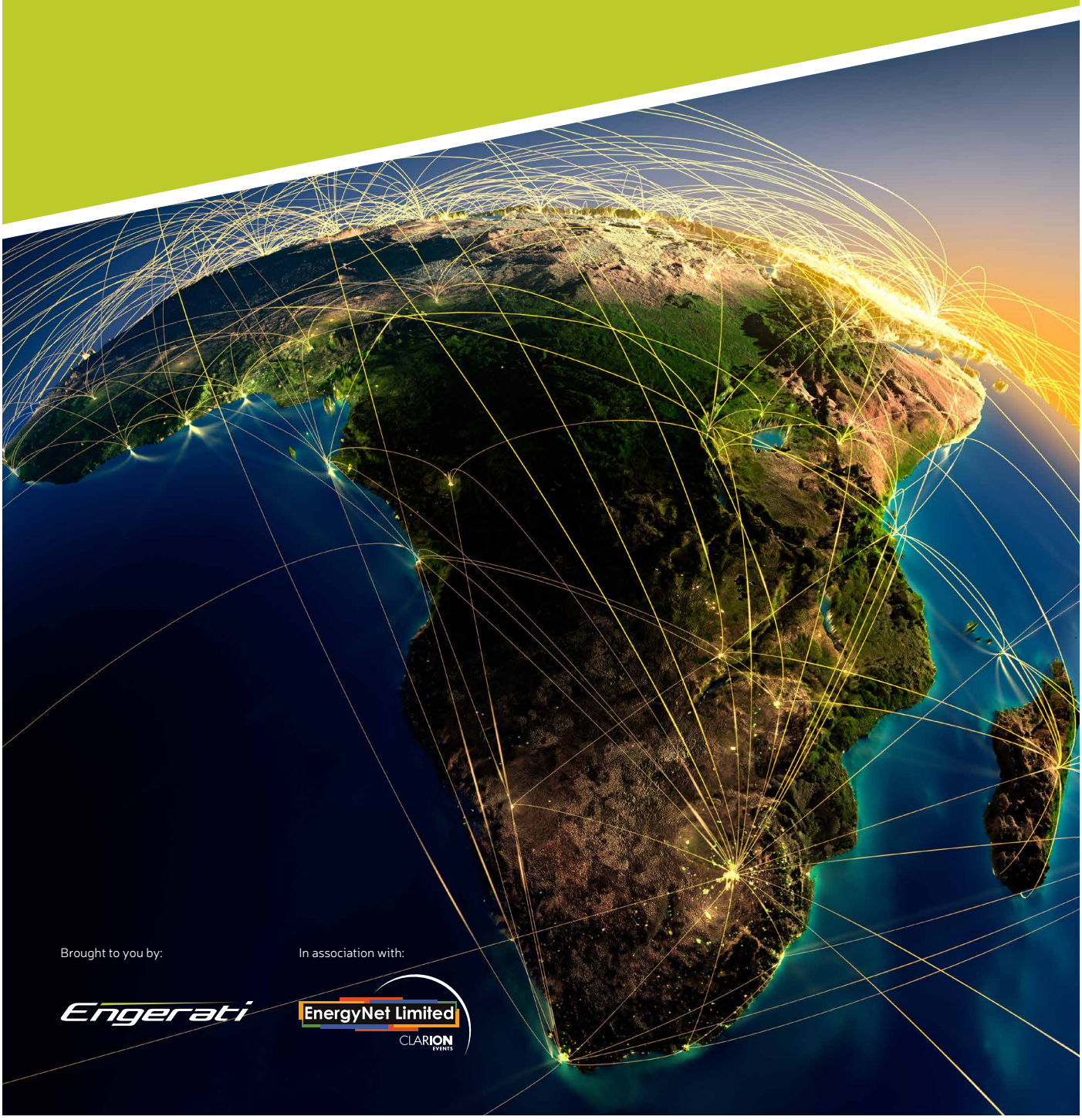
IN FOCUS REPORT

POWER IN AFRICA



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CONTENTS

NATURAL RESOURCES DRIVING ELECTRIFICATION IN EAST AFRICA

East Africa is attracting a great deal of attention when it comes to energy-related investments, not only for its impressive economic growth, but also for its rich natural resources. The region is set to become one of the world's biggest producers and exporters of oil and natural gas with 80% of the region's potential gas reserves located in Mozambique and Tanzania.

Written by Engerati Analyst
info@engerati.com

Countries including Tanzania, Kenya, Ethiopia and Rwanda, which traditionally depended on biomass to meet most of their energy requirements, are gradually shifting to modern energy sources to meet the growing demands of the expanding urban population and the rising per capita of income levels.

Research firm Frost & Sullivan's 'East Africa Energy' report highlights the fact that East Africa will have more than 50,000MW of generation potential by 2030, dominated by hydropower, coal, wind, geothermal power and natural gas-based generation systems.

While Liquefied Natural Gas (LNG) exports from these countries are expected no earlier than 2020, rapid development of gas power projects will provide a short-term growth of electricity demand in the region. As a result, the region will provide immense opportunities for companies specialising in oil and natural gas exploration and production, power generation and associated infrastructure, as well as renewable-energy technology commercialisation.

More In Focus: Power In Africa content
www.engerati.com/power-africa

East Africa Power Pool - Access Denied?

The biggest and most ambitious project in the region is undoubtedly the East African Power Pool (EAPP). Established in 2005, its main objective was to optimize the region's abundant natural resources by drawing these together by way of regional power interconnections.

