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Covering Oil, Gas and Hydrocarbon Processing

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Mwendia Nyaga, head of Oil and Energy Services Ltd in Kenya.

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Your Local Content Vehicle into the Nigerian Oil & Gas Industry

Contents

The Deepsea Metro has been drilling offshore Tanzania.

Editor's note

Falling oil prices are disastrous news for Africa which was recently celebrating an "oil boom" around the continent. Ugandan officials say they fear lower oil prices could deter companies from following through on plans to invest up to US$15bn to develop the country's oil fields. The same applies to Mozambique, which saw a US$5bn investment to develop natural-gas fields that look a lot less attractive now.

However, no one is predicting an end to African oil exploration. Big oil groups still plan to spend billions of dollars on the continent over the next decade developing recently discovered reserves. Moreover, companies have already hired rigs and drillships for next year and, in many cases, for 2016, as well. Any shift away from exploration will therefore take time.

There are many complex issues at play in the high-stakes game of oil and gas in Africa. But there is little doubt the prognosis is positive, regardless of new headwinds.

FMC Technologies has commissioned its first subsea production tree built entirely in Nigeria.

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18-20	**Intersec 2015**	DUBAI	www.intersecexpo.com.
20-21	**Oil & Gas International Licensing 2015 Summit**	LONDON	www.oilgaslicensing.com
20-22	**Offshore West Africa Conference & Exhibition**	LAGOS	www.offshorewestafrica.com
FEBRUARY			
2-5	**Nigeria Oil & Gas**	ABUJA	www.cwcnog.com
4-5	**East Africa Energy Infrastructure Security 2015 Forum**	NAIROBI	www.energysecurityeastafrica.com
18-19	**Floating LNG**	LONDON	www.floating-lng.com
MARCH			
4-6	**7th East African Petroleum Conference & Exhibition 2015**	KIGALI	www.eac.int/eapce7
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14-15	**Recruitment Summit - Cape Verde, Guinea-Bissau, Mozambique, S. Tome & Principe**	LISBON	www.eliteic.net
16-19	**Nigeria Power**	ABUJA	www.nigeriapower.com
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29-30	**M2M for Oil & Gas**	LONDON	www.smi-online.co.uk
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25-27	**11th Africa Independents Forum**	LONDON	www. petro21.com
JUNE			
1-5	**26th World Gas Conference**	PARIS	www.wgc2015.org
23-24	**2015 African Assembly**	PARIS	www.oilcouncil.com

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For Alison-Madueke, it's another first

NIGERIA'S FIRST FEMALE minister of petroleum resources, Mrs Diezani Alison-Madueke, who was the first Nigerian female executive director of Shell Petroleum Development Company (SPDC), has emerged as the president of the Organisation of Petroleum Exporting Countries (OPEC), the first woman to hold that position in the history of the organisation. She was elected by a unanimous decision. She will be president for one year, with effect from 1 January, 2015.

Mrs Diezani Alison-Madueke.

Africa oil industry refocuses priorities

FOR EXECUTIVES AT the African oil industry's recent annual get together, the traditional party atmosphere proved extremely shortlived, with news of collapsing share prices, lower oil prices, and exploration setbacks. However, this combination has succeeded in bringing executives and government officials together in one respect: they now unanimously agree that they must change their priorities in Africa. "Focus will have to be on projects with a clear path to value creation and, in this market, that has to be on development, rather than exploration," said Dragan Trajkov, oil analyst at brokers Oriel Securities in London.

For an industry that has been focused on exploration in remote and difficult locations – such as Lake Albert in Uganda and offshore Mozambique – this will represent a significant shift in operations.

Aidan Heavey, chief executive of Tullow, suggested that a move away from exploration will have important consequences for the sector. "I think you will see fewer discoveries in Africa," he said. "Shareholders want dividends – high risk exploration can be postponed for a few years".

Such a shift would reverberate beyond the continent, too, as Africa has contributed significantly to the growth in oil and gas reserves since 2010. Last year, six of the top 10 global oil and gas discoveries by size were made in Africa, with more than 500 companies now exploring in the region, according to consultants PwC.

No one is predicting an end to African oil exploration. Big oil groups still plan to spend billions of dollars in the continent over the next decade developing the recently discovered reserves, executives said. Moreover, companies have already hired rigs and drillships for next year and, in many cases, for 2016, as well. Any shift away from exploration will therefore take time. As Irene Nafuna Muloni, oil minister of Uganda, pointed out: "Africa is endowed with oil. We still have opportunities in spite of the lower [oil] prices". However, Africa-focused energy companies must consider more than just shareholder concerns. They face an additional challenge in convincing their host governments of the merits of spending cuts.

Oil and gas discoveries in countries such as Uganda, Ghana, Tanzania and Mozambique have created expectations that a wave of petrodollars will flow into government coffers. As oil prices weaken, disappointed governments may attempt to increase taxation to compensate.

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Cegelec O&G adopts Actemium brand name

VINCI ENERGIES, A worldwide leading provider of energy and information technology services, has announced the rebranding of its Cegelec Oil & Gas businesses. All Cegelec O&G activities in the Middle East region have now officially become Actemium, the VINCI Energies' brand dedicated to industrial processes.

A long-time leader in the oil & gas sector, Cegelec O&G was acquired by Vinci in 2010 and integrated into the group's energy business Line. With this rebranding, Cegelec O&G businesses strengthen the know-how and capabilities of Actemium, the Vinci Energies brand dedicated to industrial processes, with a global network of 300 business units, 20,000 employees and a US$2.6bn global turnover.

"Actemium is already a strong player in the oil & gas sector, with 19 business units and 2,500 employees serving customers in 15 countries", commented Olivier Albessard, Actemium's brand firector. "Integrating Cegelec's oil & gas businesses in our organisation will reinforce our engineering expertise in designing, building, optimising and maintaining onshore and offshore production sites".

Cegelec Oil & Gas businesses rebranding as Actemium was initiated in Europe at the beginning of 2014. It is now being implemented in the Middle East region and the company expects it to be completely rolled out worldwide by January 2015.

"This initiative represents an important step in the Vinci Energies branding strategy, as it brings together complementary capabilities that best match market requirements", continued Jimmy Neron, business development director of Vinci Energies Oil & Gas. "By joining their forces under one brand, we can offer our customers a more effective access to Cegelec's Oil & Gas expertise in large-scale projects and to the extensive Actemium network.

JDR Cables secures contract for West African oil

SUBSEA CABLE MANUFACTURER JDR has secured a contract for a West African deepwater oil project. The firm has won the work from Royal Niger Emerging Technologies, a Nigerian oil and gas service firm, in what has been described by the client as 'the first step in a bold move' for Nigerian umbilical technology and services.

JDR will supply steel tubing and umbilicals, producing the components that house hydraulic controls, chemical hoses, low voltage signal cables and chemical supply lines. The equipment will be delivered to the Abo field in the first part of 2015. The umbilical will connect an existing subsea distribution unit (SDU) to a new well through the use of two umbilical termination units (UTA).

JDR will manufacture and load out the umbilical on a 9.2m installation reel from its deepwater quayside facility in Hartlepool, UK.

The project will provide a training ground for Nigerian nationals in the integration, testing, installation and commissioning of umbilicals. The Nigerian trainees will travel to the Hartlepool facilities for the project.

Pat Herbert, executive chairman and chief executive officer at JDR, said: "We are very happy to be a part of this deepwater project. This is a testament to our umbilical engine."

OML 29 to Aiteo-led consortium, not Taleveras

MORE FACTS HAVE emerged about the ownership structure of the consortium that acquired OML 29 along with the 96 km Nembe Creek trunk line that was sold by Shell and its partners in a US$2.56bn deal.

Shell, operator of the oil lease, has sold 30 per cent in the oil field and pipeline, while France's Total and Italy's Eni SPA have disposed of 10 per cent and five per cent, respectively, in the oil block to local investors. The balance of 55 per cent will be retained by the NNPC under a Joint Operating Agreement (JOA).

Contrary to earlier reports, the Aiteo Group-led consortium, and not Taleveras, is the main shareholder with an equity stake of 85 per cent. Other members of the consortium include Tempo Energy Resources – promoted by Timi Aladetimi, who is also the owner of Ankorpoint Energy – which has a 10 per cent stake, while Taleveras, owned by Igho Sanomi, holds five per cent equity in the consortium.

In a statement issued by Mrs Oseyemi Oluwatuyi of the communications department of the Aiteo Group, she clarified that five per cent equity does not even entitle Taleveras to a seat on the board of the consortium. "Therefore it is total misinformation in the local and international media that it is the 'Taleveras-led consortium' that acquired OML 29 divested by Shell," she said.

She revealed further that the clarification had become necessary to correct misleading media reports about the acquisition of OML 29, the most prolific of the oil blocks currently being sold by Shell.

"The Aiteo Group, whose major business areas include exploration and production, issued this statement in order to clarify various print and online media reports that carried misleading stories about the details of the transaction," she added.

She also put the total cost of the acquisition at US$2.7bn, stating that while US$2.56bn was the actual cost for the acquisition of the block and Nembe pipeline, the balance has been earmarked as working capital.

The Aiteo Group consortium beat several other indigenous and international companies to emerge winner and preferred bidder in a transaction that saw the group acquiring the assets for US$2.56bn.

GE and Heirs expand footprint in Nigerian O&G

GENERAL ELECTRIC AND Heirs Holdings (HH) have agreed to expand their existing relationship to jointly pursue opportunities in Nigeria's oil and gas industry. Having identified enormous opportunities in the upstream sector and the domestic demand for oil and gas, both companies are poised to collaborate in transforming the industry landscape.

Before now, GE's collaboration with Heirs Holdings was focused on the Nigerian power sector and specifically the expansion of Transcorp Ughelli, Nigeria's largest power station. The move is a clear demonstration of a new approach by multinational companies to develop meaningful and long term partnerships with credible and strong indigenous companies across a range of sectors. It is also an endorsement of the growing maturity of Nigeria's private sector.

Chairman of Heirs Holdings, Tony O Elumelu, said the expansion of the relationship with GE represents a pivotal moment for the oil and gas industry and for Nigerian businesses as a whole. He added that this marks a major milestone in the Heirs Holdings strategy to domesticate value across the energy sector.

According to Mr Elumelu, "Partnerships like this capture the spirit of what I have termed Africapitalism and bring together global entities and world-class Nigerian companies. These are the kinds of investments we need to create employment and ensure economic value."

The developing GE-HH relationship is expected to lead to significant investment and supply chain benefits for a whole range of Nigerian companies, operating across the industry value chain. Both organisations aim is to act as a catalyst for a far broader participation of small, medium and large Nigerian enterprises.

Oando completes Umugini pipeline

OANDO ENERGY RESOURCES Ltd has announced the completion of the 45,000 bpd-51km Umugini pipeline in Nigeria. Over the past year, the company has completed wells 5, 6 and 7 bringing oil production capacity to a gross total of 7,140 boepd for the company and Energia Limited, the operator of the project. Oando Energy Resources will net 3,052 boepd of the gross total. The completion of the pipeline allows the company to export at capacity, whereas previously exports were constrained to 3,093boepd due to the existing infrastructure.

The Umugini pipeline under construction.

Chief executive officer of Oando Energy Resources, Pade Durotoye, commented, "The completion of the Umugini pipeline now allows us to maximise the value of our investments to date on the asset and provides the latitude for further profitable development of prospects and resources identified in Ebendo".

With the completion and commencement of operations on the Umugini pipeline, the Ebendo field can now produce at its full capacity.

Intersec 2015 tracks double-digit growth

THE MIDDLE EAST and Africa's fast-growing security market has been underlined by the double digit growth of the upcoming edition of Intersec, the world's largest trade fair for security, safety, and fire protection.

The global demand for security equipment is estimated to grow seven per cent annually, reaching US$117bn by 2016,* with the underdeveloped Asian, Eastern European, and Middle East & African markets leading the charge.

The 17th edition of Intersec is setting the pace, as organiser Epoc Messe Frankfurt expects the event to register 15 per cent growth in exhibition space year-on-year.

Taking place from 18-20 January 2015 at the Dubai International Exhibition and Convention Centre, Intersec will feature more than 1,300 exhibitors from over 50 countries, including 300 newcomers. The three-day event focuses on the five core areas of Commercial Security; Information Security; Fire & Rescue; Safety & Health; and Homeland Security & Policing.

"Intersec has grown from a GCC-focused event into one of the world's leading networking platforms for the global security and safety industries", said Ahmed Pauwels, CEO of Epoc Messe Frankfurt.

"The Middle East and Africa region continues to emerge as a key security market, and Intersec functions as the bellwether event that showcases the current trends prevailing across the globe, while presenting vital indicators of future developments in the industry."

LR Senergy rewarded for ethical energy work

A LEADING ENERGY services firm has won a prestigious award recognising its role in a pioneering consortium working to help developing and emerging nations improve the efficiency of their oil and gas as well as renewables' industries.

LR Senergy received the Best Oil & Gas Services Award at the 2014 African Achievement Awards Scotland in November for the firm's role in the landmark Ethical Energy Consortium (EEC) that is encouraging energy extraction and regulatory best practise.

On receiving the award, Ian Williamson, commercial vice president at LR Senergy, said: "What we look to do with the EEC, is to improve technical, safety and environmental standards, the quality of decisions and regulation in government organisations, and the capacity of those organisations to grow and become more self-sufficient. We are striving to introduce a best practice model based on good governance, technical expertise, innovative commercial arrangements and insightful transformation management. This, in turn, helps investors, the host nations and their citizens, while minimising the environmental impact.

"To receive this endorsement shows that what we are doing is being noticed and providing real value to those looking to grow their energy resources in an equitable manner. The project's progress is encouraging and many other international institutions are both endorsing and seeking to actively support transformation of national organisations to improve the efficiency of energy developments and infrastructure."

The consortium's over-arching goal is to deliver a framework for ethical and inclusive energy development for developing and emerging resource nations.

Atlas Development wins Tanzanian contract

ATLAS DEVELOPMENT & SUPPORT Services Ltd, the African-focused support services and logistics company, has been awarded its first contract in Tanzania to provide turnkey support services, including workforce accommodation, facilities management, medical infrastructure and logistical support to an international drilling company which is commencing activities in the Ruvuma Basin. This marks a further step in the company's regional development and follows the recently announced move into Mozambique.

Tanzania represents a strategic growth opportunity and further strengthens Atlas Development's established operations in Kenya, Ethiopia and Djibouti, underpinning the company's active growth strategy. The country is the focus of significant investment from international blue-chip companies, operating within both the oil and gas and mining space, and, consequently provides a solid opportunity through which to build the company's geographical, service and client reach.

Carl Esprey, CEO of Atlas Development, said: "Following this win, we now operate in five countries in East Africa. The signing of this significant contract underpins the value of our turnkey service offering and demonstrates the continued momentum that the Atlas Development brand is gaining as a leading turn-key support services provider in East Africa. We believe that this region continues to hold significant potential for us, as it plays host to some of the lowest-cost oil developers globally. Furthermore, Tanzania, and East Africa as a whole, is an important investment destination for many mining companies in addition to upstream power generators, and Atlas Development benefits from providing a full spectrum of support services solutions, ensuring we gain exposure to all facets of industrial development."

Ladol shipyard facility opens in Nigeria to attract foreign investment

LADOL, THE NIGERIAN fully integrated logistics facility servicing offshore oil and gas companies, and Samsung Heavy Industries Nigeria recently hosted a ceremony in Lagos to mark the ground-breaking construction of what will be West Africa's largest vessel fabrication and integration facility.

The facility's first client is Total Upstream Nigeria, which is finalising the integration of its Egina field FPSO in this integration facility. The Egina FPSO is 330m long and will be used to process up to 200,000 bpd from Nigeria's Egina deepwater oilfield, which is expected to come on stream in 2017.

The construction of this facility in LADOL's Free Zone marks the onset of Phase 2 of the development of the Free Zone, which has been operational since 2006.

This is the first time, in Nigeria's 40 plus years of oil and gas exploration and production that an FPSO will have been partially built onshore in Nigeria. This project will create 50,000 new direct and indirect jobs in Nigeria over the next few years; increase demand for local materials and fabrication by a factor of three to four times; and create a platform that will enable future FPSO construction to take place 100 per cent in Nigeria.

LADOL is also investing in human capital development, with its funding of a new technology academy, targeting young talented Nigerians and graduating up to 250 trained professionals each year.

Since it started operations in 2006, LADOL has turned a greenfield swamp into a world class US$500mn deep offshore logistics base.

Ophir Energy and Salamander agree merger terms

OPHIR AND SALAMANDER have reached agreement on the terms of a recommended acquisition by Ophir Energy plc and/or a wholly-owned subsidiary of Ophir Energy plc for the entire share capital of Salamander.

Following completion of the transaction, Salamander shareholders will own approximately 20.9 per cent of Ophir.

The board of directors of Ophir and Salamander believe there is compelling strategic logic for a combination of the two businesses that would substantially benefit the shareholders of both companies. The combined business would have a strong balance sheet, enhanced operating capability in both Africa and South East Asia, and wide expertise across key technical and commercial functions. The combined business has the opportunity to generate immediate operating synergies, leveraging Ophir's exploration track record and financial strength and Salamander's established Asian operating platform. The combination would provide shareholders with exposure to 21 production, development and exploration blocks in South East Asia, as well as to Ophir's extensive footprint in Africa.

Commenting on the transaction, Nicholas Smith, non-executive chairman of Ophir said: "Combining Ophir and Salamander will create a balanced African and South East Asian operating platform, designed to deliver Ophir's exploration-led strategy across both regions. We see many value-creating opportunities in both Africa and South East Asia that can be swiftly accessed by leveraging Ophir's exploration expertise with Salamander's operational strength. Furthermore, Salamander's anticipated growing production will allow Ophir to diversify its funding sources, and to continue to monetise assets for the benefit of shareholders."

Ophir is a FTSE 250 upstream oil and gas exploration company listed on the London Stock Exchange. Ophir is incorporated in England and Wales with headquarters in London and operational offices in Perth (Australia), Dar es Salaam and Mtwara (Tanzania), Malabo (Equatorial Guinea), Libreville (Gabon) and Nairobi (Kenya).

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Honourable Minister of Petroleum Resources
Federal Ministry of Petroleum Resources

H.E. (Prof) Chinedu O Nebo
Honourable Minister of Power
Federal Ministry of Power

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Low oil prices are deterring investment. That means supply difficulties in the medium and long terms, says the International Energy Agency.

Price break illusory says WEO report

"*AS OUR GLOBAL* energy system grows and transforms, signs of stress continue to emerge" said the International Energy Agency's executive director Maria van der Hoeven at the launch of this year's World Energy Outlook on 12 November.

Just one of these is the recent tumble in oil prices, brought about by a number of factors including the turnaround in the USA market. Whatever the cause, underlying instability is indicated, and investment in developing unconventional US shale resources is expected to be reduced significantly next year.

A very well-supplied market is just what OPEC wants right now, some say. At their recently held 166th Conference meeting, the Organisation decided to maintain production at 30mn bpd, as agreed back at the end of 2011.

"Although Western oil demand is forecast to increase during 2015," the statement said, "this will, yet again, be offset by the projected increase of 1.36mn bpd in non-OPEC capacity." The announcement was clearly carefully timed to let the WEO message sink in.

Close monitoring of developments in supply and demand, as well as "non-fundamental factors such as speculative activity," will be continued, the statement said.

Nigeria's petroleum minister Mrs Diezani Alison Madueke was elected as the new OPEC president, taking up the position on 1 January.

The Paris-based consumers' watchdog warns that the past second-half's uncharted developments could, amongst other predictable changes, threaten global supplies in the medium term as consumption growth heads for a near-halt over the next 25 years. Just one of these is the ongoing security crisis in Iraq, which is hindering the development of resources there. In better times these could make up the greater part of the shortfall said chief economist Fatih Birol.

Pressure for Africa to boost production

It all puts pressure on Africa to boost production in the longer term in key supply countries such as Angola, Libya and Nigeria, despite the current panic over prices. And to fast-track the massive gas developments that are taking place in the East as the rapidly globalising gas market is turning out to be a much more predictable prospect than that for crude oil.

Sub-Saharan Africa is the subject of a lengthy four-section regional survey in this year's eagerly-anticipated report. This includes a useful account of the five major hydrocarbon basins located south of the Sahara, and a country-by-country list of proven and ultimately-recoverable reserves, cumulative production and remaining recoverable resources – all as assessed at the end of 2013. Purchase details can be found at www.iea.org. SSA will be one of the key drivers of oil consumption growth as industrialised countries, including China, continue their switch to renewables, the Agency maintains.

Key points

Among the key points made about energy issues in Africa today, the IEA says:

- Energy demand grew by 45 per cent from 2000 to 2012, but still accounts for just four per cent of the world total. "Low incomes, coupled with inefficient and costly forms of energy supply, make energy affordability a critical issue".
- SSA produced 5.7mn bpd of oil in 2013. While 5.2mn bpd were exported around 1.0mn bpd of oil products had to be imported. These continue to be subsidised in many producing countries.

