, or can lose track of how the data is being treated and calibrated.

Finding Petroleum

Note – the talk included description of different geological features of the region, which are probably best seen by watching the online video.**http://www.findingpetroleum.com/event/79d7d.aspx**

What did you enjoy most about the event?

Excellent presentation by Spectrum and interesting overviews on Uganda.
Richard Walker
(Cornhill Economics)

Current material for oilcos (e.g. the new CGG Zambezi 3D survey), for companies supporting the industry and for anyone who needs to be aware of what is happening in the industry (e.g. US costs 50% of those in Africa).
Nick Cameron

Networking, and keeping abreast of current thinking.
Mike Rego

Strong and interesting technical talks in the second half

information on basins

Finance talk by Invest in Africa

The insights given by the presenters

Breadth of coverage

High quality content of presentations

It's a relatively low cost opportunity to 'network' in the industry

Oil and gas business opportunities in East Africa February 25, 2019, London, Attendees

Hugh Ebbutt, Director, A T Kearney

Geoffrey Boyd, Field Development Consultant, Antium FRONTFIELD

Paul Mullarkey, Managing Director, Auriga Energy

David Sendra, Associate Consultant, BlackRockQI

Jeff Weston, Business Development / QC Manager, Bridgeporth Ltd

Nick Pillar, Manager of Geophysics, Canadian Overseas Petroleum Ltd

Katherine Jelpke, CGG

Andrew Webb, Manager, Petroleum Reservoir and Economics, CGG

Javier Martin, Senior Geoscientist, CGG

Luke Davey, Business Development Manager, CGG

Matthew Tiffany, Sales Manager, CGG

Grégor Duval, Technical Manager Geosciences, CGG - Multi-Client & New Ventures

Leila Evans, Offshore Image Interpreter, CGG - NPA Satellite Mapping

Micky Allen, Consultant

Richard Walker, Consultant Geophysicist, Cornhill Economics Ltd

Graham Clevett, Managing Director, Cornhill Economics Ltd

Ian Newth, Director, Count Geophysics

Paul Bailey, Director, Devonport Capital

Stephen Norman, Business Development Manager, DNV GL

Emma Woodward, Regional Manager, West Africa, DrillingInfo

George Matharu, CEO, Elite Capital

Ruairi McDonald, Geoscientist, ENI

Henry Lang, Director UK and Africa, Ensure Environmental Consulting Ltd

Martin Riddle, Technical Manager, Envoi

Mark Lonergan, Senior Business Development Manager, EPI Group

Jorgen Keyser, Equinor

Richard McIntyre, Sales Manager, Finding Petroleum

Avinga Pallangyo, Events Manager, Finding Petroleum

Karl Jeffery, Editor, Finding Petroleum

Jeremy Berry, BD Director, GCA

Nick Cameron, Geological Advisor, GeoInsight Limited

Bryan Moseley, Geologist

Sian Grant, Business Development Manager, Geoprovider

Toya Latham, Analyst, GlobalData

Neil Simons, Independent Consultant

Manouchehr Takin, Independent Consultant

Michael Amaning, Senior Account Manager, Invest in Africa

Turlough Cooling, Head of Subsurface, io Oil & Gas Consulting

Peter Allen, Consultant, Layla Resources

Colin Clarke, Geophysicist, Lloyd's Register

Rupert Simcox, Data Analyst, Lynx Information Systems

David Peel, EVP Exploration, New Age

Jonathan Ffrench, Geophysicist, Noble Energy

Rowan Edwards, Structural Geologist, NPA Satellite Mapping

Abi Mirkhani, COO, OPG Supply

Greg Coleman, CEO, Petromall

Mike Rego, Independent Consultant, PetroMall Ltd

Matthew Pyett, Project Geoscientist, New Ventures - Africa, Mediterranean & Middle East, PGS

John Clure, Managing Director, Phoenix Hydrocarbon Resources Ltd

Daniel Buckingham, International Finance Broker., Pronto Business Funding

Robert Snashall, Consultant, RGSConsult

Patrick Taylor, Director, RISC (UK) Limited

Mike Larsen, Business Development Director, EAME, RPS Energy

Terry Devine, Asset Development Manager, Schlumberger

Joe Brooks, Project Officer, ShareAction

David Owen, Shell

Neil Hodgson, EVP Mediterranean and Middle East Region, Spectrum Geo Ltd

Lucas Mahushi Luhaga, Geophysicist, Tanzania Petroleum Development Corporation (TPDC)

Tim Goodwin, New Ventures Consultant, TJGX Ltd/CNOOC

H E Julius Peter Moto, High Commissioner, Uganda High Commission in London

Iain Esau, Upstream

Magnus Amajirionwu, DVC - Academic Affairs, Virtual University of Uganda

Chris Holmes, BDM, Weatherford

Lola Odunsi, Sales Engineer, WesternGeco

Chris Phillips, Regional Studies Manager, Wood plc

Andrew O'Connell, Senior Geologist, Xodus Group


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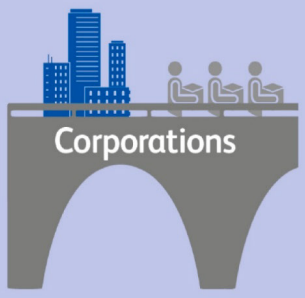
Tackling the Local Content Gap

The Challenge

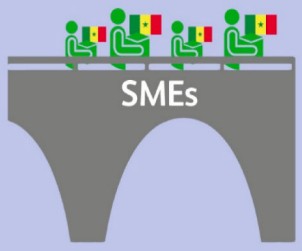
Corporations are under pressure to:

- ✗ Save time and money
- ✗ Create jobs
- ✗ Get social license to operate



Challenge (the gap)

But where / how can you start to tackle this shared challenge?



SMEs lack:

- ✗ Skills, finance, and awareness of how to compete;
- ✗ Reliable, fair and transparent business opportunities;
- ✗ Ability to scale up

The Solution

- ✓ Coordinated industry led initiative to deliver private sector local content needs
- ✓ Fulfils government expectations
- ✓ Corporations are able to leave a sustainable, impactful and scalable legacy

Partners

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