The EAPP is a grouping of 10 countries, most of which are in the Common Market for Eastern and Southern Africa trading bloc. These include Kenya, Burundi, Rwanda, Sudan, Tanzania, Uganda, Democratic Republic of Congo, Ethiopia and Libya. Egypt was once included but has pulled out due to disputes over the Nile river as a resource. This group of EAPP nations receives support from the US government, the European Union, the World Bank and the African Development Bank.

The EAPP is currently attempting to resolve the issue of poor access to electricity in a majority of the group nations. Just under 25% of the population in each country currently has sustained access to electricity. By 'pooling' resources from the various member countries, the EAPP can satisfy the region's increasing demands for reliable and cheaper power to support basic needs as well as encouraging economic growth. It is hoped that through the facilitation and coordination of power exchanges among member utilities, EAPP can establish a regional electricity market which should result in lower power and operational costs.

In terms of potential, the EAPP region has significant hydro, geothermal, wind and solar possibilities. From the power pool's point of view, grid connected large scale wind/solar generation systems are considered as priority areas next to hydro and geothermal systems. While the size of most of the national systems in the EAPP region is a constraint to the development of large scale grid connected renewable generation technologies, the power pool is designed to provide the required system size for the development of large-scale renewable energy generation systems.

While these efforts are meant to boost the region's supply of reliable power, there is a possible missing link in the strategy. The expansion of the central electricity grid may still fail to address energy, poverty and access especially when it comes to outlying rural areas. For instance, most of the upcoming big dam projects are targeted at the power pool rather than local rural energy needs.

EAPP members will reportedly be fully connected by the end of 2018. There is clearly a huge opportunity for both micro and distributed power in the region and a place for the development of mini-grids and community energy programmes.

Frost & Sullivan's Energy & Environment Senior Research Analyst, Neeraj Sanjay Mense says that energy development

WILL THE EAPP FAIL TO ADDRESS POVERTY IN RURAL AREAS?

is gaining priority as the region's economies aim to attain middle-income status over the next 10 years. However, while governments across the region are putting strategies into place, especially when it comes to diversifying the energy mix, there are burning issues such as access to funds, political uncertainty and security which often stand in the way of reaching their goals.

Added to this is the lack of adequate infrastructure and skilled resources which often lead to project delays and dwindling funds. Ongoing, quality training and collaboration with experienced project developers will be critical if the region wants to accelerate technological advancements and meet its goals.

Kenya - Sharing Resources and Untapping the Geothermal Potential

Kenya, the dominant economy of East Africa, and Ethiopia are already in the process of building a 500KV transmission line that will transmit excess power from Ethiopia to Kenya. Connecting their power systems and promoting power trade between them, with the goal of increasing security and affordability of power supplies, promoting sustainability, increasing renewable power generation, and reducing thermal power emissions.

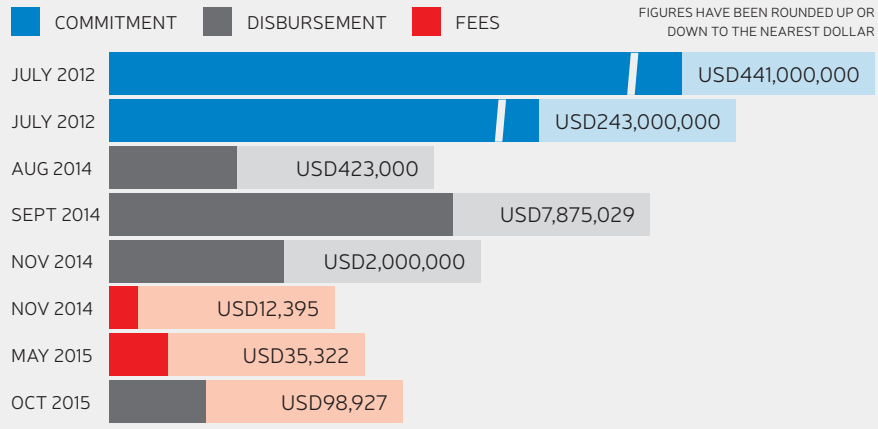
The cross-border power line falls under the Eastern Electricity Highway Project which aims to transport excess power to where demand is predicted to grow significantly in under a decade. The growing demand comes from an expected expansion of Kenya's oil and gas industry. With a growing demand and a flurry of recent discoveries in the area, there is an even greater pressure being put on the electricity system.

Once completed in mid 2018, the transmission line will facilitate the transfer of 400MW from Ethiopia to Kenya. The Kenya Power and Lighting Corporation (KPLC) and the Engineering Export Promotion Council (EEPC) have already signed a power purchase agreement and the 400MW is part of the 5000+MW initiative. The project will be financed by the African Development Bank, French Development Agency (AFD) and the Government of Kenya.

According to the African Development Bank, the transmission line will see an additional 870,000 households receiving power by 2018. By 2022, this figure will grow to 1.4 million households and the commercial sector is also expected to benefit by an additional 3100GWh of power by 2018; with an increase to about 5100GWh by 2022.

THE COMMITTED AMOUNT OF INVESTMENT FROM SEVERAL INVESTORS AND THE AMOUNT OF INVESTMENT INTO THE PROJECT SINCE 2012.

FINANCIER	COMMITMENTS
African Development Bank	USD354,300,000.00
International Development Association (Ida)	USD 684,000,000.00
Borrower	USD 106,200,000.00
France: Govt. Of [Mofa And Afd (C2d)]	USD 118,000,000.00



The East African Rift Valley, which stretches from the south of the Gulf of Aden to Northern Tanzania, contains vast geothermal energy potential which has yet to be harnessed, with the exception of Kenya.