The economic prospects for Mozambique and Tanzania are particularly good as a result of forthcoming large-scale gas exports.

- Over the last five years around 300 of the world's oil and gas discoveries were made in SSA.
- Natural gas use of 27 bcm in 2012 is similar both to the volume that was profitably exported and the volume that had to be flared.
- Oil production will rise above six million bpd by 2020 but then tail off to 5.3mn bpd in 2040, by which time East Africa will be producing in a big way. Gas production will reach 230 bcm by that year, led by Nigeria and Mozambique. This will bring sub-Saharan LNG exports towards 100 bcm/year, nearly one fifth of the world's inter-regional ship-borne trade.
- The region's energy exports generally will be drawn increasingly towards Asian markets.
- Angola will temporarily overtake Nigeria as the largest producer in the region.
- The economic prospects for Mozambique and Tanzania are particularly good as a result of forthcoming large-scale gas exports. But careful decisions will have to be made about how this handy new source of energy is used in these countries.
- Projected oil and gas output through 2040 will generate more than US$3.5 trillion in cumulative fiscal revenues. But these sums will be concentrated in just a small number of countries.

Unlike other outlooks, IEA sees greater uncertainty and more renewable energy in future global energy markets. The outlook still expects fossil fuels to support the majority of energy demand in 2040 (approximately 75 per cent), but oil and coal demand plateau at the end of the forecast period due to energy efficiency gains and government regulations. The agency cautioned the world regarding complacency in the oversupply of oil because investment in oil wells will be needed in the Middle East in the future. ■

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Following the 1970s' oil price boom, the Gulf of Guinea became the magnet of hydrocarbons activities in West Africa, a trend that continued well into the mid-2000s. East Africa – long overlooked for decades – started appearing on multinationals' radar only since 2010 after discoveries of sizeable natural gas reserves off Mozambique and Tanzania waters.

New frontiers for oil exploration in East Africa acreage

PREVIOUSLY, THERE HAVE been doubts about the amount of recoverable resources in this sub-region; however, recent oil-gas discoveries have improved prospects for their commercial exploitation.

Kenya has four prospective sedimentary basins: Anza, Lamu (both onshore and offshore), Lokichar (Mandera) and the Tertiary Rift. Its history of exploration dates back to the 1950s with the first oil well being drilled in 1960 by BP and Shell. After decades of disappointing results, exploration and development (E&D) investments into Kenya dried up until 2010, when foreign firms were attracted back to Kenya after promising discoveries in the region.

Among the most active in Kenya is UK's independent Tullow Oil, which is applying its knowledge of Uganda to the Rift Basins in East Africa where Tullow acquired around 100,000 sq km of acreage in onshore Kenya and Ethiopia. Turkana Rift Basin (Kenya) is similar in character to Uganda's Lake Albert Rift Basin. In March and November 2012, respectively, Tullow (in partnership with Marathon and Africa Oil) discovered oil at Ngamia-1 in Block 10BB and Twiga South-1 in Block 13T in the Lokichar basin. The estimated reserves were reported at 600mn barrels – with the potential of total recoverable oil to over one billion barrels.

Keith Hill, CEO Africa Oil, said: "We are pleased with the Etom discovery which extends the proven petroleum system to the northern portion of the Lokichar basin and de-risks several large prospects in that area." Angus McCoss exploration director at Tullow, added: "Continued success in appraisal of the Ngamia and Amosing fields reinforces our belief that the South Lokichar basin holds very considerable potential which we hope to replicate in additional basins."

Aggressive drilling programme

Of the 33 wells drilled prior to 2012, about 16 indicated signs of hydrocarbons. So far, 23 foreign operators are conducting exploration activities in all 44 blocks currently licensed. International Oil Companies (IOCs) have drilled 15 wells between March 2012 and June 2014, an average drilling rate of about seven wells per year (compared to one every two years in the past). Tullow Oil, with Africa Oil as joint-venture partner, has identified crudes in seven wells, while Apache and BG Group found natural gas and oil in onshore and offshore blocks. Further offshore drilling is planned in the coming months for Kenya's exclusive economic zone.

UK-based FinnCap Research commented: "At the moment there is a lot of hype about Kenya – but in some ways it is justified. We don't know whether Turkana is going to hold one billion barrels or eight billion barrels. It really could be a huge discovery." The International Monetary Fund (IMF) also said: "Big oil discoveries in the northern Turkana region have now made Kenya a major venue for oil exploration in East Africa." The US investment bank Morgan Stanley expects Kenya to start oil production within three-to-five years.

IOCs exploring in Kenya operate under a production-sharing contract (PSC), in which IOCs are contractually obligated to give 25 per cent of their block back to the National Oil Corporation of Kenya (NOCK) after two years if it is located onshore, and after three years if it is offshore. PSCs also contain an obligation for domestic supply of oil and gas.

"We don't know whether Turkana is going to hold one billion barrels or eight billion barrels. It really could be a huge discovery."

The Ngamia rig site in northern Kenya

Kenya is home to East Africa's only refining facility – the Mombassa refinery with a nameplate capacity of 80,000-to-90,000 bpd, operated by Kenya Petroleum Refinery Limited (KPRL). About 75 per cent is processed into fuel oil, light diesel (gas oil), kerosene, and jet/turbo fuel. Kenya is planning to expand its role as a regional oil transit hub by embarking on a multi-million dollar investment to increase its midstream and downstream capacity.

Emerging oil producer

Exploration in Uganda dates back to the early 1920s after oil seeps were reported along the shores of Lake Albert, according to the Ministry of Energy and Mineral Development. Since 2006, when Tullow and partner Heritage Oil discovered over 800mn barrels in the western Lake Albert Rift basin, there has been a string of fresh discoveries elsewhere. By the end of 2012, out of 50-plus wells that were drilled in Uganda, only five proved negative. Uganda's Lake Albert also contains 500 bcf of proved gas reserves. But discoveries are in a remote and environmentally sensitive area, which adds to the cost and complexity of the development, including strong opposition from local communities.

A further problem is posed by the 'waxy' nature of the oil, which is solid at room temperature, thus requiring a heated and insulated pipeline to transport it. The crude is contained in low-pressure reservoirs that increase the cost of production facilities. Though light and low in sulphur, much of the oil under Lake Albert and the Murchison Falls Conservation Area has exceptionally higher paraffin content. Thus, pipelines will need to be heated [first] for the crude to flow and refineries need expensive processing and treating capabilities.

The three-member consortium of Tullow, Total and China National Offshore Oil Corporation (CNOOC), that control most of Uganda's reserves, is now embarking on extensive drilling/appraisal programmes to confirm commercial viability at well discoveries, which could, ultimately, boost proven oil reserves. Probable (2P-1P) oil reserves – ie, that the geological and engineering data suggest with a probability of at least 50 per cent can be extracted under given economic/technological conditions – are tangibly estimated at 6.5bn barrels.

Commercial output is expected to begin by 2017-18, but 'colossal' investments (estimated at US$15bn-US$22bn) are required to produce, transport, refine and export the oil. The latter requires building a 1,300-km pipeline to the Kenyan port in Mombasa. The government prefers a gradual increase and lower peak output to slow the depletion of reserves, while the

consortium favours production expanding quickly and peaking at 200,000 bpd or more by 2020, according to reports from the Eurasia Group and IHS Global Insight.

September 2013 saw the first issue of a production licence for the Kingfisher field (operated by CNOOC) – more E&P licences are expected to be issued in 2015. Initial production will be used as feedstock for local electricity plants, according to Tullow.

Small-scale oil production is expected to first derive from Tullow-operated Mputa and Waraga fields and small-scale gas production also from Tullow's Nzizi field.

Table 1: Kenya's Licensed Blocks

Operator	Blocks	Consortium Partners
Adamantine Energy Ltd (UK)	11B	Bowleven Plc (UK)
Afren Plc (UK)	L-17	-
	L-18	-
	Block-1	Taipan Resources Inc
Africa Oil (Canada)	Block-9	Marathon Oil (US)
Anadarko (US)	L-11B	Total (France), GoK*, PTTEP (Thailand)
	L-12	Total (France), GoK*, PTTEP (Thailand)
	L-11A	Total (France), GoK*, PTTEP (Thailand)
	L-7	Total (France), GoK*, PTTEP (Thailand)
	L-5	Total (France), GoK*, PTTEP (Thailand)
A-Z Petroleum	L-1A	-
	L-3	-
British Gas (BG) Group	L-10B	Premier Oil Plc (UK), Pancontinental Oil (Australia), PTTEP (Thailand)
	L-10A	PTTEP, Pancontinental Oil
CAMAC Energy Inc (US)	L-16	GoK*
	L-1B	GoK*
	L-27	GoK*
	L-28	GoK*
Companie Espanola de Petreos (Spain)	Block-11 A	EHRC Energy (US), GoK*
ENI (Italy)	L-14	-
	L-21	-
	L-23	-
	L-24	-
FAR Ltd (Australia)	L-6	Pancontinental Oil
	L-6 onshore	Milio International (Dubai), Pancontinental Oil,
Midway Resources (Cayman Islands)	L-4	Swiss Oil Co, NOCK /
	L-13	Swiss Oil Co, NOCK /
NOCK /	Block-14 T	
Ophir Energy Plc (UK)	L-9	FAR Ltd, GoK*, Vanoil Energy (Canada)
	L-15	GoK*
Premier Oil Plc (UK)	Block-2 B	Taipan Resources Inc
Total	L-22	-
TULLOW Oil Plc (UK)	Block-10 BA	Africa Oil
	Block-10 A	Africa Oil, Afren Plc
	Block-10 BB	Africa Oil
	Block-13 T	Africa Oil, NOCK
	Block-12 B	Swala Energy (Australia)
	Block-12 A	Africa Oil, Marathon Oil, NOCK

* Government of Kenya; / National Oil Company of Kenya.

Source: PetroView

A recent Memorandum of Understanding (MoU) signed between the government and the three-member consortium stipulates that the former will establish a refinery at Hoima district, about 240 km west of Kampala, with initial refining capacity of 30,000 bpd, while international partners will construct an export pipeline. Uganda's national hydrocarbons policy also favours the development of a petrochemical industry based around an oil refinery. The Turkish Kolin Construction Co is currently building a 92-km road between Hoima and Kaiso-Tonya to connect the oilfields to the planned refinery.

Preliminary estimates suggest that the oil sector could account for eight per cent of GDP and generate annual revenues of US$5bn to the exchequer. Oil reserves are currently expected to last for 25 years or more, thereby offering a unique opportunity to tangibly improve Uganda's productive, fiscal and financial landscape (if used wisely). "Stronger public financial management systems are crucial to the efficient spending of oil revenues," the IMF advised.

Regulatory environment

The recently passed Petroleum Bill in Uganda has established a Petroleum Authority and a National Oil Company (NOC) and clarified the functions of the Ministry of Energy. The latter is responsible for granting and revoking licences (and may also open new areas for licensing), developing and implementing oil/gas policy, issuing regulation, approving field development plans and negotiating petroleum agreements. The Petroleum Authority is in charge of monitoring and regulating petroleum activities, and it oversees the review and approval process for exploration plans and budgets submitted by a licensee.

The Petroleum Exploration and Production Act governs Kenya's upstream activities. This vests ownership of hydrocarbons with the government and grants significant powers to the cabinet secretary in the Ministry of Energy and Petroleum. Day-to-day responsibility for the sector lies with the Petroleum Energy division of the Ministry. A recent IMF report observed that Kenya's petroleum regulatory/fiscal regime (dating back to 1986) needs modernisation.

Specifically, the production-sharing scheme does not properly reflect capital costs, oil prices and output volumes, while new production-sharing terms for gas need to be specified. For the medium term, a comprehensive gas-focused regulatory framework is also needed. Presently, work to redesign the framework for oil exploration, plus the model for terms for natural gas contracts is underway, with First Appearance Datum (FAD) technical assistance.

The Royal Bank of Canada Capital Markets stated: "More discoveries and increased activity should bring more oil expertise to the region, as well as oil hardware, something that should make life easier for the oil companies. The exploration programme for the next 12 months could drastically rearrange East Africa's onshore hydrocarbons map." Multinational oilfield services firms, Baker Hughes and Halliburton have already moved into the area for new businesses.

Table 2: Ugandan Oil & Gas Fields

Field	Type	Discovery year	Operator	License
Mputa 1	Oil	2006	Tullow	Block-2
Nzizi 1	Oil/Gas	2006	Tullow	Block-2
Waraga 1	Oil	2006	Tullow	Block-2
Jobi-Rii	Oil/Gas	2008	Total	Block 1/1A
Kingfisher	Oil	2006	CNOOC*	Block-3
Gunya 1	Oil	2011	Total	Block 1/1A
Jobi East 1	Oil/Gas	2011	Total	Block 1/1A
Ngiri 1	Oil/Gas	2008	Total	Block 1/1A
Kasamene 1	Oil/Gas	2008	Tullow	Block-2
Kigogole 1	Oil	2008	Tullow	Block-2
Ngassa 2ST	Oil	2009	Tullow	Block-2
Nsoga 1	Oil	2009	Tullow	Block-2
Ngege 1	Oil/Gas	2008	Tullow	Block-2
Taitai 1	Oil/Gas	2008	Tullow	Block-2
Wahrindi 1	Oil	2009	Tullow	Block-2
Mpyo 1	Oil	2010	Total	Block 1/1A
Karuka 1	Oil	2008	Tullow	Block-2
Ngara 1	Oil	2009	Tullow	Block-2

* China National Offshore Oil Corporation.

Sources: Tullow Oil, Total, Rystad Energy and IHS Edin.

New finds have put Kenya and Uganda at the forefront of East Africa's emerging oil province. Ethiopia also has potential reserves and promising geology, whilst there is oil in the Congo (DRC), on the other side of Lake Albert, the political instability and poor security make future E&D programmes uncertain.

Still, huge investments are required and governments need to maintain a welcoming environment for IOCs to help develop those reserves to their full potential. ■


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Mwendia Nyaga has held various senior positions within National Oil Company Kenya (NOCK), rising to become the state oil company's chief executive before becoming a senior consultant to Kenya's Energy Ministry – and he now heads the private advisory company, Oil and Energy Services Ltd. Stephen Williams reports.

Kenya's oil and gas potential

WHEN MWENDIA NYAGA sat down with me to discuss his new advisory venture, Oil and Energy Services Ltd, it was not in some steel and glass high-rise in the centre of Nairobi's business district but in the leafy surroundings of the Nairobi Arboretum, next to the grounds of State House, where he has his offices – just a 20-minute drive from downtown.

Nyaga and I had met the previous day and discussed the potential for the oil and gas industry to transform Kenya's economy. He told me that he was very positive about the outlook for East Africa. "If it does realise all the promises that seem to be presenting themselves, it will be transformative," he observed. "When there is production, a revenue stream will come through."

But Nyaga does not just see the revenue stream as being important to Kenya's economy. "If there is a lot of activity around, and long-term projects that maybe will create revenues in five or 10 years' time, the amount spent to bring those to fruition would represent a significant percentage of the country's GDP.

"Look at Mozambique, where production costs are being estimated to cost US$16bn. The total GDP of Mozambique is probably somewhere between US$20bn-US$30bn, in which case then, we are talking about the value of production development amounting to over 50 per cent of the country's GDP!

"So, for any country, there are, firstly, benefits arising from development and, secondly, the production revenues when the oil starts flowing."

So Nyaga is focused on the value chains that will lead to the production stages when revenue streams will be realised. And his focus is on ensuring that Kenya secures as much of those are accrued to the country.

"For us, as a company, what we are talking about most are the value chains, enhancing the local contribution, so you get the benefits early, before the production revenues come on stream, and go to the government who will decide how to best invest this windfall – say building infrastructure that will benefit the whole industrial base."

Securing parts of the value chain

So how was Nyaga's company going about securing parts of the value chain? "Our core activity is that we conduct advisory research and training, mainly for foreign entrants into the Kenyan oil and gas industry.

"But we have also expanded our services to local companies, and also for people who are interested in knowing what this particular market is about."

Mwendia Nyaga.

As most people are aware, Kenya is one in a series of 'hot plays' in the East Africa region, with the discovery of commercially viable oil reserves – and light, sweet crude at that. According to the pan-Africa banking giant, Ecobank, its research department issued a paper saying that Kenya can expect to start producing by 2017, with crude oil being transported by pipeline to the proposed Lamu port on Kenya's coast.

Aside from Kenya's own oil reserves' potential, Ecobank notes, the country is likely to play a pivotal role in the emerging upstream oil industry in East Africa such as Uganda's Lake Albert assets. Kenya's Mombasa port already has 1.7mn cubic metres of crude oil and petroleum product storage facilities, and a refinery with the capacity to supply the whole of East Africa.

> Our core activity is that we conduct advisory research and training, mainly for foreign entrants into the Kenyan oil and gas industry.

The importance of local content

Nyaga has always insisted on the importance of local content and spoken of the need for local training for oil and gas personnel as well as establishing hydrocarbon laboratories in the country. It looks as if Nyaga's lobbying has born fruit, with government policy insisting on the training of locals by those oil companies operating in the country, and the establishing of energy-sector courses at its domestic universities.

Kenya is also looking to establish the region's first seismic data processing centre, with Nyaga's former company, the National Oil Corporation of Kenya (NOCK) saying it should be able to complete the centre by next year. Explorers are likely to spend about US$750mn on drilling wells by 2017.

The centre would reduce the time taken to access and process seismic data on the region and will support regional exploration efforts.

As part of the bigger picture, Nyaga wants to make Kenya's oil sector an attractive proposition by partnering with potential players and easing the way they can enter the market. "We are trying to develop long-term relationships with our clients, many of whom initially just wanted our services to come into the market, but later asked if we can assist them in handling all manner of local issues."

However, Nyaga's most pressing concern going forward is that the country might allow corruption to take hold. "That would be my biggest fear as far as our capacity to manage the resource revenues are concerned," Nyaga said, although he also said that the situation is much improved.

"We no longer have suitcases of cash changing hands. Those days are behind us as oversight is very much improved."

Yet perhaps the real fear is in capital flight, and the unethical, but legal practice of what is termed 'transfer pricing'. This is the practice of switching earnings to low- tax jurisdictions – but Nyaga thinks this particular problem is less about revenue streams being transferred as it is about the dangers of oil industry development costs being overstated – denying the country a fair return.

Returning to what Nyaga's company is doing, it is clearly leveraging local knowledge of the markets. "Our research is based on market information. We believe that we are probably the only private firm in Kenya to have such a very wide knowledge of the operations of the industry, and even if we do not have the specific knowledge our clients require, we will know where to find it, at the most economical cost."

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When asked about how his fees are structured, he explained that they are calculated in very much the same way as the legal profession bills its clients – in terms of hours.

But, Nyaga insists, his company's services are very competitive. "Imagine the cost to a foreign company of sending an employee to the country, the opportunity costs that are lost and the difficulty that someone with no experience of the country's industry would have in researching all the factors of establishing operations here.

"So the research part is focused towards those who may want specific information, and sometimes we even have clients who are tendering for some project, and need specific market information to help in the pricing of bids.

"Take as an example an exploration company that is, say, based in Norway, and for their tender they need to include all manner of variables, such as the cost of logistics or personnel.

"We can quickly agree on the terms of reference with those sorts of clients, and we can find this information for them and that will help them in pricing contracts, giving them the reassurance that costs are pinned down."

Part of that knowledge is simply through Nyaga and his people having been inside the system and knowing what is done where. "A lot of companies have preconceptions drawn from where they last submitted a tender or bid," he said.

But, even regionally there are a lot of differences. "If you had experience in applying to the Tanzania Petroleum Development Corporation, you might believe you need to go to the National Oil Company Kenya in this country, that these are the people who make the decisions.

"But, in fact, in Kenya it is the ministry that makes the decisions. So people can waste a lot of time and money knocking on the wrong doors thinking they need to submit their documents there.

"We can help them knowing what can work and what cannot work. Because the fact is that we know the people in Kenya and as we have worked with

A general view shows an oil rig used in drilling in the Lokichar basin, which is part of the East African Rift System in Turkana County, Kenya.

them, we know what it is they are very concerned about and what it is they are not concerned about. And again this can be different between countries."

Unlike many sceptics, Nyaga believes the Kenyan government has the capacity and vision to handle the revenues that will eventually accrue to the state.

"Well, if we look to the latest national budget for Kenya next year, that will amount to US$21bn. Current best estimates are that, after production costs and at current oil prices, the treasury's take from the oil and gas market will be about US$1.8bn a year, or about one tenth of the current budget. Actually, I think that in the case of Kenya, the country could handle US$10bn without too much difficulty.

"Clearly, we have to watch the local currency, but the current forex reserve for the country right now is about US$2bn to US$3bn. So we are already managing a very large forex reserve. If we ask them to be custodians of another US$2bn, they should know what to do to avoid the resource curse with our goods becoming too expensive.