Kenya has one of the fastest-growing geothermal markets in the world and its government is very involved in building up its infrastructure. In fact, the country is set to become the global geothermal leader with approximately 1000MW by 2023.

East Africa's Rift Valley has the potential to provide up to 15,000MW of electricity. International funding is seeing the development of energy take off in Ethiopia, Kenya, Tanzania, Uganda and Rwanda.

In contrast, according to the World Bank, Kenya also has nearly 1000 MW of wind capacity potential; but currently only a meager 6 MW is installed on the outskirts of the capital, Nairobi. However, the country is in the process of developing what will become Africa's largest wind farm, the 300MW Lake Turkana Wind Power Project, which is expected to be completed in 2019. The $686 million project is financed through a consortium led by the African Development Bank (AfDB).

Ethiopia - Making Waves with Hydropower

Ethiopia considers itself the powerhouse of Africa due to its high hydropower potential; however. Only a fraction of this potential has been harnessed so far. In 2009 less than 10% of Ethiopians had access to electricity and the country was plagued by power outages. In order to overcome this situation, the government has embarked on an ambitious dam building programme.

The country is currently developing a number of hydro projects; the most impressive and ambitious of which is the $4.2 billion Grand Ethiopian Renaissance Dam project. The dam is located approximately 500 km north west of the capital Addis Ababa, in the region of Benishangul - Gumaz along the Blue Nile.

At 1800m long, 175m high and with a total volume of 10million m^3, the Grand Ethiopian Renaissance Dam will be Africa's largest dam once it is complete. The building started in 2010 and is expected to reach completion by July 2017. The massive hydro power plant project is anticipated to generate 6000MW of electricity upon completion.

The project involves the construction of a main dam in Roller Compacted Concrete (RCC), with 2 power stations installed at the foot of the dam. The power stations are positioned on the right and left banks of the river and comprise 16 Francis turbines with a total installed power of 6000MW and estimated production of 15,700GWh per year. The project is completed by a 15,000m3/s capacity concrete spillway and a rockfill saddle dam 5km long and 50m high, both located on the left bank.

While highly impressive, Egypt is concerned that the dam will be utilised for irrigation in Ethiopia, resulting in diminished downstream supply, affecting their future water security. Added to this is the concern over re-settlement of locals due to development of these hydro projects.

More than 95% of the future installed capacity in Ethiopia is from hydropower, despite a large potential for wind, solar and geothermal power. Since drought is a reality in Africa, experts agree that Ethiopia should be aiming for a wider mix of energy. Being part of the EAPP is a step in the right direction as this will give Ethiopia more energy security in the event of a drought.

Aside from hydropower, Ethiopia also leads in wind power with its 120MW Ashegoda wind farm located in the north of the country. Ethiopia is already producing another 51MW from wind generated from two different sites in the south of the capital Addis Ababa, showing that a mix of energy might not be such an unattainable vision for the country.

Capturing the Ugandan Solar Potential

As a whole continent, Africa is blessed with an abundance of sunshine. This is not a resource that should go to waste when it comes to generating clean energy.

While the potential is huge throughout the region, construction of East Africa's largest solar plant has just kicked off in Soroti, Uganda. The 10MW Solar PV plant, costing $19 million, is expected to be operational and connected to the national grid in July 2016 and will provide energy for 40,000 households.

The tender for Uganda's first PV farm launched in March 2014, with Germany's KfW Development Bank managing the procurement process. The project is funded by the European Union Infrastructure Trust Fund, and supported by the governments of Germany, Norway and the United Kingdom.

The Soroti project is the first solar power plant to be developed under the Uganda's GET FIT facility, a support scheme for renewable energy projects set up by KfW and the Ugandan government's Electricity Regulatory Agency (ERA). According to the World Bank, Uganda currently has about 800 MW of installed electric capacity, mostly from hydro and thermal sources.

According to the World Bank, Uganda currently has an 18.2% electrification rate. Power generation is low in general, particularly in the Soroti region, which is one of the highest solar potential regions in the country. With the right financial and technological backing, as well as professional project management, more projects across the East African region will be made possible.

THE SOROTI PROJECT IS THE FIRST SOLAR POWER PLANT TO BE DEVELOPED UNDER THE UGANDA'S GET FIT FACILITY

KEY PROJECTS IN EAST AFRICA

Ethiopia - Gibe Hydropower III Dam:

The US$1.8 billion project began in 2008 and, although only 88% complete, began to generate electricity in October 2015. The remaining generators will be operational by 2016. It is hoped the project will feed the national grid and increase the generation capacity of Ethiopia by 234%. Once fully complete, in 2016, the dam will supply around half of its generated power to Ethiopia and will export the rest to Kenya, Sudan and Djibouti. In August 2010 Ethiopian Prime Minister Meles Zenawi vowed to complete the dam "at any cost", saying that critics of the dam "don't want to see developed Africa; they want us to remain undeveloped and backward to serve their tourists as a museum."

Kenya - Lake Turkana Wind Power Project:

Once completed, the project will become the largest single power station in Kenya and is eventually expected to deliver 300 MW of power to the national grid. The project will be completed and operational in 2016 and should it prove successful, will save Kenya an estimated $150 million every year; that would otherwise have been spent on importing fuel for geothermal generation.

THE PARIS AGREEMENT: THE FUTURE OF RENEWABLES IN EAST AFRICA?

Written by Adam Lovett & Laura Kiwelu
April 2016
*This is an extract taken from the Africa Energy Yearbook, produced by EnergyNet

The pact announced at COP21 last December, known as the Paris Agreement, does not require countries to meet climate targets but it does oblige all nations to at least subject their climate plans to public scrutiny every five years in a far more transparent manner than most have ever done before. In return, developed countries are committed to providing more climate finance to developing nations and an adjoining 19-page decision of the Paris meeting states that developed countries should set a new goal of investing more than US$100 billion a year in low carbon technologies and infrastructure in developing countries by 2020.

This deal was viewed by many within the energy industry as less about discouraging fossil fuels and more about encouraging investors to support low-carbon technologies.

The global market for low-carbon goods and services is currently valued at around US$5 trillion a year and the Paris Agreement creates the political imperative on governments to accelerate low carbon policies. As a result the amount of capital chasing new low-carbon investment opportunities is likely to increase considerably. In the words of Stephanie Pfeifer, chief executive of the Institutional Investors Group on Climate Change, a European network of institutional investors with €13 trillion in assets, the Paris Agreement "provides an unequivocal signal for investors to help escalate the development of low-carbon infrastructure."

In tandem with the Paris Agreement the Africa Renewable Energy Initiative (AREI) was announced. The AREI is the outcome of a concept which began at COP17 held in Durban in 2011, and is backed by the African Union Heads of State. AREI is led by, amongst others, the African Development Bank (AfDB), New Partnership for Africa's Development (NEPAD) and the International Renewable Energy Agency (IRENA).

AREI sets an initial target of US$ 20 billion invested in renewable energy projects in Africa within the next four years, with the eventual goal to develop at least 300 GW of new renewable generation capacity by 2030. To do this AREI seeks to galvanise financial resources from the private sector, development finance institutions and multilateral development banks, building on existing work and initiatives (including Power Africa, SE4ALL and the Africa Clean Energy Finance Initiative) to accelerate investment in renewable energy. The AfDB and other financial groups such as the World Bank have pledged an initial US$5 billion in public and highly concessional finance between

2016 and 2020, and Canada, France, Germany, the UK, Italy, Japan and the US have released US$10 billion to support Africa's renewable energy development.

How well positioned are the legal and regulatory frameworks in Tanzania and neighbouring Kenya to take advantage of AREI?

At the COP21 meeting, Kenya's Cabinet Secretary for environment and natural resources, Prof. Judi Wakhungu, stated that Kenya is ready to take part in massive solar and wind energy production.

With the financial close of the Lake Turkana project and its ambitious geothermal programme, Kenya is indeed leading the way on large scale renewable projects. We also anticipate the financial close of a solar photovoltaic project in Kenya before the end of this year. However, as the Kinangop project has highlighted, teething issues remain on Kenyan renewable projects. In particular, problems arise due to complex land and community issues, the extent of the application of public procurement rules to renewable projects, and the need to protect the creditworthiness of the offtaker, Kenya Power. Kenya has a renewables policy in place and a well-established electricity sector, but entry into the market is not as easy as many experienced developers would have expected. In the future, we anticipate that Kenya will move towards competitive bidding for renewables and it is currently undertaking studies in this regard.

In Tanzania the development of renewable energy projects has been hampered by many factors, not least of which are ongoing concerns surrounding the solvency of the offtaker, TANESCO, a lack of incentives to attract investment and a lack of a clear procurement process to facilitate and encourage investment. Furthermore, with the anticipated exploitation of its natural gas and coal resources, the Tanzanian public sector creates an impression that its future lies in fossil rules rather than renewables.

Tanzania has had a feed-in tariff scheme in place since 2008 for small power producers (100 kW to 10 MW) which has had some limited success in attracting investors, but there are no feed-in tariffs or other clear incentives for renewable energy projects larger than 10 MW. Instead it is open for developers of larger projects to approach the Government of Tanzania for bilateral negotiations outside the feed-in tariff scheme, and the process for these bilateral negotiations is regarded as cumbersome and complex.

However, a notable first step to address this situation was taken with the introduction in February 2016 of the Electricity (Competitive Power Procurement Framework) Regulations, 2015. The regulations pave the way for the introduction of two new

> THE PARIS AGREEMENT **"PROVIDES AN UNEQUIVOCAL SIGNAL FOR INVESTORS TO HELP ESCALATE THE DEVELOPMENT OF LOW-CARBON INFRASTRUCTURE"**

sets of rules that will create a competitive bidding framework for small power projects (projects with a capacity of between 1MW and 10 MW) that utilise a renewable energy source, and for all large scale power projects (projects with an electricity generation capacity of above 10MW). The first of these sets of rules, for the development of small power projects, came into effect earlier this year.

The new rules set out a simplified, non-competitive process that applies to the development of all hydro and biomass small power projects, and wind and solar projects of less than 1MW in size.

Wind and solar projects of between 1MW and 10MW are subject to a competitive process that will be tendered in bid rounds of up to 100MW. The newly formed Electricity Infrastructure Procurement Committee will issue a request for qualification inviting interested parties to submit bids for qualification, which will be evaluated according to their technical capability, financial resources and demonstrable commitment to acquire land rights. Following selection of qualified bidders a request for proposal would be issued, which stays open for nine months for solar and 15 months for wind, inviting the submission of binding bids with a bid price per kWh in US dollars together with bid security of US$2 per kW of proposed project installed capacity. Preferred bidders arising out of the RFP stage are then invited to execute a 25 year standardised power purchase agreement after posting a second bid security of US$25 per kW.