"It is not a case of just having US$200mn in reserves and then being responsible for US$2bn."

The environmental issue

Nyaga is also convinced that the environmental issue can be safeguarded too. "Even without the government kicking in, you have a fairly strong civil society in Kenya today that will not allow massive environmental degradation being caused by the oil and gas industry. You will be stopped, maybe not by the government, but by the public. Our civil society knows how to mobilise the public and they will stop your operations.

"Probably the only thing I can add in reference to Kenya is the political environment and how, from the political side, we are seeing an approach to the industry that indicates that the Kenya leadership is quite eager to progress.

"I think they are well aware of how much money the government will require to deliver what it has promised, especially with the Vision 2030. The type of projects we have in the Vision 2030 are massive, and they are starting to be initiated, but they need massive amounts of money.

"That is somewhat different to the approach of many other East African countries. The difference is that Kenya has the vision. When you compare that to, say, Uganda – you have to wonder why Uganda took so long to reach an agreement.

"I think they may have not believed they even had the capacity to get an agreement done, and get it done right, and so didn't have the vision to fast track it."

"If there is an industry that can provide significant sums of money to the government, it's the oil and gas industry, and the recent discoveries are tangible; the oil and gas promise is not a wild goose chase! "

Somalia plans to produce oil in six years

SOMALIA PLANS TO begin producing oil and gas offshore for the first time within six years and is in talks with state governments about how revenue will be shared, according to petroleum minister Daud Mohamed Omar.

The Horn of Africa country, which has been immersed in conflict for more than two decades, is proceeding tentatively on exploration to avoid creating new tensions, Omar said at the Somalia Oil & Gas Summit held in London recently. Somali President Hassan Sheikh Mohamoud said in August the government expects to complete an assessment of its oil and gas potential this year.

"The Somali government, even though it wishes to move forward quickly in these areas, will also move forward cautiously," an interpreter for Omar said at the conference. "We do not intend to have the quest for oil and gas to re-ignite divisions and violence."

Somalia is considering its first bidding round for oil blocks since 2009 as increasing stability begins to attract more foreign investors. The government is in talks with companies including Royal Dutch Shell, ExxonMobil, BP and Chevron about reactivating dormant contracts in the country, said J Jay Park, managing director of Petroleum Regimes Advisory, which provides legal advice to the government.

New forum to addressing security challenges

IRN, THE GLOBAL summits organiser will launch the inaugural East Africa Energy Infrastructure Security 2015 forum which will take place on the 4-5 Februrary in Nairobi.

Although in the last half-decade a number of East African countries have emerged as global energy frontiers, and consequently the region is increasingly attractive to major IOCs, there are a number of specific security challenges which may hamper East Africa's booming oil and gas industry.

The Forum will address a range of issues including counter terrorism, local conflicts and violence, employee relations, pipeline and infrastructure protection, relations with the local community, maritime security and utilising local content policies within the energy industry with the main focus on oil and gas sector in the wider East African region.

The Forum will be a senior level platform where delegates will have a chance to hear presentations and case studies from a number of security experts from leading construction and oil and gas companies active in the region.

As a company, IRN has an established reputation in the oil and gas industry for organising oil and gas, as well as security-focused forums. Among the company's most recent events, the West Africa Oil & Gas Security Summit took place in June 2014 in Lagos. This well-received meeting was attended by senior level representatives from ExxonMobil, Shell International, G4S, Subsea7, Total E&P, Hunt Oil Company, Nigerian Army Corps of Artillery, GE Global Sub Sahara Africa, West African Gas Pipeline Company and many others.

While many lessons have been learned during the past 100 years of rig operation, accidents still occur and formal health and safety training is as important as ever, writes Nicholas Newman.

Using effective HSE training to mitigate risk

DRILLING FOR OIL and gas, whether onshore or offshore, carries potential considerable risks ranging from small incidents like a pipeline leak to fires and massive explosions leading to loss of life. This range of small to large incidents demonstrates that the industry must adopt a safety-first culture for both the physical rig structure to the people, the roustabouts who live and work on rig platforms.

According to the Baker Hughes Worldwide Rig Count, there were 1,325 rigs in operation outside Canada and North America in January 2014. Of these international rigs, 148 were in operation in Africa.

Rig accidents

Major oil rig accidents are thankfully relatively rare. However, lesser accidents, small fire incidents and explosions are more common and more numerous and have occurred on rigs around the world including Africa. In the Middle East and Africa, as elsewhere, mishaps such as blowouts, platform sinking and helicopter crashes are the most common occurrence and operators and rig staff are trained to be prepared and ready to deal with these problems. For instance, when Saudi Aramco's rig, lying off the Gulf coast of al-Safaniya region - the site of the world's largest offshore oil field - sank during maintenance in December 2013, 24 rig workers were rescued with minor injuries. Unfortunately, three Asian workers were drowned despite the rescue operation that was put in place. In January 2013, a US$40mn, 1,000-ton engineering structure, part of an offshore platform, belonging to Iran's South Pars gas field, sank whilst being installed in the Gulf. Luckily there were no reported injuries to staff but the incident delayed the expansion of the Iranian South Pars fields.

These and other incidents have encouraged health and safety authorities throughout the region to increase enforcement of existing regulations and working practices. Rig incidents have directly led to tightening up of regulations and improving working practices throughout the industry. Safety consciousness has increased whilst incremental improvements to the design of new rig structures, components and materials alongside software and personnel protective equipment have been made in recent years.

Fire prevention

Stakeholders including operators, designers, regulators and unions are constantly looking at ways to prevent and ameliorate oil and gas platform hazards. Much has been learned in the last century of rig operations yet accidents and even disasters continue to happen. For fire prevention and protection, designers of oil and gas platforms have to consider two distinct events: short fires and long fires and their distinct strategies and treatments.

Rig incidents have directly led to tightening up of regulations and improving working practices throughout the industry.

Short fires are those that can be put out by staff in the vicinity using installed fire-fighting equipment. Long fires, are fires that take over an hour to put out and may exist for days or even months. A long fire contributed to the sinking of the Arabian Drilling Company's Arabdrill 19 Jack-Up rig in the Khafji Field, Saudi Arabia in 2002. To prevent and combat long fires takes a combination of design, engineering and safety consultants working together, integrating the research of engineering safety consultants such as Nowatec or Scandpower, who make use of risk analysis modelling software, to determine the drivers behind fire hazards and analyse different safety design features. When Dr Jurek Czujko, CEO of Nowatec, was asked how things have changed in recent years. He said that, "The requirements for safety are twice as large."

Rig design

Rig designers have two strategies for the prevention and control of fires: passive fire protection and active control and protection. The first strategy, passive fire protection (PFP) is defined, in the recently issued ISO standard (ISO, 1999), as 'a coating, cladding or free-standing system which, in the event of a fire, will provide thermal protection to restrict the rate at which heat is transmitted to the object or area being protected'. Such materials including firewalls, provided by 3M and Invicta Protection, are used to prevent escalation of the fire and to guide personnel along escape routes to the safety of high protection zones whilst awaiting evacuation and to protect essential safety items and critical components such as separators, risers and topside emergency shutdown valves. Most commonly used today are the spray applied epoxy intumescent and subliming coatings, though cementitious materials, also known as bendable cement such as Portland cement, were widely used in the past. However, applying passive fire protection materials can be expensive, time consuming and add several tonnes of weight to rigs.

> Much has been learned yet accidents and even disasters continue to happen

The second strategy, active control and 'fire protection', comprises several systems that start automatically when smoke or fire is detected. For example, 3M offers a variety of ESD (Electrostatic Discharge) and blow down mechanisms including water deluge and foam systems, monitors and inerting systems, as well as the humble fire extinguisher. The primary form of active fire protection for hydrocarbon processing areas is the fixed deluge of foam to control pool fires ,cool equipment (except that impinged by jet fires), limit the effects of fires (eg, radiation, smoke movement) and to facilitate emergency response and evacuation, escape and rescue (EER) activities.

Protective clothing

The protective clothing you see roustabouts wearing today is not just there to make them look good and fashionably dressed: it serves to protect employees from hazards such as heavy chains dropping on feet to chemical spillages touching skin. Manufacturers including, JCB, CAT and Drager provide a wide range of protective gear to protect workers from slipping on oil, protection for ears and eyes, specialist firefighting and chemical hazard clothing.

Danish risk consultancy company DNV, attributes 80 per cent of the industry's accidents to

Demand for formal health and safety training has grown rapidly in recent years.

human error including inadequate or lack of timely routine maintenance, poor monitoring of safety procedures and a corporate culture that discourages feedback on problems as well as management blindness. As one industry insider said recently, "many corporate executives, when they go on inspection tours of rigs, are so blinkered they fail to see the reality of the dangers, which are so apparent to everyone else on the rig."

Demand for formal health and safety training has grown rapidly in recent years, according to Teresa Budworth, chief executive of health, safety and environmental examinations body NEBOSH (National Examination Board in Occupational Safety and Health). On offer locally are numerous petrochemical related health and safety best practice staff training courses, available at various levels including introductory, intermediate and advanced, either in-house, distance learning or public courses. In addition, there are a growing number of health and safety consultancies in the region, including Consusinternational.com in Abu Dhabi which offers process safety, hazard identification and risk assessments services for oil and gas operators.

Danish company DNV attributes 80 per cent of the industry's accidents to human error

A growing number of health and safety oil rig related businesses are being asked to train the increasing number of local citizens, required by governments to be employed as roustabouts, in safety standards and processes including fire safety procedures as well as instilling a positive health and safety culture. In addition, there are an increasing number of distance learning courses available for both new entrants and to those needing to regularly update their skills whilst working in the workplace.

The demand for health and safety services including training, risk assessment and other related services is likely to increase in the region due to a variety of factors including improvements in enforcements and the upgrading of regulations. In addition, the demands imposed by an increase in new exploration and production activity, both in traditional production areas such as Nigeria and Angola and in new hydrocarbon provinces such as the East Africa, increase the need for health and safety training. Many of these new production areas are in increasingly remote locations requiring sophisticated inbuilt rig platform protective measures and personnel who can be more self-reliant in tackling accidents and incidents. ■

Going to extremes

SAFETY SHOWERS THAT are required for the safety of employees not only have to meet the latest requirements and regulations governing health and safety, they also have to be able to withstand and operate reliably in extreme environmental conditions. Get it wrong and the employer can be liable for the consequences, and the employee could be seriously injured.

Janet Dickinson, operations manager of safety shower specialists Showers & Eyebaths Services, commented on why oil, gas and utility plants need to look carefully at conditions facing their workforce when specifying their safety equipment needs:

'With the worldwide search for oil, gas and other natural resources ever widening, global contractors are turning their attention to increasingly inhospitable environments. The extraction of such resources, which previously concentrated on areas such as the North Sea, now encompasses countries ranging from the freezing extremes of Kazakhstan and Alaska to the heat of the Middle East.

"With breakthroughs in drilling techniques, it is now possible to operate in temperatures dropping to minus 40°C and right up to 40°C. The goal posts are therefore moving all the time with regard to coping with potential hazards.

"Fortunately for the welfare of workers, previously less stringent rules governing safety in plants have long gone. Even in the emerging markets, health and safety requirements surrounding quick, effective decontamination are getting tougher with companies having to meet strict specifications and compliance to the ANSI Z358.1-2009 International standard. Such requirements are encouraging operators and specifiers to look at the quality of the units, their operational needs and length of service. Going for cheap is not necessarily going to be economical in the long term."

"As a starting point you need to look at your water supply," said Janet. "If you can't connect directly into a reliable mains water supply then you require a self-contained unit. Gravity fed tank showers, are the ideal solution providing a guaranteed supply and instant tepid water. They are not affected by water interruptions or electricity failure, making them, operationally, some of the most efficient and cost effective safety showers on the global market. Units are built entirely of GRP and Stainless Steel which ensures that they are corrosion resistant and avoid costly maintenance issues normally associated with using galvanised steel and wood based materials.

"You then need to look at the environment. In very hot countries, where the water supply feed is exposed to extreme heat, the water would be heated naturally by the sun to a dangerously high temperature. If the water was to remain at this temperature, it could cause or increase injury to the user.

"In situations where the contaminant is a burn-inducing chemical, the hot water would intensify the burns and cause the substance to be absorbed further into the skins pores.

"At the other end of the environmental scale, to suddenly douse someone with freezing cold water would not only shock them but at the very least give them hypothermia. The pores would close immediately, trapping the contaminant therefore hampering attempts to wash it off.

"In order to resolve these problems we ourselves have spent a great deal of time designing effective water cooling and heating methods which go beyond the 15 minute tepid water drench time as recommended by the ANSI.Z358.1 standard as we don't believe that just 15 minutes is enough when working with or near potentially harmful substances.

"In hot climates the provision of a chiller unit, coupled to a tank shower, reduces the water to the recommended 20°C. The chiller only activates when the incoming water exceeds this temperature, when the water has been cooled to the correct temperature the unit deactivates. Chiller units can be fitted to any tank shower.

Moving away from dry land to the sea, safety showers on oil and chemical tankers have to meet different design specifications to those on oil and gas fields.

Janet continued: "The units need to soak up huge wave momentum, whilst also delivering an uninterrupted flow of water to wash away hazardous spills and materials. The water tank of a safety shower can hold in excess of one tonne of liquid three metres up in the air. When static on land, this tremendous weight is not a problem.

However, out on the high seas, a shower is put under extreme stresses and strains. This will twist a solid stainless steel water tank, as the constant shifting of its load exerts a huge strain on the tank. By using a flexible plastic tank and 316 external reinforced stainless steel framework, the forces involved can be absorbed, as well as withstanding the salty atmosphere. An additional special GRP internal baffle de-compartmentalises the load, thus reducing momentum.

Fugro strengthens modelling capabilities

INCREASED INTEREST IN new development areas for oil and gas and renewable energy is resulting in growing demand for high-quality metocean data relating to these largely unexplored regions. In response, Fugro has strengthened its numerical modelling capabilities.

Modelling the complexities of local environmental conditions requires refinement, both in the wind fields driving the models and in the model grid size. Although global models are available, their scale is often too large to capture regional features like tropical cyclones with enough accuracy.

Fugro's newly expanded team of modellers is now working to fill this gap by creating a range of small-scale regional hindcast models that are nested within coarser global versions and driven by high-quality atmospheric model data.

Of course, validation is an essential part of the modelling process. Fugro has a unique advantage in this respect with its ever-increasing bank of specific, measured metocean data from a wide range of locations around the world providing an excellent validation source.

The products and services the modelling team can provide include long-term data sets for wind, wave and current hindcast; atmospheric, wave and current forecasts; and the site-specific modelling of near-shore wave and current processes. Fugro is also using high-quality atmospheric and current models to drive industry-recognised oil spill modelling software, resulting in improved accuracy in the prediction of oil spill trajectories.

Fugro is coupling current and wave models with sediment transport modules in order to derive the sediment pathways and identify the erosional and depositional areas to be considered in the planning and design of port and coastal infrastructure.

Multi-client seismic data offshore Mozambique

SCHLUMBERGER HAS ANNOUNCED the availability of its multiclient seismic survey offshore Mozambique. The Schlumberger multi-client seismic data offered in collaboration with the National Petroleum Institute of Mozambique (INP) includes reprocessed 2D lines and newly acquired seismic data, and provides detailed imaging of the subsurface.

"The recent discoveries and regional appraisals in the area indicate significant frontier exploration potential," said Maurice Nessim, president, PetroTechnical Services, Schlumberger. "By combining multi-disciplinary expertise for advanced attribute analysis and high quality acquisition technology, the data can provide valuable insights in this geologically complex area including illumination of the profile of structures and identification of faults."

More than 110,000 km of exclusive 2D seismic data—the most extensive data library of offshore Mozambique—are available for licensing, including more than 36,000 km of recently acquired long-offset 2D data using the ObliQ* sliding-notch broadband acquisition and imaging technique.

The Schlumberger multi-client data are available in all offshore blocks offered in the Mozambique 5th Licensing Round issued by INP.

Savannah begins FTG survey in Niger

SAVANNAH PETROLEUM, THE Niger-focused oil and gas company, has announced that its airborne Full Tensor Gradiometry (FTG) survey on the R1/R2 licence area has begun.

The commencement of the survey was marked by a ceremony at Niamey Airport on 21 November 2014 in the presence of representatives of the Niger Ministry of Energy and Petroleum and other guests, as well as representatives of Savannah Petroleum and ARKeX, a leading geophysical service company which will be conducting the FTG survey.

During the survey the ARKeX N344CS Twin Otter aircraft will operate from China National Petroleum Corporation's Jaouro airstrip which is located in close proximity to the R1/R2 permit. The N344CS will make a series of daily flights over the R1/R2 licence area and its surrounds, acquiring valuable geological data which it is anticipated will materially expand the company's existing R1/R2 exploration target inventory. The survey is expected to be completed in Q1 2015.

Speaking at the ceremony, Adolphe Gbaguidi, director general hydrocarbons, said: 'At its first management committee a few months ago, Savannah Petroleum took the commitment to conduct an FTG Survey on its license area. Today the Ministry of Petroleum is pleased to witness that Savannah is keeping its promises. The ARKeX plane is here and will fly to Agadem to start the survey. We are extremely happy because it will be the first time an FTG Survey is done in Niger. Having access to an advanced technology like this is exactly why we chose to diversify our partners and welcomed Savannah in Niger. We thank Savannah for making such an innovation in Niger's oil and gas industry, and hope that the results of the survey will help Savannah improve its subsurface geological model with the objective to make important discoveries.'

Jim White, CEO of ARKeX, said: 'ARKeX and FTG have a successful track record in assisting the exploration of African rift systems and we are delighted to be bringing our acquisition, processing and interpretation expertise to Savannah Petroleum in Niger. We believe the resulting high resolution 3D gravity data ARKeX will produce should have a significant positive impact on future exploration activity in the basin and are very pleased to have been awarded the Savannah Petroleum survey.'

Airborne gravity/magnetic survey confirms viability of leads in Chad

ERHC ENERGY CHAD, a subsidiary of ERHC Energy Inc, a publicly traded US company with oil and gas assets in sub-Saharan Africa has announced that preliminary findings from an airborne gravity/magnetic survey of BDS 2008 in southern Chad strongly confirm the viability of leads in two focus areas identified by ERHC's technical team after careful analysis of previously collected data. ERHC's sub-contractor, Bridgeport Ltd, a specialist geosciences company, has completed the survey that began in October.

The aerial survey, flown over 4,720 km line, evaluated the hydrocarbon potential within ERHC's Block BDS 2008 in the area north of Esso's Tega and Maku discoveries in the Doseo basin and a second area situated east of OPIC's Benoy-1 margin discovery in the Doba basin. Bridgeport employed a three-sensor aircraft equipped with a GT-2A airborne gravity system for gravity recording and a G-822 Mobile Cesium Magnetometer for aeromagnetic recording. The aircraft was flown at an altitude of 150 metres.

"Bridgeport conducted a precise data acquisition, and the first-order leveled raw free-air gravity and magnetic anomaly maps strongly confirm the viability of the leads," said ERHC's senior geoscientist Michael Shafie. "The findings are very impressive. While final processing and interpretation is currently going on, our team is already discussing proposals for the requisite follow-on seismic survey."

ERHC is pursuing a rift margin play in BDS 2008 similar to exploration strategies that led to recent major discoveries in East Africa. ERHC's focus areas in the Block are located on a rift margin along the Central African Shear Zone. Regional stratigraphic mapping indicates the presence of alluvial fan deltas and lacustrine deltas in ERHC's areas of interest, which provide both reservoir and seal rocks.

The company owns 100 per cent of the interest in BDS 2008. To spread risk, ERHC management continues to discuss the possibilities of a farm-in into Block BDS 2008 with potential partners.

In November, ERHC announced it is proceeding with Exploration Phase 2 in Kenya's Block 11A, committing to either acquire 3D seismic or proceed directly to drilling one exploration well during the next two years.

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Ghana gives Eni the OK for US$6bn offshore gas project

GHANA'S GOVERNMENT HAS given Eni the final green light to develop gas resources in the offshore Cape Three Points block, expected to begin production in 2017, Reuters reported.

The government also plans to acquire a third FPSO to be used for the US$6bn offshore project, which must now be approved by Ghana's parliament.

"This project promises to deliver up to 170 mmcfd for the next 20 years and put Ghana on its way to a future where one of the critical constraints to power generation (cheaper fuel) will be addressed," it said.

The US$6-bn project covers all costs leading to production of oil and gas, including the initial cost of the FPSO, which will be leased, according to a senior official at Ghana National Petroleum Corp. Eni operates the OCTP block, while Vitol and GNPC serve as partners.

BP expands in Egypt with US$240mn investment

BP EGYPT HAS confirmed that it has been awarded two new exploration blocks as a result of the 2013 EGAS bid round. BP and its partners have committed to invest a total of US$240mn in the blocks over different phases.

Block 3 – North El Mataria is BP's first entry into the onshore Nile Delta. The block is located in the northeastern part of the Nile Delta cone, approximately 57 km to the west of Port Said city. BP will operate the block with 50 per cent equity and Dana Gas of Abu Dhabi will hold the remaining 50 per cent working interest.

Block 8 - Karawan Offshore is located in the Mediterranean Sea. The block lies at approximately 220 km to the NE and 170 km to the NW of Alexandria and Port Said cities respectively. BP will have 50 per cent equity and the block will be operated by Eni which holds the remaining 50 per cent.

The programme will include 3D seismic and three exploration wells in each of the onshore and offshore blocks in phases over six to eight years.

Hesham Mekawi, BP North Africa regional president, commented, "BP is proud of the successful partnership it has had with Egypt for 50 years. We look forward to continuing to play a key role in the development of Egypt's energy sector and maximising the use of our existing resources. Our expertise and latest technologies will be deployed for mutual benefit in these new blocks which we believe have gas-bearing characteristics. Exploring the two blocks will require substantial investments to unlock their potential, and will be done as part of our commitment to meeting Egypt's energy needs. We also look forward to working with our Abu Dhabi partners at Dana Gas."

Kilwani North to produce first gas in 2015

THE KILWANI NORTH field onshore Tanzania is expected to start production at approximately 20mn scfd in early 2015. Construction of a two kilometre pipeline from Kilwani North-1 wellhead to the new SongoSongo processing plant is expected to be completed by the end of 2014.

Once producing, Kilwani North Development Licence (KNDL) will represent a major milestone for Aminex by providing first revenues to the company from its Tanzanian assets. Independently verified resources at KNDL are estimated to be 45bn cfg in place.

London-listed Aminex Petroleum operates the asset with 65 per cent, with RAK Gas 25 per cent, Bounty Oil 10 per cent. If Solo elects to take up 13 per cent entitlement, on account of the discussions it is having with Aminex and the Tanzanian authorities, Aminex's equity will rise to 52 per cent.

Africa LPG and Kautex sign deal in Nigeria

AN INDIGENOUS FIRM, Africa Liquefied Petroleum Gas (Africa LPG) Equipment Company has signed a pact with Kautex Maschinenbau of Germany to establish a composite gas cylinder manufacturing plant in the country.

The plant, which would be the first composite gas cylinder manufacturing factory in sub-Saharan Africa, is estimated to gulp about US$50mn (N8.4bn) and it would be sited in Lekki Free Trade Zone, Lagos.

The construction and commissioning of the plant, which would take about 15 months, would help bring down the price of composite gas cylinders that now ranges between US$109 and US$120. It is also expected to reduce the price of cylinders, encourage the conversion from steel cylinder to composite cylinder and ultimately bridge the huge gap in gas utilisation.

The plant, estimated to have the capacity to produce one million cylinders annually, would take off with 150,000 products in the first phase, then progress to 500,000 and ultimately one million.

The Federal Government through the Nigerian Content Development and Monitoring Board (NCDMB) has placed strict restrictions on the influx of imported steel cylinders into the country.

NCDMB had therefore set a target for local manufacture of five million gas cylinders by 2015.

Taofiq Tijani, Lagos state commissioner for energy and mineral resources, while speaking during the signing of the pact, said the project was in line with the state government's Eko Gas project and would therefore enjoy support from this administration.

Excelerate to lead Equatorial Guinea FLNG studies

OPHIR ENERGY HAS appointed Excelerate Energy as its lead midstream partner for provision of FLNG facilities for the block R project offshore Equatorial Guinea.

Excelerate will lead a consortium of technology providers likely to include Samsung Heavy Industries and Black & Veatch. The EquatoGuinean Ministry of Mines, Industry and Energy, GEPetrol, Ophir and Excelerate are due to sign a Memorandum of Understanding on the project soon, ahead of awarding a full front-end engineering and design contract shortly.

Ophir estimates recoverable gas resources from block R at 3.4 tcf. It plans a four-phase development, beginning with the Fortuna field. A further 2.1 tcf-plus will be phased in later from the Silenus, Tonel, and other offshore discoveries.

Enhancing safety with LNG for offloading systems

THE WORLD IS looking increasingly to natural gas to satisfy its growing energy demand, much of which will probably be met by remote offshore resources such as the massive deposits off the coasts of Australia and East Africa. Offshore natural gas is converted into liquid form - LNG - for cost-effective storage and transportation over long distances. LNG takes up about 1/600th the volume of natural gas in its gaseous state. In remote areas, floating LNG (FLNG) units are ideal, and they have caught the interest of both major oil and gas players and many nations.

So far, only a few projects have come to fruition for a combination of reasons. Most importantly health and safety (HSE) requirements must be met as LNG is highly flammable and very large offshore platforms need to be moored and maintained for as long as 20 years.

"We expect that FLNGs have the potential to become a major game changer," said Xavier Delineau, managing director of the oil and marine hoses business of Trelleborg Industrial Solutions.

"Using FLNGs, the supply chain takes a shortcut," he continued. "The gas can be efficiently processed, treated, liquefied, stored and exported on the same vessel, directly at the source. There is no need for a permanent pipeline transportation network. It is very cost effective. Positioned remotely from the coast, the operation is also much safer in certain locations in the world."

In the quest for a solution that would contribute to making FLNG operations safer and more reliable than existing ones, Trelleborg started development of Cryoline LNG in 2009 together with oil and gas companies Saipem and Total. The resulting LNG tandem offloading system is safe even under extreme weather and environmental conditions.

Vincent Lagarrigue, marketing and project major for the oil and marine hoses business of Trelleborg, said, "With traditional side-by-side offloading solutions, the distance between the LNG carrier and the FLNG terminal is typically no more than five metres, Using our new cryogenic floating flexible hoses, this can be increased to as much as 150 to 250 metres, significantly limiting the risk of collisions."

The operator will be able to connect the system at wave heights of up to 3.5 metres and to offload with four-metre waves. This means improved offloading availability and less downtime than with conventional loading arms or mechanical aerial systems. The liquefaction process for natural gas involves cooling to cryogenic temperatures as low as -165°C. Producing a hose to handle media at this temperature has been difficult. The patented system is made of one vertical reel along with three cryogenic hoses and a connection head. There are two lines for the LNG transfer and one for vapour return to the FLNG unit.

The hoses feature a hose-in-hose design with an inner hose that transports the cryogenic fluid. It is protected by an outer hose, which, in turn, is protected by an insulation layer between the hoses. The hoses are fitted with an integrated leak-monitoring system that detects even very small leaks, enabling the operator to react in good time. There is also a specially designed connection system.

"It is based on proven technologies within the Trelleborg Group," said David Mayau, technical and engineering manager for Trelleborg's oil and marine hoses. "Tandem offloading floating operations have been used for many years in oil transfer and it is a configuration that operators know how to handle. Apart from the safety, it is a flexible and reliable solution." There have been numerous tests to fulfill tough customer requirements, including

The future for shale gas in Africa

AFRICA IS HOME to a wealth of natural resources with 30 per cent of the world's known minerals. It also houses significant producers of oil and gas owing to recent discoveries. Less well known is that Africa is home to important shale gas resources, estimated by the US EIA agency in a report of 2013 to amount to some 1,362 trillion cubic feet (tcf) of technically recoverable shale gas in six countries: Algeria, South Africa, Libya, Egypt, Tunisia and Morocco. See Table 1.

In total, Africa's estimated technically recoverable shale gas resources are more than double those of the US (with 665 tcf) and exceed those of China (with 1,115 tcf). Algeria, with 707 tcf is not only the leading potential shale gas country in Africa but ranks in third place behind the infant shale developments in China and Argentina. South Africa, with 390 tcf, comes second to Algeria in Africa and is followed at a distance by Morocco. The potential shale gas resources of Algeria, South Africa and Libya greatly exceed their conventional gas resources, offering the prospect of a surge in electricity supply to households and industry, a reduction in blackouts as well as new jobs and increased government revenues.

However, industry experts suggest that the amount of economically viable shale gas reserves will fall well short of estimated reserves. In the case of Algeria, this is likely to be around 145 tcf, though the actual figure will depend on the current market price of gas together with extraction costs.

Industry experts suggest that the amount of economically viable shale gas reserves will fall well short of estimated reserves.

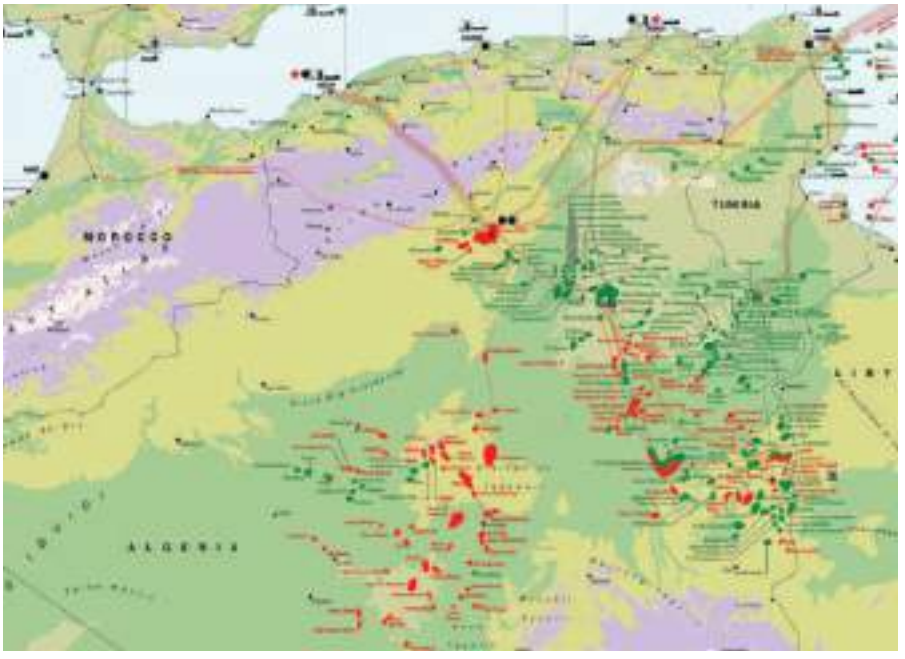

Fig 1: Algeria's hydrocarbon map.

Shale prospects

"Despite the hype, there has not been much activity," stated Stéphane Foucaud, managing director of institutional research for FirstEnergy Capital LLP. Moreover, he added, "We are not expecting this industry to take off any time soon". To date, only Algeria, Morocco and South Africa have offered a few exploration blocks. One major obstacle is that governments have to design shale-specific clear, if not transparent, rules for the bidding process, fiscal and contract terms, the government "take"and geological information for each shale block in order to attract serious interest whilst offering an acceptable balance between reward and risk for each party. Another is that shale gas explorers need to assess the geology and size of the potential resource to determine whether and where to drill. For example, Algeria's energy ministry estimates that it will take between seven and 14 years to confirm the size and viability of its shale gas reserves, reported Al Jazeera, October 2014. In Algeria's recent bidding round Statoil and Shell were awarded the Timissit Permit Licence in the Illizi-Ghadames Basin and Repsol and Royal Dutch Shell the Boughezoul block in the north. See Figure 1.

Preconditions for shale exploitation

According to Nic Newman's *The New Shale Gas Countries: The prospects for shale gas outside North America,* PennEnergy 2014, many factors affect the viability of shale gas exploration and

Table 1. Estimated shale gas reserves in Africa 2013-2014

COUNTRY	TECHNICALLY RECOVERABLE SHALE GAS RESERVES TCF (1)	STAGE IN EXPLORATION AND PRODUCTION PROCESS	PROVEN CONVENTIONAL GAS RESERVES TCF	PRODUCTION OF CONVENTIONAL GAS BCF/YEAR
Algeria	707	Licencing	159.05	2,922.92
South Africa	390	Exploration	0.42	45.20
Libya	122	N/A	54.63	12.0
Egypt	100	N/A	77.20	2,141.05
Tunisia	23	N/A	2.30	65.80
Morocco	20	Licencing	60.0	0

Source: (1) EIA/ARI World Shale Gas and Shale Oil Resource Assessment 2013, BP, Statistical Review of World Energy 2014

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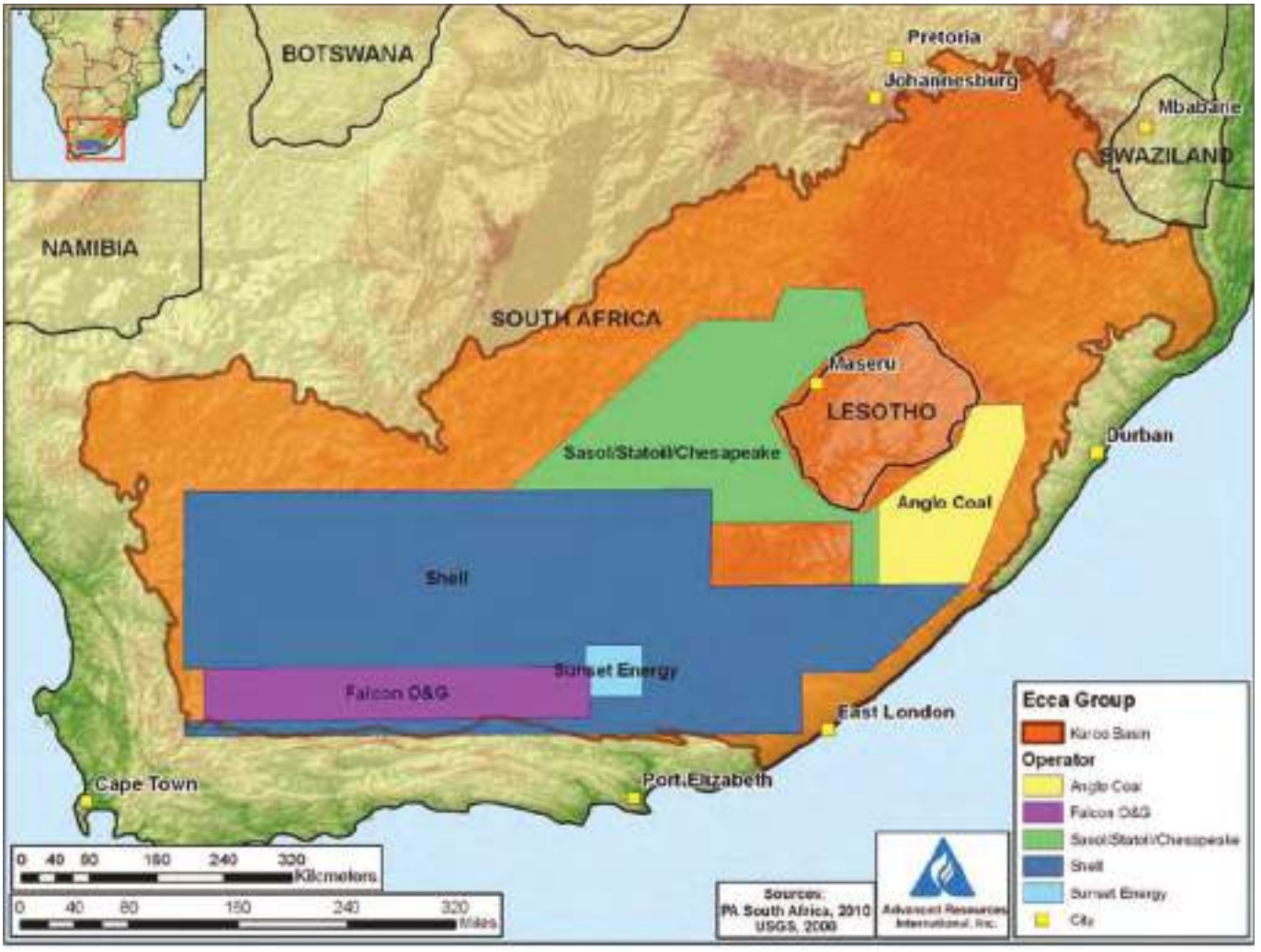

Fig 2: Map showing operator permits in the Karoo Basin, South Africa.

production, including, the right geology, infrastructure, land access, size of market, field service capacity, water availability, fiscal factors, politics and, increasingly, the public's attitude towards fracking and horizontal drilling. Of these, the geology, the market, field service capacity, availability of water and politics are important considerations for the future of shale in Algeria and South Africa.

Algeria and South Africa have the "right rocks" but uncertainty remains as to the quantity of gas that could be extracted economically. Both offer a large and growing market for gas. In the case of Algeria, shale gas offers to replace declining conventional gas output which dropped from 88 bcm in 2005 to 78 bcm in 2013, whilst domestic gas consumption rose from 20 bcm in 2003 to 31 bcm in 2013. Algeria's ambitious shale gas target of 10 bcm in 2015, if realised, could boost exports to Europe eager to reduce its dependence on Russian gas. In South Africa, shale gas could reduce the country's substantial fuel import bill, boost electricity production and thereby facilitate an expansion of energy intensive industries such as petrochemicals, plastics and fertilisers. However, the future of shale in South Africa is hostage to economic viability, environmental considerations and water availability alongside the possibility of a major offshore conventional gas discovery.

Expertise in shale severely limited

Exploration and production of shale gas depend upon the presence and capability of field services, in particular, the availability and number of high power drilling rigs with sufficient hydraulic fracturing capacity and completion and support services. Despite oil and gas production in several African countries, the continent does not have a well-developed oil field support service sector and expertise in shale is severely limited. Moreover, large quantities of water are essential for hydraulic fracturing, an essential process in the extraction of shale gas. Arid and semi-arid conditions typify the locations of shale gas formations in both Algeria and South Africa. Complicating the situation further, water used in shale extraction is chemically treated, making the water that emerges from the well unusable for other purposes. "As a result, it is likely to be much more expensive in Africa than the US to produce shale gas," suggested Stéphane Foucaud.

An essential precondition for development of natural resources is the presence of a stable political and transparent regulatory and fiscal climate. Algeria has paid the price for a widely acknowledged difficult business environment, including a poorly constructed law for shale, an opaque, faction-riddled government, a state-dominated economy and the uncertainty generated by an election in 2015 - all factors which have deterred private investment. As Foucaud pointed out, "in Algeria, politics make any business both conventional and unconventional complicated".

In contrast, South Africa has a 'can-do' culture. "Unlike most African countries, South Africa has a well-developed financial, industrial, infrastructural and educational base, which is well able to support the scale of economic development required to develop oil and gas fields," stated Ashby Rudd, global head of oil & gas investment banking, at Standard Bank, South Africa. With over half the reserves of Algeria, South Africa has amended its hydrocarbon laws and attracted Royal Dutch Shell, Sasoil, Statoil and independent Falcon Oil and Gas to its shale gas reserves located in the Karoo desert. See Figure 2.

If viable quantities of shale gas are found it is likely that South Africa will be producing the first commercial shale gas on the African continent. However, given the high costs of shale gas drilling and extraction, Stéphane Foucaud, rightly asked, "Why would one bother with shale gas in Africa when so much conventional gas is available? For instance, off the coast of East and Southern Africa many significant natural gas finds have been found. It is likely that such conventional cheaper opportunities will be prioritised over more expensive shale gas". ■

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First subsea tree assembly in Nigeria

LEADING SUBSEA SERVICE company FMC Technologies Inc has commissioned its first subsea production tree built entirely in Nigeria. The equipment, manufactured for Shell Nigeria Exploration and Production Co Ltd's (SNEPCo) deepwater Bonga North West project, marks the company's first subsea equipment engineered, manufactured, tested, installed, and serviced entirely in the country.

Oil production from the first well at the Bonga North West began on 5 August 2014. Four oil producing wells and two water injection wells in the Phase 1 development will be connected to the Bonga FPSO.

Shelagh Daley, area manager of FMC Technologies Africa region subsea, said: "We have been working with SNEPCo to supply subsea systems for the Bonga North West development since 2010. This local manufacturing of equipment marks a significant milestone for the company and for the country's energy industry.

"FMC Technologies is contributing to the development of the Nigerian economy not only harnessing and utilising the country's natural resources, but also by employing and developing skilled local professionals. FMC Technologies' operations in Nigeria are responsible for more than 2,000 jobs in Nigeria, including employees and through our supply chain."

RAK Petroleum ups stake in Côte d'Ivoire field

UAE-BASED RAK Petroleum, an energy investment company, announced that it has invested up to US$10.6mn to increase its indirect stake in an oilfield situated in Côte d'Ivoire.

The company raised its stake in the oil field Block C1-27 to 9.1 per cent following an acquisition by Foxtrot International, a West African exploration firm in which RAK Petroleum is a shareholder.

Prior to the increase, RAK Petroleum previously held about eight per cent of indirect stake in Block C1-27. Foxtrot and its joint venture partners bought the shares in the block from Energie de Côte d'Ivoire, a statement said.

Block C1-27 contains Foxtrot and Mahi, which are the two largest gas fields in Côte d'Ivoire.