It is not the first time that large scale investment has targeted the Africa renewables sector and developments are still slow moving, with many obstacles to overcome. However, the AREI is an Africa-led initiative and it has a fixed near-term goal of developing 10 GW of new renewable energy generation by 2020. This means that the continent has proactively set itself an achievable target that should help to galvanise the development of financial products to assist to de-risk offtaker creditworthiness issues, and spur national governments in their on-going regulatory reforms.

EXPERT CORNER

CLICK TO WATCH OLUNIYI ROBBIN-COKER, CEO, **PAWA PLÉS**

Even with government guarantees, without revenue collection working properly then it is only a matter of time before you run out of money for your generation project.

CLICK TO WATCH ROB SCHUEFFNER, MICROGRID COMMERCIAL MANAGER, ELECTRIC POWER DIVISION, **CATERPILLAR**

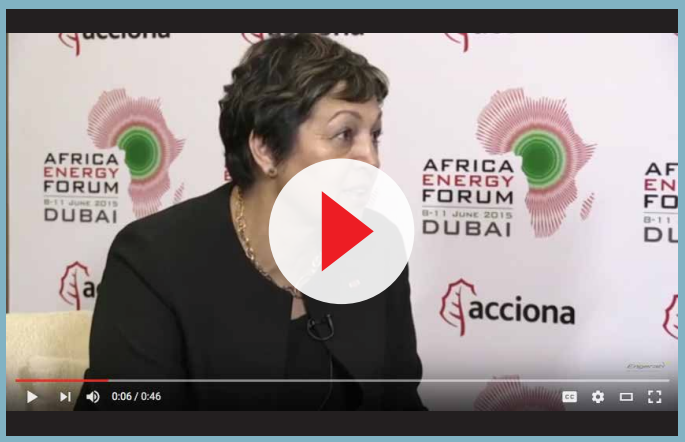
Micro-grid hybrid systems are a fundamental change. A change that creates the same exciting opportunity as with the telecoms industry; to skip big central infrastructure issues.

CLICK TO WATCH THEANS EHLERS, MANAGING PRINCIPLE, INVESTMENT BANKING - RESOURCE AND PROJECT FINANCE, **BARCLAYS AFRICA**

Is there really a shortage of development projects in Africa and people willing to take those risks? Theuns Ehlers offers an alternative perspective. "The challenge developers face isn't project funding, but getting these deals to close."

CLICK TO WATCH KASPER DALSTEN, DIRECTOR, **VESTAS WIND SYSTEMS**

Kasper Dalsten discusses the price of power in the African continent. With the average system cost of generating power being 160-180 kWh how can the continent look at strategies to compete with other countries on price.



CLICK TO WATCH NESIDE TAS ANVARIPOUR, FORMER CEO, **AFRICA50**

Neside Tas Anvaripour talking on the advantages of introducing small, scale-able renewable projects such as wind or solar PPAs vs large scale projects which require huge amounts of preparation, structuring and financing.

CLICK TO WATCH ANGELI HOEKSTRA, POWER & UTILITY LEADER AFRICA, **PWC**

Angeli Hoekstra speaking about the developing political landscape in Africa and it's affect on the regulatory environment; and how Africa is building bridges for established inter-connectivity between nations - improving connectivity for regions as a whole.

SOUTH AFRICA - WAVING THE FLAG FOR RENEWABLE POWER IN AFRICA?

Written by Engerati Analyst
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Today's South Africa is considered a beacon of light for renewable energy, and it's clear that there is a real desire to create a mix within the country's energy sector. However, South Africa remains a heavily coal-driven economy, which also relies upon imported oil and gas from both Liquefied Natural Gas (LNG) sources, and neighbouring countries to generate power - with renewables topping up the grid rather than the other way round.

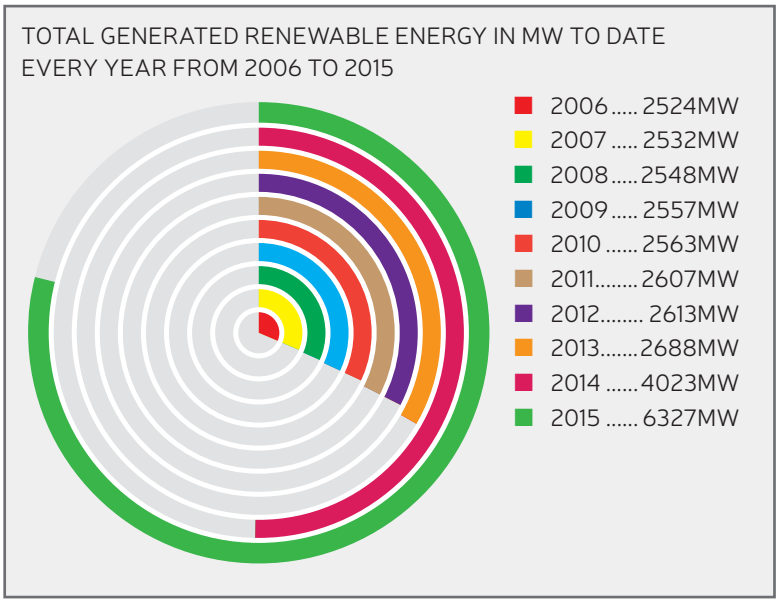
The issue of gas, or at least the lack of, in South Africa is now a top concern for the government and the last few years have seen the drawing up of a Gas Utilisation Master Plan. The success of the Southern African Power Pool (SAPP) has allowed for stronger trading relationships between involved nations and has opened up discussions of a gas pipeline connecting South Africa to Mozambique's considerable natural gas resources.