Foxtrot International produces more than 70 per cent of the gas in Côte d'Ivoire from the Foxtrot and Mahi fields and is nearing completion of a four-year plan to develop two other discoveries, the Marlin oil and gas field and the Manta gas field.

The first production from the Marlin field is expected in 2015.

"Development of the previously discovered Marlin oil and gas field and the nearby Manta gas field is on track following the successful installation last month of the jacket over the Marlin field, part of a four-year, UJ$1bn, expansion programme on Block CI-27," the company said.

"Once completed, the platform, the second production platform on the block, will support development of both fields and increase deliverability from Block CI-27 commencing in 2015."

The first platform on Block CI-27, which has been in operation since 1999, currently processes a daily average of 145mn cfg and 1,000 barrels of oil and condensate from the Foxtrot and Mahi fields.

Eni starts production offshore Angola

ENI HAS STARTED production of first oil from the West Hub Development Project in Block 15/06 in the Angolan deep offshore, approximately 350 km northwest of Luanda and 130 km west of Soyo. The field is currently producing 45,000 bopd through the N'Goma FPSO, with production ramp-up expected to reach a daily production of up to 100,000 bopd in the coming months. The start-up of the East Hub Development, expected in 2017, will raise overall production from Block 15/06 to 200,000 bpd.

The development project started with a very successful exploration campaign. Having won the international bid round in 2006, in Block 15/06 Eni drilled 24 exploration and appraisal wells, discovering over three billion barrels of oil in place and 850mn barrels of reserves. The discoveries were then developed quickly and efficiently, achieving an industry-leading time to market of only 44 months from the Declaration of Commercial Discovery thanks to the application of a new modular development model. Indeed, the West Hub Development entails the sequential start-up of the Sangos, Cinguvu, Mpungi, Mpungi North Area, Vandumbu e Ochigufu fields.

Eni will also continue its exploration programme in Block 15/06: potential discoveries tied in quickly and cost efficiently. A recent example is the Ochigufu discovery, which added 300mn barrels of oil in place and which will be tied in to the N'Goma FPSO within the next two years.

Eni CEO Claudio Descalzi commented, "The start-up of the West Hub in Angola is a milestone in Eni's upstream activities. Starting from an extraordinary exploration success we have achieved an industry-leading time to market of only four years from the declaration of commercial discovery. This result reflects a new, modular, development model which adds value to our strategy of organic growth. The start up of the West Hub is also significant in terms of Eni's presence in Angola, where we are again operator of a major producing project"..

Sankofa goes ahead for first oil in 2017

GHANAIAN AUTHORITIES HAVE approved the Plan of Development (PoD) for the Sankofa complex offshore Ghana. Eni is the operator of the Offshore Cape Three Points (OCTP) block in the Tano Basin, where the field is located. The PoD envisages first oil in 2017 and first gas by 2018. Eni estimates discovered volumes here as 490mn barrels original oil in place (OOIP) and 1.2 tcf of gas in place (GIIP).

The government is particularly interested in Sankofa development because "this project promises to deliver up to 170mn cfd of gas for the next 20 years and put Ghana on its way to a future where one of the critical constraints to power generation (cheaper fuel) will be addressed." The key challenge is the processing and transportation infrastructure to get the gas to several power plants in the country. Ghana is building a number of gas-fired thermal plants and even importing thermal barges, all of which will need at least 400mn scfd by 2018.

Oil production is expected to peak at around 50,000 bopd.

Total unveils FPSO for CLOV

TOTAL HAS INAUGURATED its US$9bn FPSO for the CLOV project on Block 17 in Angola. CLOV went into production in July this year and has 34 undersea wells with a maximum production capacity of 160,000 bpd. The project covers an area of 380 sq km and holds an estimated reserve of 505mn barrels of oil with a 20-year-old life span, the French explorer said.

Total group president Patrick Pouyanne said, "Despite the recent volatility in oil prices, the group has a long-term vision alongside previously announced projects, such as Kaombo in Angola. Total has three strengths — ultra-deep water, liquefied natural gas and Africa. It is the largest oil producer in the continent and in Angola."

At 700,000 bpd, the block is touted to become Total's most prolific production site, which will help bring the company a step closer to achieving production potential of three million bpd by 2017.

Total operates Block 17 with a 40 per cent stake, alongside Statoil holding a 23.33 per cent, ExxonMobil with 20 per cent stake and BP carrying the remaining 16.67 per cent.

Bowleven gets Bomono extension

BOWLEVEN, THE AFRICA-focused oil and gas firm, has been given another year to meet its commitment to drill two exploration wells on the Bomono permit onshore Cameroon.

The Edinburgh-based company said the authorities in the West African country have granted a one-year extension to the Bomono exploration licence, to 12 December 2015, to allow for the completion of operations.

Bowleven added that preparations for a two-well drilling programme on Bomono are underway. The company said a rig has been mobilised to Cameroon and drilling operations are expected to commence around the end of the year. Before the permit was extended the company had a commitment to drill two wells on Bomono by December 2014. Bowleven is awaiting approval from Cameroon's President Biya for a deal to sell stakes in the Etinde permit offshore for a total US$250mn, which it agreed in June.

RWE Dea increases production volume and plans further exploration in Egypt

RWE DEA DOUBLED its oil and gas production in Egypt. North Africa is a strategic core region for Dea. The company is one of the leading foreign investors in Egypt and has been producing oil and gas in the country for 30 years. RWE Dea presented applied technology highlights and recent projects at the MOC 2014 in Alexandria.

At the company's own booth and in the technical programme, Dea presented technology highlights and case studies of its exploration and field development work in the onshore Nile Delta and the Gulf of Suez. "North Africa is one of our strategic core regions," explained Maximilian Fellner, general manager of RWE Dea Egypt. "In Egypt, Dea can look back upon three decades of oil production. We recently doubled our overall production in the country through getting our onshore gas project Disouq on stream. We are delighted about these success stories and will continue on this track, as we see further potential in the region," Fellner added.

Since 1984, Dea has produced over 640mn barrels of crude as operator in the Gulf of Suez. With ongoing investments in modern technology and infrastructure, Dea has maintained high production levels from the three oil fields over the years.

Dea has plans for additional exploration in the Gulf of Suez. At the East Ras Budran Offshore concession, the company plans to acquire seismic and drill an exploration well. The work programme for the recently awarded two offshore concessions (the award is subject to approval by the Egyptian authorities) will include seismic reprocessing and two exploration wells at the East Ras Fanar Offshore and one well at the Northwest El Amal concessions.

An important growth project for RWE Dea in Egypt is the Disouq onshore gas development in the Nile Delta. Dea achieved first gas last year and added the own built Central Treatment Plant to production this summer. For 2015, the company expects further production increases from Disouq up to the capacity of approximately 200 mmcfd of gas.

AFRICAN RIG COUNT

The Infield Systems Ltd. Rig Count tracks industry-wide offshore rigs engaged in drilling and related operations, which include drilling, logging, cementing, coring, well testing, waiting on weather, running casing and blowout preventer (BOP) testing.

NOVEMBER 2014 - OFFSHORE

	NOVEMBER 14	OCTOBER 14	VARIANCE	NOVEMBER 13	OCTOBER 13	VARIANCE
Country	Offshore	Offshore	From Last Month	Offshore	Offshore	From Last Month
ANGOLA	21	22	-1	18	19	-1
NIGERIA	17	18	-1	19	17	2
GABON	5	6	-1	4	4	0
CONGO (BRAZZAVILLE)	4	5	-1	6	5	1
MOZAMBIQUE	1	1	0	4	3	1
GHANA	2	2	0	3	3	0
CAMEROON	3	3	0	4	3	1
EGYPT	15	15	0	19	17	2
TUNISIA	2	2	0	2	2	0
SOUTH AFRICA	2	3	-1	1	1	0
TANZANIA	2	2	0	2	2	0
EQUATORIAL GUINEA	1	2	-1	2	2	0
NAMIBIA	1	1	0	1	1	0
LIBERIA	1	1	0	0	0	0
LIBYA	2	2	0	0	0	0
TOGO	0	0	0	1	1	0
SENEGAL	1	1	0	0	0	0
BENIN	2	1	1	0	0	0
KENYA	0	0	0	1	0	1
MOROCCO	2	2	0	0	0	0
MAURITANIA	0	0	0	0	0	0
TOTAL	84	85	-5	85	82	7

Source: Infield Systems Ltd.

Sahara in extended well test, to first oil 2015

SAHARA ENERGY, THE Nigerian independent, is carrying out an extended production test on the Oki field in OPL 274 in northwestern Niger Delta. This is preparatory to first oil from the field, sometime before the end of first half 2015. The company successfully drilled two appraisal/development wells and an exploration well between September 2013 and August 2014, with the first appraisal/development well logging 64 metres net pay in 12 sands and flowing 3,129 bopd in several zones. The second appraisal/development well encountered 91 metres net in 19 reservoirs and tested at 2,397 bopd. Sahara did not disclose the number of sands that were tested. The exploration well found 30 metres net oil sands in four levels and flowed 1,600 bopd. The company reported that seven new pays showed up in the two appraisals.

Liberia to launch round covering Harper basin

LIBERIA IS SET TO launch a new offshore licensing round in 2015 covering the virgin Harper basin, just weeks after bids were submitted for a four-block offering in the Liberia basin. Althea Sherman, COO of state-owned Nocal, said "a bid round focussing on the Harper basin....is planned for next year once regulatory reform has been completed."

Norway-based TGS will support Nocal in the Harper basin round much as it did in the Liberian basin offerings.

Peter Conn, head of geophysics at TGS, said "it is anticipated there will be a licensing round across the Harper basin...announced in early 2015."

Using the Polarcus Asima vessel, TGS acquired about 6,180 sq km of 3D seismic data in the undrilled basin last year.

The survey was acquired over blocks LB-2, 3, 4, 5, 29 and 30, although it is unclear if all of these will be made available to bidders.

Conn said analysis of this seismic data combined with other information "indicates all the elements of a working petroleum system present."

More than 30 large leads have been identified, each covering an area of more than 40 sq km, with 11 larger than 100 sq km.

Large channel systems of Cenomanian to Maastrichtian age are among those prospects to have been pinpointed.

The Harper basin covers an area of about 20,000 sq km and is sandwiched between the Liberian basin to the north and the Ivorian-Tano basin to the south east. Conn said the Harper basin is the last undrilled basin along the West African transform margin saying it is a good analogue to the Tano basin.

MOL has provided a fleet of Allison Transmission-equipped heavy-duty trucks to ENAFOR, enabling the company to establish drilling operations in the Sahara desert.

Enafor recruits MOL trucks for Sahara expansion

SPECIAL DUTY VEHICLE manufacture MOL is to provide a fleet of desert-tough trucks for the Algerian company ENAFOR. The fleet will be enabling the company to set up drilling sites in the Sahara by functioning as the logistical back bone of the operation.

ENAFOR continues to work on maintaining and expanding its output capacity. This growth incorporates an increase in drilling operations, which involves pushing deep into the Sahara desert to reach untapped reserves.

The company's operations are based in Hassi-Massaoud, a town about 1,000 km south of Algiers. It is from here that the rigs and their support network will be dispatched, into the desert on an unforgiving cycle of exploration as they seek to expand their operation. Typically the rigs will be assembled along with the support infrastructure and run for six weeks. After this they will be dismantled and moved on to the next location.

The lynch pin to this task is the fleet of immense MOL trucks. These mechanical beasts will eventually be a 65-vehicle strong fleet. Ten model HF5066 tractors are already on site, each with a GCW rating of 90 tonnes and supplied with matched trailers also built by MOL. Another 55 HF7566 tractors with a GCW rating of 110 tonnes will be provided over the next 30 months. All 65 vehicles are 6x6s.

The MOL trucks will deliver and unload the unassembled rigs to their drilling locations along with facilities and accommodation for the crews. It is a demanding task.

Unloading and loading has in the past always been with a winch and gin-poles. MOL has, in the case of both its HF5066's and HF7566's, chosen to use a winch and tail-roller only. It is an arrangement that functions well because the ENAFOR equipment is skid mounted. The MOL trailers that have been supplied with the HF5066's have a bed length of 12200 mm and can carry two 20 ft ISO containers or one 40-footer. These trailers are designed for tail loading, but can load over the front-end if required, with the final metre forming an angled ramp. In this mode the tractor will reverse to the tail end of the trailer and winch the load on. Alternatively if the load is a vehicle it can drive on under its own power.

In between loading and unloading the trucks will be hauling loads right up to their capacity in the 50°C heat and on adverse desert terrain where power and stability are essential. The accommodation units of the drilling crews can be up to two or three times as wide as the trailer on which they are being pulled.

Specified with rugged features including a solid front bumper known as a 'cow catcher', MOL trucks like this HF7566 assigned to ENAFOR are ready for the challenges of desert terrain.

Delivering that power and stability in each of the 65 tractors is a combination of a 600 bhp Cummins QSX15 turbocharged and charge air cooled 11.9-litre in-line six engine, and an Allison 4700 Series automatic transmission. Given the duties these vehicles will be carrying out and the environment in which they will be performing it is a formidable combination.

MOL has used Allison transmissions for over 40 years and they are equipped as standard. In the case of the ENAFOR fleet they were chosen for two reasons: high torque capacity and reliability. They are essentially desert-proof.

These transmissions set in a tough chassis with a 6x6 wheel configuration make the trucks more than suitable for the gargantuan task ahead of them. Allison's torque multiplication and continuous power technology add to the ability of the trucks to manoeuvre and negotiate unforgiving desert routes.

Unfaltering durability is a must

In terms of reliability the necessity for this is not just an economic factor. When the consequences of a failure or breakdown in a remote location as punishing as the Sahara desert is considered, it is clear why unfaltering durability is a must.

The increase in the fleet over the next two-and-a-half years is due in part to ENAFOR's continuing commitment to maintain and grow its output capacity, protecting its market share. Their intention is to double the number of 34 rigs they currently have in operation by 2018. An increase like this will demand a rise in transport capacity, not only for the rigs, but for the associated support buildings and equipment too. ■

Transporting the disassembled drilling rigs through unforgiving desert is no easy feat.

IFC promotes Nigerian power projects

IFC, A MEMBER of the World Bank Group, has signed agreements to provide US$80mn of debt financing to Azura Power West Africa Ltd, a 450 MW gas-fired independent power project in Nigeria (the Azura-Edo IPP). The project will strengthen Nigeria's gas-to-power value chain and deliver much-needed electricity to almost 14mn residential consumers in the country.

The Azura-Edo IPP consists of the construction, operation and maintenance of a 450 MW gas-fired open-cycle power plant located in Edo State, Nigeria. It also includes the construction of a short 330kV transmission line and an underground gas pipeline spur connecting the power plant to the country's main gas trunk line.

The project has been developed by a consortium of investors led by Amaya Capital Ltd, a principal investment firm focused on energy projects in West Africa. The other shareholders are American Capital Energy and Infrastructure, the Africa Infrastructure Investment Fund 2, Aldwych International Ltd, Pan African Infrastructure Development Fund 2 LLC, and the Asset & Resource Management Company Ltd.

Mr Sundeep Bahanda, co-founder of Amaya Capital and Dr David Ladipo, managing director of the Azura-Edo IPP, said in a joint statement: "The completion of the financing is a major milestone in

our project development timeline. We have been working very closely with our financing partners over the past few years and today's signing reflects all the tireless work put in by all the financiers and our advisors."

IFC is providing US$50mn in debt for its own account, and US$30mn of subordinated debt, for a total of US$80mn. IFC is also mobilising US$212.5mn, of which US$177.5mn has been jointly raised with Dutch DFI Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden (FMO), in long-term financing from a pool of eight development finance institutions.

"This project is a cornerstone of the World Bank Group's energy business plan for Nigeria to support the country's extensive energy reform programme," said Bernie Sheahan, director for infrastructure at IFC. "The World Bank Group's substantial involvement in the Azura-Edo power project is a clear confirmation of our commitment to help the Federal Government of Nigeria develop a sustainable gas-to-power sector."

IFC has worked closely with its sister institutions of the World Bank Group, which are providing additional support to this landmark transaction: the Azura-Edo IPP is the first project to benefit from the World Bank guarantees to support the mobilisation of private capital in the power sector in Nigeria, and will further gain from political risk insurance to be provided by MIGA for equity and commercial debt.

As the first project-financed greenfield independent power project in Nigeria since the country's ambitious power sector reforms, the transaction is expected to form a replicable model for future power plants in the country, and as such pave the way for further private sector investment in Nigeria's energy sector. Currently, it is estimated that only 35 per cent of the population has access to electricity in Nigeria, despite the country housing the world's eighth largest gas reserves.

ONGC eyes Mauritius as Africa-India petroleum transit hub

MRPL HAS ENTERED into an MoU with STC Mauritius and IndianOil, to set up a Petroleum Terminal at Mauritius.
This JV Terminal to be constructed with an investment of around USD 130mn will facilitate re-exporting of petroleum products from Mauritius to Indian Ocean Islands and mainland Africa. This could turn Mauritius into an India-Africa petroleum transit hub, besides enhancing the oil supply security status of Mauritius.
Currently MRPL exports about 1.2mn tpa of petroleum products to Mauritius through STC-M. MRPL has been successfully supplying the total fuel requirement of Mauritius through the STC-M since 2006.

SacOil considers US$446bn gas pipeline

OIL AND GAS explorer SacOil Holdings has teamed up with the South African and Mozambican governments to study a possible US$6bn gas pipeline between the two countries.
If viable, the pipeline and the distribution facility will carry natural gas from Mozambique into South Africa, as well as other southern African countries.
South Africa, whose coal-fired power plants are not environmentally friendly, is the nearest big outlet for Mozambique's vast natural gas reserves.
"The indicative gas requirements of, as well as benefits to, Mozambique and South Africa appear to justify such a pipeline," SacOil said.
SacOil, Mozambique's state owned firm IGEPE and South African government-owned pension fund Public Investment Corporation would fund the project.

Engen Ghana to supply aviation fuel

ACCORDING TO THE managing director of Engen Ghana the passenger flight throughput to and from Ghana is increasing, and this has also brought about an increase in aviation fuel by airlines, some of whom are now doing daily flights to Ghana.
Engen Ghana is now operating a growing retail network of 24 sites, with the addition of the 25th service station only last month. "We currently serve more than 60 commercial customers across the broad spectrum of Ghanaian businesses, not just limited to mining, shipping, marine, construction and transportation haulage and power generation."
At a ceremony as part of the 21st anniversary celebration of Engen Petroleum Ltd of South Africa, the parent company of Engen Ghana Ltd, the managing director of Engen Ghana Ltd, Henry Akwaboah, said the company would join others who supply aviation fuel. He said suppling aviation fuel is part of Engen Ghana strategy to become the oil company of choice in Ghana.
"This company has the vision of becoming the oil company of choice in sub-Saharan Africa and the Indian Ocean islands. What this means is that we need to increase our product offerings to our customers and it has always been our desire to be in the aviation sector in the country because there is an increase in the number of flights to and from Ghana and, since we have the capability to supply aviation fuel, why not?"
He disclosed to Citi Business News that the company has lost out on a number of tenders in Ghana and the West African sub region because they do not supply aviation fuel in Ghana, which is the reason why Engen Ghana has decided to do so. Mr Akawboah said plans are far advanced and Engen is set to begin the supply within first quarter of 2015. The entrance of Engen Ghana supplying aviation fuel brings to three the number of companies who supply it. The other two are Shell Ghana Ltd and Total Ghana Ltd.
According to Henry Akwaboah, the company takes particular pride in the growth and strides chalked by Engen Petroleum Ltd which was formerly known and called Mobil Oil of South Africa.

Because He founded the earth upon the waters...
And four fifths of the earth is under water

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The first pillar of risk-based process safety management is "Commitment to Process Safety." Clyde Young, PetroSkills instructor/consultant looks at the importance of leadership.

The importance of leadership in process safety management

A ***FORMALISED MENTORING*** system can ensure workforce involvement and compliance with company and regulatory requirements, increase the competency of personnel and enhance the process safety culture of the entire organisation. Within this element there are several essential features that lead to a more effective process safety culture.

Providing strong leadership is critical for any organisation that strives to manage the risk associated with the activities essential to process safety. Leadership is a skill that is not necessarily intuitive to managers and mentors. Leadership is a skill that can be learned.

In this article, we explore process safety leadership. This is part of a paper that was developed by PetroSkills' John M. Campbell, instructor and consultants Clyde Young and John Kanengieter for presentation at the Center for Chemical Process Safety (CCPS) 9th Global Conference on Process Safety [1].

Over the last several years, significant resources have been devoted to examining the issue of process safety culture, and strong leadership has been cited as a key element to enhance a process safety culture. Study of major accidents within the oil, gas, chemical and allied industries have found that the safety culture of organisations is often proposed as a contributing factor, and development of a culture of process safety as the solution. Presentations at symposia and conferences point to enhancing culture and providing leadership as necessary to address breakdowns in process safety management systems.

The first pillar of the Center for Process Safety (CCPS) Guidelines for Risk Based Process Safety (RBPS) is "Commit to Process Safety." Supporting this pillar is the element "Process Safety Culture", which is defined as, "the combination of group values and behaviours that determine the manner in which process safety is managed." One of the four essential features of process safety culture is "strong leadership."

Strong leadership essential

What is "leadership?" It has been described as "organising or influencing a group to achieve a common goal." This would intimate that the leader is a boss or manager, but is a manager necessarily an effective leader? There is considerable literature about leadership. This literature includes quotes about leadership, how to find "natural" leaders and how to develop leadership skills. There are workshops about leadership and even university degrees in leadership. If there are so many resources dedicated toward understanding and teaching leadership, why is leadership listed as something that needs to be enhanced in symposia, papers and reports that deal with managing process safety in high hazard activities? It may be because leadership and culture are considered human factors. When associated with process safety, they are known as factors that can lead to loss of the standards of consistently reliable human performance. These standards are relied on as part of an organisation's defenses against process safety incidents.

Providing strong leadership is critical for any organisation that strives to manage the risk associated with the activities associated with process safety. Image: CPS

Every person working in the oil, gas, chemical and allied industries should perform their jobs under the guidance of a process safety management system. CCPS defines a management system as a "formally established and documented set of activities designed to produce specific results in a consistent manner on a sustainable basis." Producing specific results in a consistent manner all the time requires that all personnel perform at a high level. If culture is defined simply as "the way we do things around here," this is influenced greatly by leadership. But leadership doesn't reside in the role of one person. Leadership needs to be imbedded within the organisation with every person. This is a skill that can be learned by all and dependence on one individual with authority or one person who might be considered a "natural" leader can lead to failure of the system.

> One of the four essential features of process safety culture is "strong leadership."

When teams cease to function effectively and breakdowns are discovered in the system to manage process safety, it is highly likely that there is a breakdown in goals, roles and expectations in the team.

Every person working in or supporting the operation of a high hazard process must be able to recite and explain the goal of every team they work with. There should never be in any doubt what every team's goal is.

Clear roles needed for each team

Because we may and probably do work on several teams, it is vital that we are clear of our role on each team. What is my primary function to support achieving the goal? There should never be in any doubt what every person's role is on that team.

Does each person on the team have a concisely developed set of expectations for individual and team behaviour? Is there some way for the team to check that the expectations are being met? What is the procedure for addressing deviation from expectations?

A PetroSkills client recently asked for a one-day overview of risk based process safety management for upper level management. Four sessions of this overview have been delivered around the world to the business unit managers and their direct (team members) reports. Leadership and working as effective teams are two elements of the session that address the issue of process safety culture in this client's operations.

A key learning point offered by participants is that a clear understanding of goals, roles and expectations comes from leadership and exhibiting the appropriate leadership role. Many leave the session with an action item to conduct team work sessions to establish/reaffirm goals, roles and expectations. ■

PetroSkills Consulting offers consulting expertise on this subject and many others.

1. Clyde Young and John Kanengieter, "Process Safety Management Mentoring: Developing Leaders", The (CCPS) 9th Global Conference on Process Safety, the Center for Chemical Process Safety , April, 2013.

AVEVA software for greater safety and efficiency

AVEVA HAS LAUNCHED its latest software solution: AVEVA Control of Work. This advanced suite of products enables the highest levels of safety and efficiency to be achieved when planning and performing both routine maintenance and in-plant engineering operations in potentially hazardous plant environments. It comprises best-in-class applications for Risk Assessment, Work Permit Management, Work Activity Plotting, Isolation Planning, Safe Job Analysis and Lessons Learned Reporting.

Jan Edvin Pedersen, vice president of enterprise asset management, AVEVA, explained some of the advantages of using this new technology; 'One of AVEVA Control of Work's major benefits is its interoperability with a wide range of enterprise asset management solutions, such as SAP, IBM Maximo and AVEVA WorkMate. This open approach provides access to the asset information necessary for effective planning and execution of all types of in-service engineering tasks.

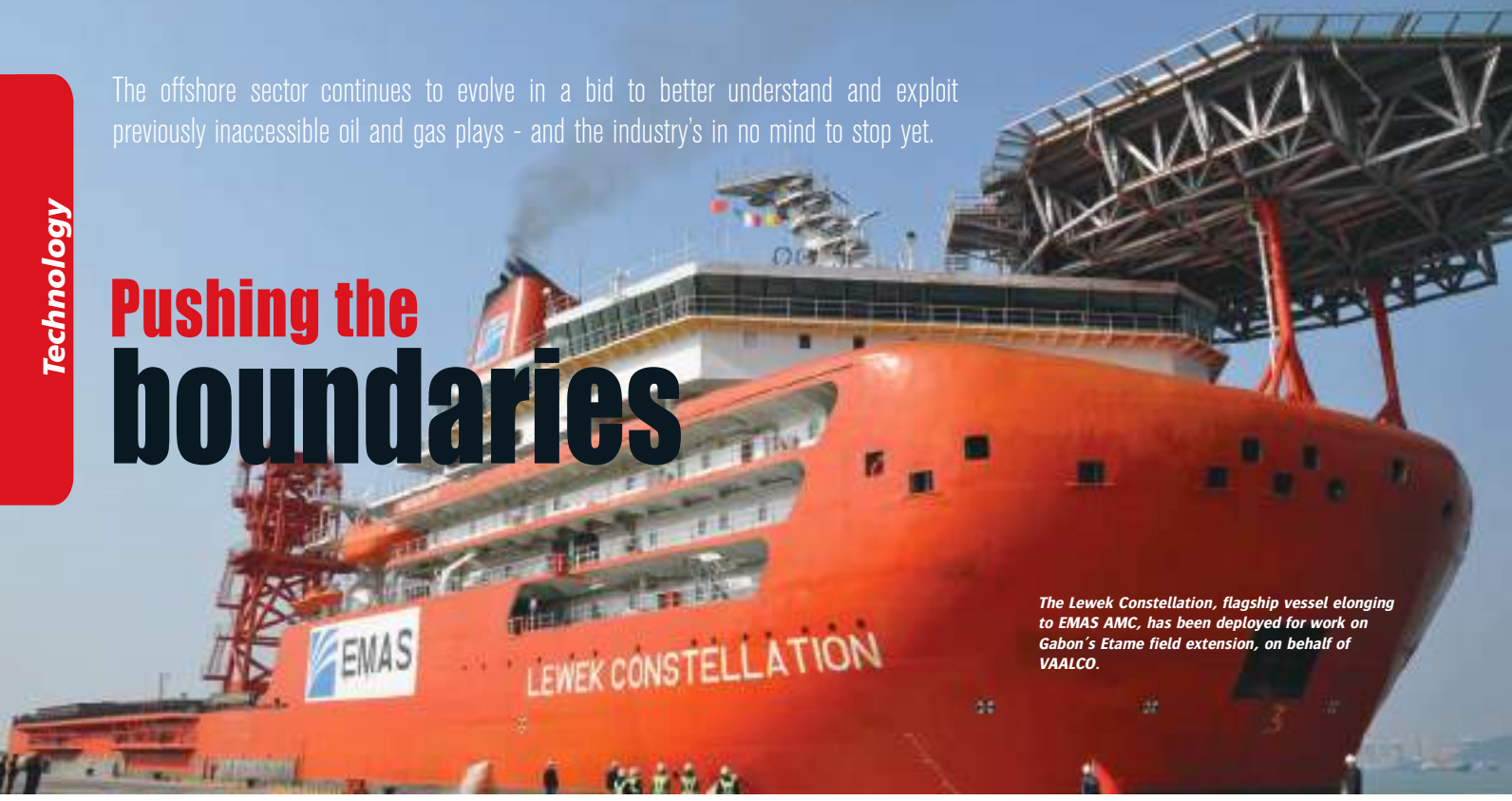
Not only can this make such tasks safer, it can also enable better use of resources and downtime, offering an excellent return on investment. It is quick and easy to implement, which together with its market-leading 2D and 3D visualisation, make it an unrivaled solution for asset operations.

AVEVA Control of Work provides a clear, current overview of all planned and in-progress work on a facility, enabling operators to plan more effectively and to complete both routine and ad hoc maintenance tasks more efficiently. This results in better use of valuable resources, reduces risks both to personnel and to the facility itself, avoids incidents and minimises costly downtime. Through the provision of these capabilities from the beginning of an asset's life cycle, it can also accelerate and de-risk a new plant's transition into operational readiness.

"AVEVA Control of Work is an essential tool for any plant operator looking to work more effectively, reduce operational risks and more easily ensure compliance with industry regulations and standards,"added Edvin Pedersen, AVEVA.

The offshore sector continues to evolve in a bid to better understand and exploit previously inaccessible oil and gas plays - and the industry's in no mind to stop yet.

Pushing the boundaries



The Lewek Constellation, flagship vessel elonging to EMAS AMC, has been deployed for work on Gabon´s Etame field extension, on behalf of VAALCO.

TESTING EVER DEEPER waters and new reservoir structures, the offshore has always presented a challenging environment for drillers the world over.

That's no different in Africa, which continues to yield new surprises: huge gas pools off the coast of eastern Africa, an area long deemed barren, and complex pre-salt formations off Angola and elsewhere, akin to those in Brazil, on the other side of the Atlantic.

None of it could be possible without the continual evolution of offshore technology, from the drilling techniques themselves and the equipment deployed, to the incredible robustness of sub-surface installations and all production infrastructure.

Leading experts in this field have prospered as the global offshore market has ballooned.

And it's an evolution that's truly a global and collaborative effort, with territories like Angola, Nigeria and Mozambique, the testing ground for many new techniques developed in labs and offices all over the world.

FMC Technologies is a regular face on some of Africa's large offshore projects. It's currently working for Tullow Oil in Ghana supplying subsea systems for the Tweneboa-Enyenra-Ntomme development (TEN project).

With a backlog of orders at their highest level in four years, and healthy revenues, it suggests that demand for subsea services is getting stronger.

The company's Ghanaian order alone was worth an estimated US$340mn.

Still, the complexity of such offshore work, especially deep beneath the ocean waves, means it is always a team effort.

The next generation of subsea systems

In one joint initiative recently announced, FMC Technologies is working alongside a number of other deepwater producers - Anadarko Petroleum, ConocoPhillips, BP and Shell - to develop the next generation of standardised subsea production systems.

The new equipment will be designed to meet the challenges of producing oil and gas from deepwater reservoirs with pressures of up to 20,000 psi and temperatures of 177°C at the mudline.

High pressures and extreme temperatures are a common feature of working in deeper waters all over the world.

And this naturally means that boosting reliability and operability are also high on the list.

John Gremp, FMC Technologies' chairman, president and chief executive, said the alliance was a good example of how offshore firms "can come together to overcome the technological and economic challenges facing our deepwater industry".

The enormous scale of offshore activities - with major projects routinely stretching into the many billions of dollars - means it's essential to control escalating costs.

When industry-wide demand is high, the cost of rig hire alone can climb above a quarter of a million dollars per day for some of the larger, more powerful rigs.

Striving for standardisation

The FMC Technologies initiative is especially significant in that it will strive for standardisation of materials, processes, and interfaces, where possible, all in a bid to keep costs down; it's arguably the industry's greatest challenge.

With a backlog of orders at their highest level in four years, and healthy revenues, it suggests that demand for subsea services is getting stronger.

Even for the big guns, collaboration is still very much a prerequisite for success.

Italy's Saipem recently teamed up with Japan's Chiyoda Corporation to establish a standalone company to support growing activity in the subsea fields development sector.

The new company, Xodus Subsea, is to be based in London and provide studies, engineering and consultancy focusing mainly on the early phase of projects, such as front-end engineering, conceptual studies and basic design. Saipem boss Umberto Vergine said he believes that the subsea sector is continuing to grow and that the new partnership will help the company gain an early understanding on how future projects are being developed.

"We will then be able to anticipate market needs, supporting our clients through new technology, improved operations and the whole subsea development chain of activity."

Indeed, the challenges of the offshore, and the constant drive for innovation, stretches right across the industry, from state-of-the-art seismic work conducted by high-spec scientific ships, through to project execution and completion, oil and gas processing, and, eventually, transportation.

In another recent project, leading offshore contractor EMAS AMC deployed its flagship vessel, the Lewek Constellation, for work on Gabon's Etame field extension, on behalf of VAALCO.

This US$120mn assignment included the installation of rigid and flexible pipelines along with the transportation and installation of two production platforms.

EMAS AMC is also enjoying a purple patch serving the world's offshore market, recently declaring record revenues of US$1.5bn.

And, in a sign that it intends to continue pushing the boundaries, it will see the new ice-class, multi-lay offshore construction vessel, the Lewek Constellation - with ultra-deep water pipe laying and heavy lift capabilities - turn fully

operational at the start of next year.

The ship will be employed for her maiden deepwater pipelay project in 2015.

Although there may not be any ice to contend with off the coast of West Africa, it's clearly a significant point in time as the industry attempts to unlock the hydrocarbon potential in and around the Arctic, perhaps one of the final and greatest tests for offshore drillers.

Understandably, this is not a game for the smaller companies.

The enormous cost and technical complexity involved means the offshore environment remains dominated by big international names, from the producers themselves, and their drillers, right through to the service and equipment providers.

At least in the case of West Africa - unlike the Arctic - the exploration risk is now reduced as a result of the long history of production and discovery there.

Again, in Gabon, Shell and partner China National Offshore Oil Corp Limited, recently announced a new deepwater find with the Leopard-1 well, which identified a column of approximately 200 metres of net gas pay.

The well was drilled 2,110 metres deep to a total vertical depth of 5,063 metres.

A Shell spokesman said the latest find - in a territory where it has been active for over 50 years - is a testament to the "innovation of our explorers in pursuing new plays, and application of our global sub-surface expertise".

Xodus Subsea is to push the boundaries of the submerged sector.

Then there is the emergence of Africa's pre-salt formation plays, an exciting new challenge for all the industry to get to grips with.

Next door, Italian energy group, Eni, also confirmed a light oil discovery in the Congo, where preliminary estimates for the Minsala Marine find, in the Marine XII Block, are about one billion barrels.

The field sits 35 km offshore and just 12 km from the recent Nené Marine discovery.

The Leopard-1 well was drilled in 75 metres of water to a total depth of 3,700 metres, passing through a hydrocarbon column of 420 metres.

"It has been over four years since Eni started exploring the shallow water pre-salt plays of West Africa, and this campaign continues to deliver great results," commented Eni's chief executive Claudio Descalzi.

The group has already discovered four billion barrels of oil equivalent (boe) between the Congo and Gabon.

It's the third find in the now prolific Marine XII permit pre-salt play following the earlier Litchjendily and Nene Marine discoveries, both now under development.

Descalzi added that the latest discovery underlined Eni's "strong technical competences" and the effectiveness of the group's exploration technologies, "especially given the technical complexity of exploring the West African pre-salt plays."

None of these technology challenges, nor the associated financial burden of offshore exploration and production, are likely to go away anytime soon.

But with innovation continuing to yield such positive results - especially one billion barrel finds off mature producer states like the Congo - it's a challenge well worth the effort.

Just as the industry has always done before, expect to see more innovation in the years ahead in a bid to make the impossible, possible. ■

"We can see the direction we need to go: subsea. But the barrier is achieving the necessary level of observability, understanding and control. We need more instrumentation subsea, and that instrumentation needs to be able to monitor itself."
By Torgrim Aas*, FMC Technologies

The future of surveillance is subsea

IT IS NO exaggeration to say that the offshore oil and gas industry's path of technological development follows NASA's. Operations are getting remoter, the environment is becoming more extreme, systems and infrastructure are getting more complex, and direct human involvement is on the wane.

We have not chosen this path out of a fondness for high-tech approaches, but because we are compelled by the availability of the natural resource, by economic constraints and by the limits of the manpower at our disposal.

However, the biggest barrier to progress along this path is a lack of visibility of what's happening subsea with our systems and infrastructure.

This lack of visibility has serious short-term implications, the most severe being the missed opportunities to spot small problems and to deal with them before they escalate into costly and disruptive control incidents.

Longer term, this lack of visibility and control prevents us from making the mind and the technology shift necessary if we are to continue safely and profitably to extract hydrocarbons. Here we set out our vision for effective subsea condition and performance monitoring (CPM) and describe how one operator has become an early adopter.

What we do with data now

Currently, we do not expect any more data than the minimum required to keep a field producing. This constitutes the limits of our visibility and also the control such visibility affords.

Subsea sensors are our eyes under the sea, and every time one fails or goes missing we get a little more blind. We believe a kind of subsea dark age could be looming, because most offshore fields are old, with ageing and reduced instrumentation. Even though it is a challenge, those brownfield sites are the ones that need condition and performance monitoring (CPM) most.

Today, it is still most common to instrument the field to monitor the production alone, ignoring the fact that stopping equipment failure through proactive maintenance will boost field uptime.

On a typical field today, it is possible to capture and analyse three types of data from the subsea control system. The first we do fairly well. This type of data tells us about the general characteristics of hydrocarbon production, such as pressure, temperature and flow rate.

The second tells us about the production support systems, typically pressure, temperature and flow measurements relating to the chemical injection system and hydraulics, or other measurements related to the electronic control system.

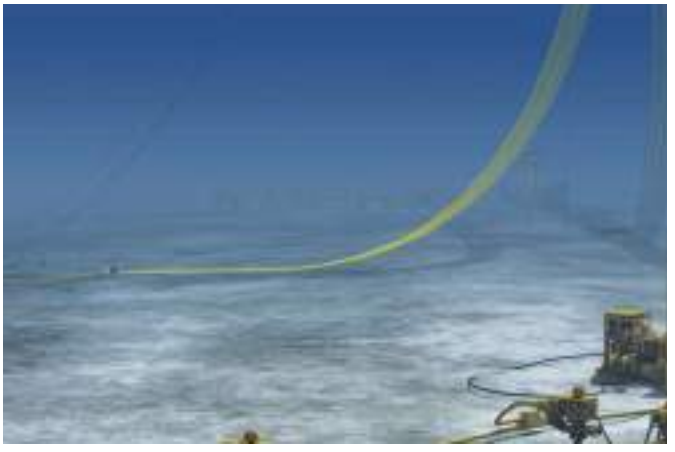
The third class of data tells us about the production equipment and the control system, for example, sensor power consumption and communication status, internal statuses on the micro-controllers and CPUs, and temperature and pressure sensors inside the control system itself.

The second and third types of data represent key areas of necessary improvement.

Direction of travel: subsea

With operators we regularly look 50 years into the future to discern the technology developments we need to set in motion today. The scenarios differ in detail, but have strong commonalities.

Our operations are getting remoter and deeper. The environments we operate in are becoming more extreme. The systems and infrastructure we deploy are getting more complex. And direct human involvement is on the wane, firstly because of the cost and risk of putting people in those environments, and secondly because of a growing scarcity of skilled people able to troubleshoot and maintain the systems.



Total's Pazflor project offshore Angola began producing oil and gas using FMC's gas-liquid subsea separation and pumping systems.

We can see the direction we need to go: subsea. But the barrier is achieving the necessary level of observability, understanding and control. We need more instrumentation subsea, and that instrumentation needs to be able to monitor itself.

Our interim vision, developed with the most forward looking operators, is to move all topside processing subsea.

CPM: our journey so far

The impulse to date has been our desire for a system that gives the operative and our service engineers the information they need for much earlier troubleshooting than had been possible before.

Most failures happen suddenly and without warning, so the key is to detect symptoms before they lead to a full-blown malfunction. Such symptoms may be, among many, increased sand production, higher sensor power consumption, or sluggish valve operation.

When we designed our first CPM solution it was based on the idea that it should use existing instrumentation. Further, we knew that the biggest benefit of such a system would be to provide the right user with the right information at the right time, to stop small problems becoming big ones.

We felt that the simplest way of doing that was just to reorganise existing data and present it in a better way to the user at his onshore location. Later there would be opportunities to weave in more complicated solutions using mathematical models capable of estimating the condition and performance of equipment based on available instrumentation and product knowledge.

But at the time there was a more immediate need. That's because, typically, on a field, the data available are presented to the offshore operatives for control and production monitoring purposes.

Users other than the offshore operative, such as maintenance engineers and production engineers onshore, must use the same graphical user interface (GUI) to get access to the data they need, or dig through historical databases. This is a difficult, time-consuming and inefficient process.

For the engineers this data trawling is comparable to

Most offshore fields are old, with ageing and reduced instrumentation.

searching line by line alphabetically for a business name that might match your need, instead of going straight to the relevant service category where they are all helpfully laid out.

So, together with our service engineers, we designed a system that presents equipment - and issue-related information in dedicated views. Whether you are troubleshooting a choke, worrying about hydrate formation, or have actuator issues, the information you need is located at one, predictable place.