While fossil fuel generated power remains dominant in South Africa, the government and Department of Energy have recognised the importance of renewable sources in closing the country's energy gap. South Africa has one of the largest, and yet seemingly un-captured, potentials for renewable energy in the world with one of the highest levels of solar radiation on the entire planet, making the introduction of solar, wind and potentially hydropower seemingly a no brainer.

Karén Breytenbach, Head of the IPP Office for the Department of Energy in South Africa, commented, "in the morning the wind blows, during the day the sun shines and in the afternoon the wind blows again". The driving force behind South

Africa's shift to a mixed energy network came after a series of blackouts in 2009-2010 which caused considerable damage to the country's economy. Spurred on by the severe energy shortage and with a growing reputation as one of the world's biggest polluters, the South African government invested in a 'green economy', with green industrial companies and jobs being introduced.

We are now finally seeing renewable programmes catching up, with an increasing number of projects being planned for future development. Looking back to five years ago, renewable energy was a small fish in a very big South African pond; fast forward to 2014 when Engerati last interviewed Karén and the country was already on its way to generating around 4000MW of renewable energy on the grid. What is now clear is that this evolution of the renewable energy sector in South Africa has provided more than just a beneficial rise in electricity access for its population.



For example, it has caused a maturation of the Independent Power Producer (IPP) market and has seen hundreds of these companies coming to South Africa to participate in the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

South Africa's IPP Success Story

In 2011, President Jacob Zuma of South Africa said, "The biggest barriers to developing renewable energy in Africa to date are not technological, but financial". For the South African government the issue of raising the finances to meet the ever growing energy needs of the country is ongoing. The South African Department of Energy's development and implementation of the REIPPPP and the initiation of a framework enabling IPPs to compete at auction for renewable projects is, however, a success story for South Africa.

It has clearly shown how the private sector can be strongly incentivised to develop programmes that take advantage of renewables - which considering the geographic location and abundance of high winds and waterways - is an ideal solution for the whole African continent.

It's clear that outside investment and advice has been central to the success of IPP integration in the country. As Karén said back in 2013, 'the best price will win but you also have to have the best financial, legal and technical consultants that you as a country can afford'. As the third bidding window for the REIPPPP came to a close in 2015 and with the fourth bidding window currently being evaluated, the program now ranks amongst the best in the world and is considered internationally as a role model for renewable energy appropriation. A blueprint for other countries to follow.

Meeting South Africa's energy needs has forced the government to introduce private investors to create competition against the existing monopolising utilities such as Eskom - which remains traditionally coal focused and firmly state owned. Despite the financial squeeze on Eskon leading to the premature closures of several existing projects, the introduction of the REIPPPP and the creation of a bidding and capping system in the energy market has seen a gradual lowering of energy prices and an increase in economic development and foreign investment.

With private sector funding, the country has signed up to a further 47 projects since 2010 - with 28 in construction before 2013 and the last 19 signed off and ready to begin in the coming years. A further positive externality of these projects in the South African region is the revitalisation of local economies through the creation of employment initiatives and the encouragement of community involvement.

There has also been a considerable transfer of skills and knowledge from large international firms to local South African construction companies. The continuing IPP interest and competition has seen a lowering in the average cost of electricity, as well as a spread of economic development to rural areas and the creation of pockets of industry. In a roundabout way, this is ultimately helping to tackle the endemic issue of poverty and supplying electricity to low income households in South Africa.

A Word of Caution

The success of this programme has not been matched by similar progress in the transmission and distribution networks which need to be strengthened to cope with the intermittency of power, in order to translate the success of the generation programme to the end customer. South Africa is still plagued with regular power cuts and load shedding programmes.

It is vitally important that other countries following this model have a similarly aggressive parallel strategy for the grid.

The Southern African Development Community (SADC) and the Southern African Power Pool (SAPP)

The rest of the SADC region is also generally improving. Mozambique still relies heavily on oil for generating its power, but saw the first two gas IPPs start construction in 2014 as well as the continued construction of a new coal power station. Mozambique's grid is becoming constrained but their state-owned utility, Electricidade de Mocambique (EDM), understands what needs to be done for the county's energy sector to continue moving forward. The government's envisaged generation capacity raises the possibility for EDM to export power to surrounding countries via the SAPP, utilising the trade relationships between neighbouring nations. Malawi is also looking to follow suit with Mozambique and South Africa, and procured its first IPP in 2015.

Zambia has started the construction of the Maamba Power station, the first IPP coal power station in the country in 50 years, and several hydro schemes such as Copperbelt Energy Corporation (CEC) Kabompo dam are in development. Zimbabwe is also choosing to focus on hydro developments. Angola has faced funding headwinds in 2015 following the oil price crash in 2014, but several power projects such as the Luachimo dam are underway. Clearly following in South Africa's footsteps the nations of the SAPP are seeing an increased amount of renewable energy sources being introduced to the grid.

Namibia however has some challenges. It has one of the highest solar radiation footprints in the world but is currently failing to introduce solar powered generation to the country. Instead it is importing most of its power from a relatively unstable South Africa and generating a reasonable amount of electricity from the hydro resource in the north of the country. Lastly, Namibia will need to see new projects introduced in the next few years in order to give itself a stable base load of energy.

KEY PROJECTS TO LOOK OUT FOR IN 2016

The Maamba Power Station

Zambia's first IPP coal power station in 50 years.