The system not only categorises the service you are looking for, but also presents it together with related services you are likely to need.

A system that presents equipment- and issue-related information in dedicated views.

We call these normalised results "Technical Condition Indices", and they make it easy to get an overview of the current field and equipment status.

A big step forward

This was a big step forward in the broad goal of taking the quantities of raw data that subsea sensors produce and turning them into useable information, and presenting this information to the right users, at the right time. With such access to information, both for the customer's operatives and for our service engineers, the right decisions can be made.

In the end this will move the customer from a reactive to a proactive maintenance mode which will give an increased uptime due to better planning and interaction with our service organisation. ■

Case study: North Sea

OUR FIRST FULL CPM system, monitoring a complete field, was delivered to a field in the North Sea.

The operator relies on modern technology and dares to push technological boundaries for how a field is run.

Its operations are tightly integrated and the team includes vendors like FMC Technologies. They know that the subsea equipment, even though you can't see it, is a critical part of the production and needs close attention.

Our aim was to create a system that would not replace their existing offshore operator graphical user interface (GUI), but rather create a separate GUI targeting the onshore users whose nformation needs were not met by the existing GUI.

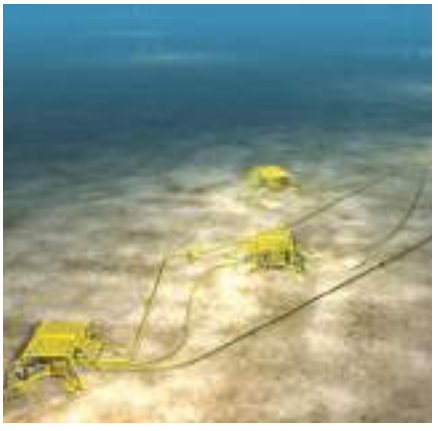
The system delivered ended up being one of the primary views for the onshore engineers when monitoring and troubleshooting the subsea field.

The system consists of a data collection software that reads all the data available from the subsea control system. The data are forwarded securely to an onshore analysis server which also runs a web server hosting a web-based GUI that targets the different users. Already after one year in operation the CPM system has detected several incipient problems before the operators saw any issue. One of those detections occurred a full three months before the symptoms would typically present themselves. It has also reduced the amount of time used for troubleshooting issues where the symptoms are far from the original cause.

Challenges: Human

The first challenge was to capture the knowledge stored in the heads of our experienced service engineers. We had to understand and absorb the operator's troubleshooting techniques and the different ways any given equipment could malfunction so that it could be covered properly by the CPM analysis algorithms.

The second challenge emerged when the CPM system was put into operation: the complexity of the system required more people than initially planned, and we discovered certain operational procedures not covered by the system.



FMC is also working subsea for Tullow Ghana.

Although an operator will have standard procedures for most tasks there will always be tricks and workarounds that are unique to operators and specific fields. The CPM system must "be aware" of these to avoid false alarms.

Building the competence and knowledge about a given subsea field takes time, and because no two fields are identical, a skilled engineer is not easily replaced.

Challenges: Technical

Pump and separator stations are already subsea. The compressor is preparing for its journey down. But the extreme environment makes putting such instruments under water a challenge.

Instrument location, type, how to power it, how to replace it, and where to put the communication link are some of the problems that must be solved, and they all depend, for example, on equipment size, distance from power supply, communication bandwidth and more.

Such advanced measurement will also require more subsea data processing, which in turn will require extra subsea monitoring of micro-controllers and the consumption of memory and power.

Increasingly today instruments collect this information, but they are limited by the subsea or topside control systems' ability to communicate the extended data to the user in a usable way.

Thus on most fields service providers have limited or no access to data that is critical even though it is unrelated to production, data for instance on sensor power consumption and communication bus statuses.

Apart from monitoring the production equipment itself, support systems also need monitoring. These include battery packs, embedded control systems with distributed processing, bus controllers, power supplies, and chemical injection systems.

Conclusion: Rethinking the value of information

We believe the way forward is more instrumentation subsea. We need more information about the instruments and the equipment itself. To put it another way, we need to watch the watchers.

The technological challenges will be solved. It's only a matter of time. The bigger challenge is shifting the mindset of the operators from a reactive approach to maintenance to a proactive one.

The amount of data from subsea fields will only increase. Our instruments will become more and more talkative.

This can seem to be overwhelming. Will the lonely offshore operator drown in all the data? Not if we think now about how the right data can be communicated to the right user at the right time.

The technology exists already, the question is whether it is used correctly, or even used at all.

By allowing vendors access to the equipment data, troubleshooting time will be reduced and field performance will be improved. It gives us a clear opportunity to give both better service in the short term and better design in the long term.

This is a matter of trust but also of rethinking of the value of information.

How do you quantify the cost benefits of an information-rich, pre-emptive approach to subsea control? It is difficult, but only because control incidents are by definition unpredictable. You cannot budget for them. Their consequences can fall anywhere on a vast spectrum, from a few hours of downtime to a catastrophe that inflicts heavy damage on the environment, on human welfare and on a company's balance sheet, reputation and share price.

**Torgrim Aas is a CPM Specialist in Production Performance Services for FMC Technologies Inc.*

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The integrity of flanged connections is critical to the containment of fluids in a piping system.

The flange protection challenge

LOSS OF CONTAINMENT, whether in chemical lines such as hydrocarbons and gas systems or water distribution lines, will have significant environmental, operational and commercial impact, and could pose a serious safety risk.

Flanges present a unique corrosion protection challenge because solutions must not only prevent corrosion, but also allow future access to fastenings in the event that maintenance or disassembly is required. Exposure to corrosive environments or polluted industrial atmospheres leads to high corrosion rates of unprotected flanges. In addition, due to the complex geometry of a flanged connection, problems such as crevice corrosion found within the void between the two flange faces and galvanic corrosion found where dissimilar metals are used are common and can prove severely detrimental to the integrity of the piping system.

Corrosion issues and inspection of flanges

As flanged connections are a critical component within the piping system, effective monitoring and inspection techniques are required to minimise unscheduled shutdowns due to leakage in order to meet ever demanding production requirements. Usually, leakages occurring between the flange faces are the primary concern, leaving fastenings and pipe external protection unaddressed, which can lead to serious problems especially when external environmental conditions are severe.

Insufficient external protection can lead to rapid and more extensive damage to the flanges and fastenings which will in turn accelerate the deterioration of the sealing system as a whole. The consequences of such a situation are not easy to predict since they are dependent upon prevailing conditions. Depending upon the severity of the environmental conditions there may, at best, be a slow continuous degradation of the substrate; however, under extreme conditions, the external corrosion process may rapidly reach a point where the structural integrity of the system is adversely affected and could result in a catastrophic loss of containment.

Since visual inspection of the sealing faces of flanged connections can only be accomplished during a shutdown of the system, it is vital that this process is made as simple as possible and therefore elimination of external corrosion must be a high priority. If shut down is not an option, then an alternative method of inspection would be to use ultrasonic techniques, but again this process can be made much more complex and inaccurate if external corrosion is not controlled.

Therefore, external corrosion protection of flanges and fastenings is critical in order to be able to both monitor the system and provide more effective and realistic quality control and inspection procedures.

External corrosion protection of flanges and fastenings is critical.

Existing solutions

Due to the complexity of flange geometry, it has become a challenge to design efficient solutions to protect flanges against corrosion. The ideal solution would be a system that combines excellent corrosion protection along with a simple installation procedure and is suitable for all flange sizes and shapes, in conjunction with easy bolt access for inspection purposes.

The most common solutions available on the market are maintenance paints and mechanical solutions. Maintenance paints are hard coatings that are bonded directly to the substrate, commonly epoxy or urethane based. As flanges involve lots of angles and edges, paint systems will struggle to coat effectively due to the thinning effect when paints are applied over an edge. Applying thicker layers may address the issue of edge protection, but it may also lead to seizing of fastenings which prevents subsequent access. In addition, accessing the bolt will be difficult without cracking the coating and it will therefore be necessary to re-apply the coating after the inspection.

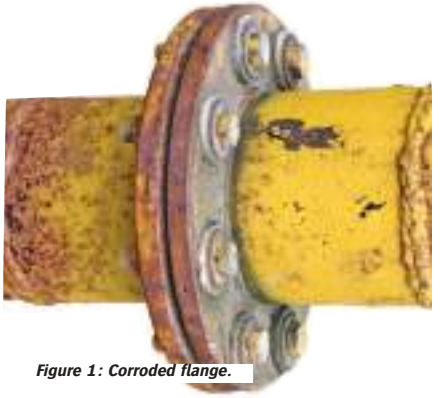
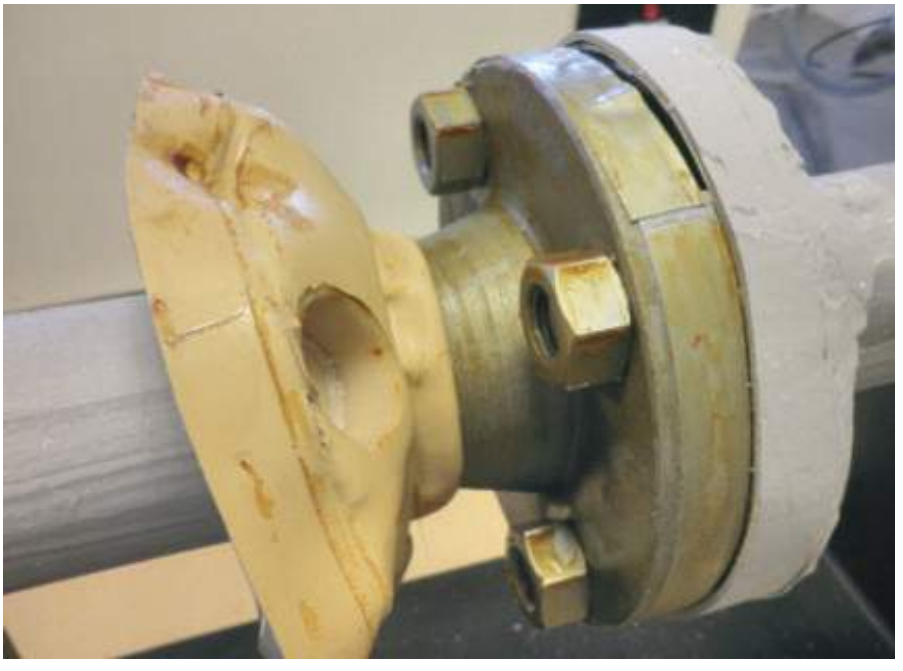


Figure 1: Corroded flange.

Mechanical solutions such as covers and clamps encapsulate the flange or the void between the flange faces and they are usually constructed from stainless steel or plastic and incorporate a



Close up of salt spray test showing no corrosion under the encapsulating system .

rubber seal. This protection is rigid, not flexible and requires having the correct cover or clamp size in stock to cater for each size of flange.

Another commercially available solution is tapes or semi-solid tapes. These come in various forms such as petrolatum tape, wax or visco-elastic polymers embedded into fabric for wrapping. Tapes are supplied on a roll and are wrapped around the surface to be protected. They provide reliable corrosion protection, thanks to the water-repellent nature of these semi-solid polymers. However, these materials can be time-consuming and difficult to apply on complex shapes. If access to bolts is required, these relatively soft materials can be readily cut away, but cannot be easily resealed afterwards to reinstate the protection, and normally must be replaced with new.

Hot-melt thermoplastics are relatively new on the market. They are essentially a wax-like meltable polymer which is heated to high temperatures and then spray applied onto the surface with specialist hot-melt equipment. The main advantage of using this solution is the fact that it can be re-melted and recycled, which offers a cost-effective solution for flange protection. However, it requires hot work as well as specialist equipment and contract application service, and while the coating can be reused it cannot be easily opened up and resealed to facilitate inspection.

Another relatively new form of flange protection are polymer bags containing Vapour Corrosion Inhibitors (VCI), which entirely cover the flanges. The sealed bag is composed of a low permeability polymer with internal VCI film (and drying agents). They are quick and easy to install but the ends of the bag are sealed using normal adhesive tape – not the most durable or effective of bonding mechanisms. The large vapour space inside the bag means that a relatively large amount of moisture may be trapped inside the system and the VCI's are consumed over a period of time.

Peelable coating for corrosion protection

To offer an alternative answer to flange corrosion issues, Belzona has formulated a new peelable coating concept, Belzona 3411 (Encapsulating Membrane), specifically designed for the protection of flanges, fastenings and associated pipework.

Belzona's R&D chemist, Ruckseeta Patel, described the new technology, "With the use of clever polymer chemistry, we have created a flange protection system strong and flexible enough to be peeled back without tearing. This solution features the flexibility of elastomers but is based on a completely new technology excluding the use of isocyanates and toxic metal catalysts. The system bonds to manually prepared surfaces and does not involve hot work, making it safe and easy to use."

The coating offers full corrosion protection due to its use with a corrosion-inhibiting base layer, Belzona 8411, and its high adhesive properties that exclude any moisture.

The corrosion resistance of the system has been proved by the salt spray test, used to assess a coating's ability to resist attack from a continuous salt fog. The salt chamber converts a five per cent sodium chloride solution into a hot fog at 35°C (95°F). The test piece consisted of an assembled flange joint, one side being bare steel and the other an existing paint system.

Encapsulating system being cut for inspection.

After 1,000 hours of exposure to the salt-fog atmosphere, no corrosion was reported under the encapsulated system. In comparison, the exposed steel part at the end of the flange showed a high level of corrosion.

In order to provide a durable seal at the application extremities and exclude any moisture, the system requires a good adhesion, particularly to manually prepared surfaces. Adhesion testing has been performed on three manually prepared substrates according to ASTM D429/ISO8510-1 St 2. The results have shown a cohesive mode of failure on all substrates.

Substrate	Preparation	Adhesion	Failure Mode
Rusty carbon steel	Manual	Cohesive abrasion 6.6 pli	1.16 MPa
Epoxy paint	Manual	Cohesive abrasion 6.4 pli	1.12 MPa
Polyurethane paint	Manual	Cohesive abrasion 6.4 pli	1.12 MPa

Table 1. Adhesion testing results on three different substrates.

Release properties and flexibility

Another property of this new system is the ease of access to the fastenings. When maintenance is required, the system can be simply cut open by using a sharp knife to cut through the membrane in the gap between the flange faces around the circumference of the flange. The membrane will be then be peeled back with the bolt caps, exposing bolts and flanges. Once the required maintenance has been completed, the membrane will fold back to its original position.

In order to be peelable, the system needs to be tough and flexible. Tensile strength, elongation and tear strength were determined according to ASTM D412/D624.

	Belzona 3411 Unreinforced	+Belzona 9311 Reinforcement
Tensile Strength	410 psi	670 psi
	2.8 MPa	4.6 MPa
Elongation	66%	24%
Tear Strength	21 pli	100 pli
	380 kg/m	1830kg/m

Table 2. Tensile strength, elongation and tear strength results.

To reseal the repair, the surface of the system has to be cleaned around the flange circumference to remove all dirt, grease and surface contaminants. Then a further quantity of Belzona 3411 will be brush applied onto the cut around the circumference of the flange for a quick and simple reinstatement of the flange protection.

This encapsulating system can be used not just to provide a complete corrosion protection for flanges, fastenings and associated pipes, but also as a preventive system which helps improving and facilitating further monitoring and inspection of flange faces.

Ensuring asset reliability has become one of the major challenges faced within many industries today. As a result of this, a growing demand for new and more effective corrosion protective systems can be identified. The corrosion protection challenge presented by flanges has led to the development of a number of solutions. However, most of them fail to meet all the requirements of providing excellent corrosion protection, a simple installation, are suitable for all flange sizes and shapes, and allow easy access for inspection purposes. Made available in 2014, Belzona's innovative encapsulating membrane system has been specifically developed to meet all of these requirements. Its unique design ensures that further monitoring and inspection of flanged connections can be easily carried out. ■

Juan Lopez and Alice Jucquois, Belzona Polymerics.

Innovative new subsea tool

A SIMPLE YET innovative new tool is set to make waves in the oil and gas industry after successfully undergoing a commercial trial at award-winning subsea training and trials facility, The Underwater Centre. Commercial divers and ROV pilot technicians recently trialled the 'Waveblade' while working in Loch Linnhe, simulating a realistic operational environment.

Waveblade, a lightweight, hand-held submersible power tool, is designed to remove marine growth through vibration, without harming underlying surfaces. The tool has been developed to be used as a hand tool for divers and also as a separate tool to be fitted to the arm of an ROV.

Waveblade's patented technology delivers high frequency resonance through its oscillating head, sending multi-directional vibration through the blade into the unwanted marine growth. The wave power has been shown to remove organic growth more thoroughly in a fraction of the time without damaging surfaces compared to current methods such as scrapers and high pressure water jetting.

Advice, support and expertise regarding the operational aspect of the trial was provided by the marine operations, ROV instructors, dive team and support staff from The Underwater Centre, who participated in the trail.

James Hall, chairman of Waveblade, said that the first trial had gone exceptionally well.

"The Waveblade is very different from anything else on the market. During the trial, it worked brilliantly for the divers and ROV pilots, and the results were very much what we had hoped for," he said. "The feedback we have had so far has been very positive."

LDD completes specialist installation off Gabon

LDD HAS SUCCESSFULLY finished a specialist foundation installation for the Etame Marin block field expansion project, offshore Gabon. The company completed the very remote installation safely and on schedule.

VAALCO Gabon (Etame) Inc is the operator of the Etame Marin block. EMAS AMC, the subsea services division of EMAS, is undertaking the block expansion project on behalf of VAALCO Gabon (Etame) Inc. and its working interest partners. LDD was awarded the foundations contract covering drilling, grouting, lifting and handling in April 2014.

LDD worked closely with EMAS AMC to install four 48-in. piles for each of the two jackets. Each pile was 140 metres in length and penetrated approximately 42 metres below the mudline. The companies worked off EMAS' new flagship vessel, the Lewek Constellation.

Because of the remote working environment offshore Gabon, LDD was equipped with a large suite of spare equipment to ensure that any problem could be quickly rectified without affecting the project schedule. Additionally, replacement tools were quickly supplied through the Acteon Group.

EMAS AMC's other work includes engineering, procuring, installing and commissioning of rigid pipelines, along with transporting and installing flexible pipelines for Etame and Southeast Etame/North Tchibala, in water depths of 80 metres.

Lee Edwards, project manager, LDD, said, "For the Etame Marin block project, LDD utilised its LD2500 reverse circulation drill, which worked straight out of the box. LDD is unique in that it can pull together a range of services for jacket foundation installation under a single contract, which reduces the schedule, costs and risk for the client. The successful completion of this project further proves LDD's capabilities as a jacket installation specialist in the offshore industry and strengthens its oil and gas portfolio."

Fracture analysis services from Baker Hughes

BAKER HUGHES HAS released its StageWatch fracture analysis services that include monitoring sleeves and retrievable pressure/temperature (P/T) gauges to collect P/T data. In the post-acquisition phase of data, the StageWatch services pair P/T data with additional information to learn more about subsurface formations, reservoirs, and fields. This enables better planning for future wells, provides a clearer understanding of the reservoir, facilitates data-driven completion designs to increase production and ultimate recovery, and helps identify more effective refracturing strategies.

The StageWatch P/T gauges are housed in a monitoring sleeve, which is run in the hole as part of the casing string to record pressure and temperature in the wellbore before, during, and after fracturing operations. Sleeves can be placed anywhere in the wellbore, so data can be captured from multiple zones without modifying the existing casing programme. After the fracturing job is complete, all of the P/T gauges are retrieved in a single run using a coiled tubing bottomhole assembly.

The full set of acquired data can be easily downloaded from the gauges and quickly processed to characterise the reservoir, the fracture network, and the production potential. The StageWatch services data interpretation component offers a clearer picture of the subsurface environment, which in turn helps operators improve overall field production, operational efficiency, and ultimate recovery.

Kerui leading in comprehensive oilfield solutions

THE SERVICE OF nitrogen production and injection is a measure for an oilfield to increase its production. In Tahe Oilfield, which is located in Xinjiang, China, Kerui Petroleum Equipment Co Ltd, a Chinese enterprise leading in comprehensive oilfield solutions globally, has achieved another success. Now its overall success rate of nitrogen injection for production improvement is more than 95 per cent and its cumulative production increment is 100,000 tons. According to the features of vuggy carbonate reservoirs at deep layers in Tahe Oilfield, Kerui has adopted its self-developed three-time oil recovery technique based on injection of nitrogen into vuggy reservoirs, and completed the operation of air injection for 115 wells. In operation, while successfully overcoming the challenge of nitrogen injection for wells with the depth of over 7,000 meters, Kerui, again, verified the high quality and high efficiency of the nitrogen production equipment with an output pressure of 70 MPa, which was independently developed and manufactured by Kerui oilfield services.

A person concerned about Kerui oilfield services said, "Kerui's membrane separation technique for nitrogen production is one of the core techniques of Kerui oilfield services. Up until now, Kerui has successfully applied for over ten inventions and new applied patents based on this technique. As the largest nitrogen production equipment manufacturer and service provider, and with more than 60 teams to provide nitrogen production engineering services, Kerui has provided various technical services, which are

customised for nitrogen production, to CNPC, Sinopec, CNOOC and other oil giants in China. Now, Kerui's share in the Chinese nitrogen production market is 85 per cent." As a Chinese enterprise leading in comprehensive oilfield solutions globally, Kerui works hard to make technical innovations and to improve its technical capacity and strives to create constant value and high-level services for its customers, by upholding the principle of "customer first and market oriented".

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Making your industrial network safer

One approach to industrial security is Defense in Depth, based on the standard zone and conduits model.

APPLYING THE RIGHT cyber security measures in industrial networks can improve safety, reduce downtime and increase productivity. Just because there is a firewall protecting the edge of a network does not mean the plant network is secure. Since many cyber security incidents originate from within industrial networks, additional security measures need to be taken in order to harden control networks.

Over the past few years, there have been a number of high-profile, advanced malware threats that have attacked the energy sector. While these are significant threats that need to be taken into account in the oil and gas industry risk assessments, the fact is they account for a low number of overall threat sources.

Most cyber threats are unintentional and originate from within the industrial network itself. Industry research shows that the biggest threat sources are from device and software failure and malware (see Table 1).

Industrial networks are susceptible to internal incidents because many PCs on the network run 24 hours a day, seven days a week, and do not have antivirus protection. In addition, there are many ways for malware to enter control networks, such as USB keys, maintenance systems and visitor laptops. Controllers designed for real-time I/O (input/output) and not robust network communications, may not respond well to malformed messages or high levels of traffic. Finally, many industrial networks are 'wide open', with no isolation between sub-systems, making it easy for problems to spread.

Why IT solutions do not work for plant networks

IT professionals have been successfully dealing with cyber security threats for years. However, these same solutions cannot be applied to control and SCADA (supervisory control and data acquisition) networks. This is because:

- Control devices cannot be secured with automated third-party tools.
- Patching or updating PLCs (programmable logic controllers) is usually not practical.
- Manufacturing networks cannot be shut down for testing, configuration and maintenance, as is done with business networks. Instead, industrial security products must be set up and maintained while the plant network is running.
- Industrial networks use unique communication protocols not seen in the IT world and not addressed by IT security products.
- Plants require hardened equipment that can survive harsh electrical and environmental conditions.
- Also, plant networking equipment needs to work for decades, whereas IT gear has a lifecycle measured in years.

Finally, engineering staff need cyber security solutions that are simple to use. While you could be an expert in making products or programming PLCs, you are not likely to be a cyber security expert. Thus, industrial cyber security solutions need to be easy to use in order to minimise human error in set-up and ongoing use.

"Industrial networks are susceptible to internal incidents"

Threat source	Industrial network incidents (%)	Incident type
Hackers and terrorists	9.4	Intentional
Insiders	10.6	
Human error	11.2	Unintentional
Malware	30.4	
Device and software failure	38.4	

Source: The Repository of Industrial Security Incidents, 2011.

Defense in Depth

One approach to industrial security is Defense in Depth, whereby there are multiple layers of defense and types of security that work together to prevent network incidents or to contain them if they do occur. A key best practice for Defense in Depth is to implement the zone and conduits model as defined in the ISA IEC 62443 (formerly ISA99) standard. While not a regulation, this standard provides practical guidance that leads to more robust cyber security. It recommends defining 'zones' within networks and allowing the zones to communicate only through secure 'conduits'. With this method only the minimum necessary network traffic passes between zones and unusual traffic generates alarms and is blocked.

The zones and conduits model provides a framework for network segmentation that prevents cyber security incidents from spreading. In brief, a security zone groups logical or physical assets that share common security requirements. For example, the network could have a controller zone and a supervisory zone. Each zone has a defined border that can be either logical or physical and delineates which elements are included and which are excluded.

Communications between zones must be via a defined conduit. A conduit is any pathway of communication that enters or exits a security zone. The conduits are the perfect 'choke points' where security measures, such as industrial firewalls, can be implemented to ensure that only the traffic needed by the plant is allowed to pass. These security measures can compensate for the devices they protect not having sufficient built-in security.

In addition, focusing on conduit mitigation is typically far more cost effective than having to upgrade every device or computer in a zone to meet security requirements. In fact, it is often not even feasible or possible to upgrade industrial devices, such as PLCs and RTUs (remote terminal unit), as it can take years for updates to become available for them.

Furthermore, such updates can often only be applied during a plant shutdown – an infrequent occurrence, which may not be easy to line up with needed security updates.

Below are examples of how this approach was applied by Belden to protect different oil and gas applications.

For an offshore platform

An offshore platform is a complex facility with many networked devices. In considering how to approach cyber security related to the oil and natural gas processing operation, a few core principles were determined:

- PLCs are critical assets
- PCs (especially those with humans in front of them) are threat sources
- Networks we do not control are untrusted.

Using these principles, a preliminary zones and conduits analysis was done. While determining many of the zones was relatively straightforward, a question arose as to how to handle the I/O server that connected to both the business network and the control network.

The solution was to create a 'de-militarized zone' (DMZ) which allows dual access to a shared resource, but not direct access through it. This can be accomplished using two two-port firewalls or one multi-port device.

In a refinery

Like the offshore platform, an oil refinery is a complex operation and many of them have more than one process underway at any given time. In this example, each process had its own master zone, with supervisory, basic control and process zones within the master.

After a first pass at determining zones and conduits, the proposed plan was reviewed again and a risk analysis performed. This highlighted that one of the major risks that could lead to process stoppage was the accidental or intentional tripping of an emergency shutdown.

Based on this realisation, the zones and conduits were revised to include separate safety integrated system zones from the process control system zone.

"A security zone groups logical or physical assets that share common security requirements"

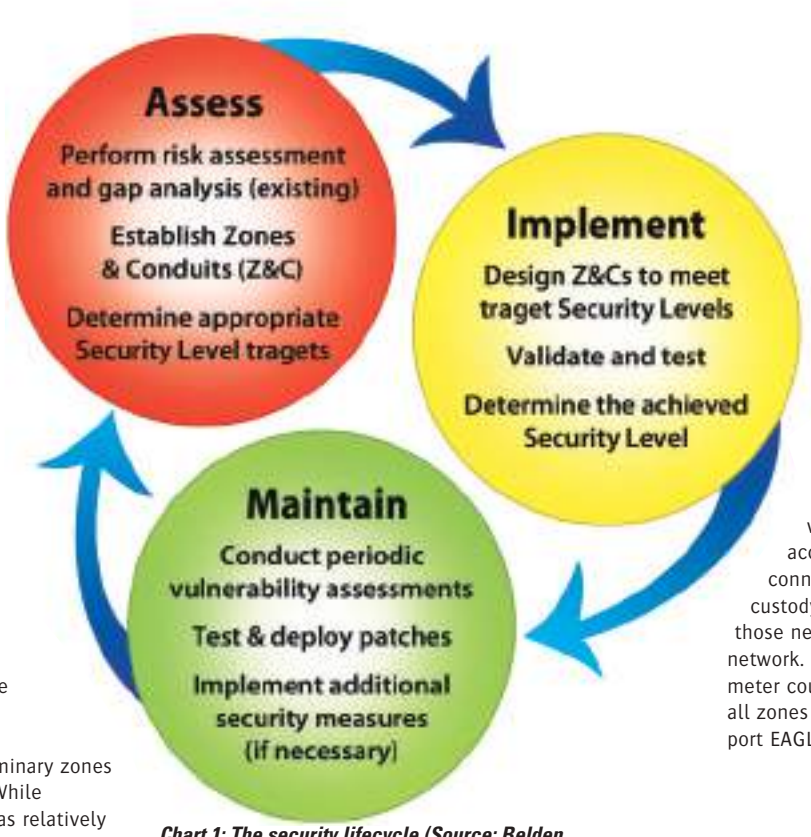

Chart 1: The security lifecycle (Source: Belden Design Seminar 2014)

For pipeline infrastructure

A pipeline system includes the pipeline itself, pump stations and connections to one or more WANS (wide area networks). There are usually several points in the system where custody transfer of the resource occurs, with the resource being measured with flow meters.

One approach is to focus on securing the critical assets only. For example, a Tofino Security appliance could be a conduit to the control network in the pump station.

Another approach would be to take into account that flow meters connect to two networks for custody transfer, and one of those networks is not a trusted network. In this situation, the flow meter could be put into a DMZ and all zones separated with a multi-port EAGLE firewall. ■

This article was based on a session focusing on cyber security at a Belden Industrial Ethernet Infrastructure Design Seminar held in Houston earlier this year. Belden provides end-to-end signal transmission solutions to meet the mission-critical network infrastructure needs of industrial, enterprise and broadcast markets. The company's security hardware and software solutions include increased customisation capabilities with improved ease of use. The enhancements of its next-generation products allow for the easy installation of upgrades on live systems with minimal configuration, says the company. For more information visit www.belden.com

Belden's industrial cyber security solution

BELDEN'S PRODUCT LINE supports security at many levels of communication, including at the physical level, with high-reliability cables and, at the data level, with switches that have many built-in security features. At the network level and higher in the OSI (Open Systems Interconnection) model, Belden's security-specific products include EAGLE routers and Tofino Security appliances.

In general, the EAGLE family of routers and firewalls can help secure the edge of networks. They are layer 3 routers with firewalls and stateful packet inspection and have VPN (virtual private network) capabilities for securing connections between untrusted networks.

Use of the Tofino family of products can secure the core of industrial networks. The Tofino Security appliance is a Layer 2 bridge with no IP address that can be installed without disrupting live networks and with no changes to network design. It provides high levels of security using a 'whitelist' approach that allows for simple deployment, says the company.

The Tofino product line also includes modules that do content inspection (also known as deep packet inspection) for popular industrial protocols, such as Modbus TCP, OPC Classic and EtherNet/IP. This capability inspects messages and only allows approved types of messages through. For example, allowing read messages to pass through the firewall, but blocking written messages.

Recruiting crew for offshore oil and gas production and exploration increasingly means guaranteeing two very important welfare-based communications needs. Firstly, communications to keep these employees safe, and secondly communications to keep them in touch with family and friends. Both are certainly desirable – but, asks Vaughan O'Grady, are they feasible?

Crew welfare: keep them happy - and keep them safe

ALLOWING OIL AND gas industry workers to keep in touch when far offshore or in very isolated areas is one of the many bonuses of modern satellite communications. Of course, satellite isn't always necessary, but at some point — especially offshore — it becomes the only option. How far out you would be when that happens is a matter for some debate, however. Fibre rings can be found a long way out to sea and, depending on how high you can place it (a nearby onshore mountain could be useful) line-of-sight microwave could extend a signal to more than 100 km.

But even if your installation can be linked to the shore, fibre in particular is expensive. When should, for example, an oil company consider it? Brad Grady, senior analyst with NSR, which provides satellite industry market research and consulting services, explains that when a platform is likely to be needed, then, "depending on how long they believe that asset is going to be in place, a company will do the analysis as to whether or not they're going to use terrestrial or satellite".

Thus offshore exploration, increasingly happening a long way out to sea, often involves satellite or microwave links for some or all of the life of the operation. The development phase may justify more sophisticated communications as wells are drilled and if prospects look good. If production takes place and is likely to continue for some time, fibre could be a reasonable investment. Other technologies — typically Wi-Fi — then extend communications to the staff on board.

But, says Grady, "There's still satellite; it just won't be used as heavily." This means that if a contractor comes on site and wants to link with his own network, or if a backup is required in case fibre links are damaged, the satellite option is always relevant. "It's always going to be there. It's not an either/or proposition," said Grady.

But whatever the communications technology used, one thing that has changed in recent years is the needs of crew members. These days they will expect, at the very least, to be able to call or text their family. Ideally they would like to do that without having to go up to a bridge or control centre.

That's why there are numerous companies offering them the chance to do that — companies like Globalstar, a provider of mobile satellite voice and data services to businesses, government, and consumers, which offers products like Sat-Fi. This is a hotspot that allows customers to use smartphone or Wi-Fi-enabled devices to send and receive calls over the Globalstar satellite network. "They'll be able to do email and SMS with friends and family quite comfortably from their own cabin if they like," said Mark O'Connell, director of European sales and business operations for Globalstar.

Voice, short messaging service and low-bandwidth internet access can be available to just about anyone who can pay for satellite connectivity.

Conventional satellite phones and prepaid service plans are also available from Globalstar in many regions throughout the world — including North Africa. "Our customers can provide crew calling to their employees as part of their main contract with us. Alternatively they can provide separate crew calling via our prepaid system and share prepaid cards with their crew," said O'Connell.

Globalstar offers CDMA-based communications via a low earth orbit (LEO) constellation, whose advantages include zero latency — that is, no time lag — and excellent voice quality.

Globalstar is far from alone, of course. Companies offering satellite services globally (like Inmarsat) near-globally (like Globalstar or Iridium) or regionally (like Yahsat), with satellites at varying distances from earth in a variety of orbits and using various parts of the spectrum (depending on demand, spectrum availability and market), have transformed remote communications in recent years, alongside service providers like Hermes and RigNet.

Thus voice, short messaging service and low-bandwidth internet access, some of which are shared with crew, can be available to just about anyone who can pay for satellite connectivity. There are also more bandwidth-intensive applications available thanks to newer systems like O3b, which is a medium earth orbit system that intends to combine low latency with broadband internet.

But it is unclear whether the company decision-makers on oil rig or vessel communications would feel that eliminating latency would outweigh such potential disadvantages as cost and, in the case of O3b, the need for a lot of on-deck equipment (notably VSATs) and lack of global coverage (problematic if a rig is capable of going to new locations). "It all really comes down to latency vs throughput vs cost vs coverage," said Grady.

Real time video driving demand

Much of the initial customer base for broadband satcomms will come from large-scale consumer markets or cruise ships, for example, which can use internet connectivity as a selling point. Oil rigs will not have the user numbers or necessarily need that sort of investment; even operational needs will, said Grady, often only require a megabit per second or so download. "Real time video is what's driving a lot of demand," he said. "Seismic data or an ROV checking out the drill site during workover work, for instance. But it's not necessarily as much bandwidth as people expect."

Thus, in theory, a few megs download capacity can be shared between operational and crew needs with no strain on resources. "The most typical deployment is two virtual networks [on a rig] running over the same equipment," suggested Brady. This can even stretch to three, if a visiting contractor wants a piece of bandwidth. Some service providers are nevertheless trying to sell the idea of separate networks for crew and operations. This certainly has its adherents. However, says Brady, "a lot more internal logistics need to be taken into account...retrofitting equipment in order to do that is relatively difficult."

Of course, if economics allow, you could do this by taking signals from two different bands, especially as the more reliable Ku and C bands are nearly over-subscribed. For example, if you're offshore Nigeria the risk of occasional downtime on a Ka band service due to heavy rain might make it unsuitable for operational use, but crew would be less concerned by occasional breaks in service.

Alternatively, as Grady pointed out, if crew are mainly working or asleep, an astute rig owner may just avoid scheduling his own important calls for the few hours when crew need to call home, which, as he said, "improves the economics and utilisation of the satellite network".

One meg may not sound like much, but even with 512 bits/sec, downloading a film could be possible. The continuing march of technology through compression, caching, store and forward and other technologies is also a factor.

Globalstar's Express Data, for example, uses a variety of advanced information compression and performance enhancement techniques, to optimise traffic flow across the existing Internet infrastructure giving a 38kbps performance from 9.6kbps. "Typically people who use Express Data are people who have a large data requirement,"

Globalstar's Express Data uses a variety of advanced information compression and performance enhancement techniques, to optimise traffic flow across the existing Internet.

O'Connell explained. "For example, in the fishing community people who would need detailed weather maps spanning out over a number of days so they can see what conditions they're going to be facing out at sea. It also has applications within the emergency response and disaster relief sectors, oil and gas, forestry, mining — all of these in areas where people are remote."

While some level of crew connectivity for entertainment and socialising — whether real-time streaming or just SMS — is increasingly as important as good wages in tempting crew offshore, many companies may regard safety and tracking as the most important form of crew welfare. SPOT for example, provides one-way satcoms in very isolated areas and will soon be available from Globalstar in most of sub-Saharan Africa for the very first time. SPOT is a subsidiary of Globalstar that offers emergency notification technology, allowing users to communicate from remote locations around the globe. Thus a SPOT personal tracking device enables individuals to send Check-In/OK messages, help messages or SOS messages, if necessary, to the emergency services, colleagues or family.

A gateway in Botswana

"We're building a gateway in Botswana at the moment and we expect to bring it on line shortly," explained O'Connell. This will be a simplex [one-way communications]-only gateway. He adds, "The gateway will greatly enhance our coverage in Africa, making simplex and SPOT products available in countries such as Botswana, South Africa, Namibia, Mozambique, Tanzania, Madagascar, Swaziland, Lesotho, Malawi, Angola, Zimbabwe, Rwanda, Burundi and Zambia. Our simplex and SPOT service will be key to organisations in the animal tracking, oil and gas, NGO, alternative energy, mining, personnel tracking and personal safety sectors."

The fact that in today's oil and gas market you can talk to or text friends, possibly even browse the Internet, or be found if in trouble no matter where you are gives you a major advantage over your predecessors from the early days of the offshore oil boom. On the other hand, you are also likely to be much, much further out to sea or away from population centres than they were.

However, if you're hoping to play live, streaming Xbox by satellite on a rig many kilometres offshore sub-Saharan Africa you may have to wait — but possibly not that long. More satellites are going up, including the fast-growing new generation of high throughput satellites (HTS) although the geostationary ones far from earth may still have issues with latency. However, "There's a lot of talk about doing constellation approaches even closer [to the earth] than O3b," said Grady. This could mean not just lower latency but lower prices if competition kicks in. Whether the enterprise market rather than large-scale consumer markets proves a more appealing target for these systems remains to be seen.

On the other hand, if the recent rather nervous discussions at ADIPEC about the lack of skilled younger employees joining the industry are anything to go by, perhaps high speed data satellite communications for crew entertainment might be a way to attract them (along with their iPads, Galaxies and whatever else) out to sea. One way or another, therefore, broadband may soon be going further and higher than ever before. ■

Baker Hughes selects Powerlog

CGG HAS ANNOUNCED that PowerLog has been selected by Baker Hughes as its petrophysical software application of choice.

PowerLog is CGG's petrophysical software for well log analysis. As part of the Baker Hughes-CGG strategic alliance, the two companies have collaborated under a joint software development agreement to enhance PowerLog for its deployment as the preferred petrophysical software of Baker Hughes.

Jean-Georges Malcor, CEO CGG, said: "Our strategic alliance with Baker Hughes, which is focused on shale optimisation, brownfield development and software collaboration, is delivering tangible results. Now, with the first results of our software development agreement coming to fruition, we add a new and important aspect to this relationship with the delivery of our combined capabilities to the desktops of our clients to further improve their exploration and production performance."

Hydrocarbon pore volume of a teapot dome field reservoir.

PowerLog is designed for efficient multi-user environments and enables petrophysicists, geophysicists, geologists and engineers to collaborate to better understand the reservoir. Greater insight into subsurface rock and fluid properties can significantly improve completion design and enable E&P companies to reduce their costs and risks while drilling more productive wells.

Sercel extends frontiers of downhole operations

SERCEL HAS ANNOUNCED the launch of GeoWave II, an innovative new downhole seismic tool for conducting safe and efficient Vertical Seismic Profile (VSP) and hydraulic fracture monitoring surveys in the most hostile well environments. GeoWave II is the industry's first digital multi-level array specifically designed for high-temperature, high-pressure wells. It is capable of continuous data acquisition at temperatures of up to 400°F/205°C and is pressure-rated to 25,000 psi/1,725 bar. With new optimised high-speed telemetry, up to 120 levels can be safely deployed on standard wireline for hotter and deeper reservoirs. GeoWave II can also be configured to provide the longest array (3000m) in the market by using larger intertool spacing.

Optimised for seismic surveys and microseismic applications, GeoWave II is the most versatile tool, allowing downhole operations to be conducted in any well type with a diameter of 3'' to 22'', and is compatible with downhole tractor systems for deployment in highly deviated and horizontal wells. It is manufactured to the highest standards with material and components designed to withstand high-pressure/high-temperature environments for prolonged periods without the need for a cooling system. It features system testing and monitoring capabilities and also allows easy deployment and safe retrieval in all conditions.

Pascal Rouiller, Sercel CEO, said: "We are proud to add a new cutting-edge product to our suite of downhole tools, demonstrating once again Sercel's commitment to offer our customers new technologies in all our market segments. The new GeoWave II is our response to the E&P industry's growing need to deploy larger arrays in more hostile conditions for applications ranging from microseismic monitoring in deeper shale plays to 3D VSP surveys in challenging environments."

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