The Grand Inga Dam - The Congo River

In 2015 these power stations were reportedly under construction. A financial squeeze on their builder, Eskom, meant the large proportion of time, money and effort had been directed towards the closure of the projects - however they are now due to be completed in 2016.

Medupi and Kusile Power Stations

Is Inga going to happen? This was the question we put to Karén Breytenbach at the Africa Energy Forum in 2015. 'I really hope so. The project will be a big game changer in the Southern African environment' was her answer. South Africa seems determined to look towards hydro-power as a massive source of generation in the coming years and so interest in the Inga dam project has grown in intensity now that political rifts in the Democratic Republic of the Congo (DRC) have begun to settle.

The Grand Inga mega-project is a priority project for a number of Africa development organisations, including the Southern Africa Development Community (SADC) and is hoped to generate 40,000 MW of renewable energy if the project goes ahead.

At last year's AEF there was much talk of 'will it, won't it happen' - this year the progress of the project will be up for further discussion. Following a treaty signed between DRC and South Africa in 2013, the first stage objective of the project, namely laying the foundation stone, was completed in October 2015. A series of social and environmental impact assessments are being completed and construction is planned to commence during 2016.

TO IPP... OR NOT TO IPP... THAT IS THE QUESTION.

Written by Nigel Whittaker, Managing Director, Songas
*This is an extract taken from the Africa Energy Yearbook, produced by EnergyNet

Nigel Whittaker, Managing Director of Songas, the vertically integrated gas processing, transportation and electricity generation company in Tanzania, comments on some recent issues surrounding the energy sector in the country. Songas is majority owned by Globeleq, a leading independent power producer in Africa.

Songas has been operating since 2004, providing reliable and affordable electricity in a region which continues to suffer from a lack of dependable electricity supply for both domestic and industrial customers.

Despite the lack of access to electricity, Tanzania's GDP growth continues at 7% (Source: IMF mission to Tanzania, March 2016) and is likely to hold steady during 2016. Imagine the social and economic impact on the country, and indeed, the continent, if the perfect investment environment was created by both sector players and policy makers?

Of course, progress is slow for various reasons including the need for significant capital investment to construct and deliver grid electricity to remote regions; the need for public subsidies to enable poor people to obtain and keep their connection; maintaining/upgrading of existing equipment to reduce system losses; dependence on one type of generation technology (hydro needs regular rainfall; oil fired generation is subject to market and exchange rate fluctuations), and ensuring the correct regulatory and legal framework.

All of these contribute to the government's large financial burden, particularly when policy makers have to prioritise between sectors – sometimes resulting in compromises and unclear economic benefits. Other barriers such as political risk/corruption, minimal transparency and creditworthy off-takers also impact the sector's development and ability to encourage investment and growth.

With the absence of available funding and specialist experience in their own governments, leaders can adopt a partnership approach with the private sector for large infrastructure projects. Whilst some choose to pursue the path of full or partial privatization, others encourage public and private partnerships which allows the government to maintain control or keep an interest in its electricity sector. The use of independent power producers (IPPs) help to remove the burden

of financing large infrastructure projects from the government and state owned utilities, allowing funds to be redirected and thereby benefiting economic growth.

Through Songas, Tanzania has shown what can happen when public and private partnerships work together to develop successful infrastructure projects. Songas was the country's first natural gas to power project and was supported by Globeleq, the Government of Tanzania, sector participants, a newly appointed regulator and the World Bank. As one of the cheapest thermal generation tariffs in the country, Songas has been estimated to save Tanzania $5 billion in costs associated with purchasing imported fuel oil used in more expensive oil fired generation.

Large infrastructure projects use substantial resources and incur significant public debt, in some cases with questionable value for local residents. There continues to be much tension within the country as to how much the private sector should be involved in the electricity, oil and gas sector, particularly when a lack of transparency around project selection and policies still exist.

The use of IPPs in Tanzania continues to be viewed with a certain degree of skepticism, distrust and controversy. Some view IPP contracts as costly due to the need for capacity charges. These are essential for the existing IPPs to survive in Tanzania as a result of the structure of the sector (the utility controls transmission and distribution as well as owning/operating generation). Using IPPs actually works better and is more cost effective as the utility only pays for IPPs when they are available. The utility owned plants however continue to pay for all costs associated with the plant whether they are generating or not.

There also exists the view that keeping generation under the control of the state owned utility is much more affordable. However, it is misleading to compare numbers that do not cover the same cost categories – for example some plants do not include fuel costs when estimating their charges. In the case of the newly inaugurated Kinyerezi II plant the costs of the loans and funds needed to build the power plant are assumed at the corporate level rather than at the facility level) even though they are still incurred costs.

To continue to move forward in sector development, the government needs to be supportive of the longer term picture - not award projects as a reaction to the current situation – focus on regulations and capabilities needed for sector growth.

Providing around 20% of electricity to the grid, Songas believes that the government's focus should focus on establishing financial stability of the sector. In TANESCO's February 2016 tariff review application to the local regulator, EWURA, they indicate TZs 699.75 billion (approx. US$320 million) is owed to its creditors at 2015 year end. The utility stated that it had been "...under-recovering for every unit sold including the period since our last tariff application in 2013". The situation was exacerbated by ongoing drought and limited availability of the hydro plants, forcing the utility to rely on more expensive oil fired emergency power plants.

So it seems that discussion and education around cost reflective and transparent electricity tariffs should be a key agenda topic for the Tanzanian sector. The utility is starved of capital and needs a tariff that allows for cost recovery as well as using its own revenue streams to fund operations and new investments. Further subsidies could be given (eg Government purchasing fuel on utilities behalf) but this is ineffective and ends up diverting expenditure from much needed projects elsewhere in the country.

The private sector is the best way to deliver the investment and efficiencies necessary to make the energy sector successful. The private sector therefore needs to have confidence in a creditworthy offtaker in order to encourage further investment and allow for additional capacity.

With the continued excitement around new and proved reserves in the domestic natural gas sector, investments need to be co-ordinated to ensure the maximum benefits are secured by Tanzania.

Songas believes that the current situation is in time, able to be fixed. The public and private sectors need to engage and tap into the existing knowledge and expertise in the industry. To do this all that is required is commitment and the desire to set up clear and transparent processes (such as a central authority with representatives from public and private sectors) to make sure this engagement is effective.

About Songas

Songas Ubungo power plant generates 189 MW of electricity using gas from the Songo Songo Island gas fields, off the coast of southern Tanzania. By utilizing the country's own natural gas resources, the Songo Songo gas to electricity project has substantially reduced operating costs for TANESCO and other industries in Tanzania. Over US$5 billion has been saved since commercial operations commenced in 2004. Songas is majority owned by Globeleq, an experienced independent power producer in Africa with more than 1,200 MW of generating plants in 8 locations across 5 different countries.

ENERGYNET - AFRICA INVESTOR'S PORTFOLIO 2016/17

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THE QUEEN'S AWARDS FOR ENTERPRISE: INTERNATIONAL TRADE 2014

EnergyNet Ltd. organise a global portfolio of energy forums, investment meetings and collaborative dialogues focused specifically on the power and industrial sectors across Africa. Proven to engage the decision makers and technical directors behind Africa's most exciting economies, EnergyNet places economic development at the heart of industrial solutions, helping to generate a more stable and viable investment option for our partners in Africa.

Our upcoming meetings in 2016 & 2017 include:

EGYPT ENERGY INVESTMENT SUMMIT 16-18 February 2016 | Cairo

EnergyNet will host the first Egypt Energy Investment Summit in Cairo this February. The Summit will bring together the world's leading power developers, investors and technology and solution providers to discuss capacity building within Egypt's industrial communities and create a dynamic platform for new and accelerated development of Egypt's energy sector. This pragmatic meeting will enable companies from across the world to explore the opportunity in Egypt's energy and power sectors, with a focus on private sector development and investment realisation.

www.egypt-investment-summit.com

SOUTHERN AFRICA ENERGY & INVESTMENT SUMMIT: 4-6 May 2016 | Maputo, Mozambique

For 15 years EnergyNet has worked closely with the Government and stakeholders of Mozambique, Namibia, Botswana, South Africa, Madagascar and Zambia. This year, we bring these countries together in Maputo Mozambique, the Heart of Southern Africa, to celebrate regional cooperation and promote energy and infrastructure projects that require both private and public sector support to succeed..

www.southern-africa-summit.com

18TH ANNUAL AFRICA ENERGY FORUM 22-24 June 2016 | London

The 18th annual Africa Energy Forum (AEF) will take place from 22-24 June in London. AEF has established itself as the international marketplace where governments and power utilities of Africa unite with the energy industry to focus on delivering power & infrastructure projects across Africa. All the players in the industry are in the same place at the same time. Over 1800 industry stakeholders are expected to attend in June 2016 including; government representatives, utilities, financial investors, power technology providers, power developers and EPC contractors.

With massive demand for power in Africa and international investors keen to fund power projects, this is the most established African power event that African governments and private sector attend year on year.

www.africa-energy-forum.com

2ND ANNUAL POWERING AFRICA: NIGERIA 3-4 October 2016 | Abuja

Powering Africa: Nigeria 2016 is a two-day private sector-led summit on structured finance, development finance and private equity for Nigeria's Discos, Gencos and power sector leaders.

The programme will feature interactive dialogue between private sector banks, multilateral investors and DFIs, government and developers to discuss the changing investment landscape placing the critical role of the private sector at the heart of the agenda. The platform will showcase the vast opportunities that await investment in Nigeria's newly reformed energy sector as well as offer solutions to overcome financial challenges, deliverables and risks that will ensure the reliability of supply for Nigeria. Participants will also have the opportunity to attend the black tie gala dinner, honouring some of Nigeria's most prolific deal makers.

www.poweringafrica-nigeria.com

2ND ANNUAL POWERING AFRICA: GHANA 6-7 October 2016 | Accra

The Powering Africa: Ghana summit will provide a platform for investor insights on the future direction of the power sector in Ghana. The agenda will focus on the country's electricity landscape following the division of the energy and power ministries, the critical issues facing the government and investors, and the future project pipeline which is rapidly growing under the leadership of the Minister for Power. Meet with 250 decision-makers including DFIs, banks, developers and EPCs to discuss what is needed to fully support and enable the transformation of Ghana's electricity sector in the medium to long term.

www.poweringafrica-ghana.com

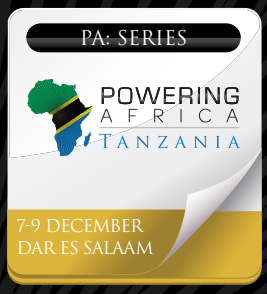
ENERGYNET - AFRICA INVESTOR'S PORTFOLIO 2016/17

2ND ANNUAL SOUTH AFRICA: GAS OPTIONS 26–28 October 2016 | Cape Town

The South Africa: Gas Options meeting is a focused 2 day investment meeting taking place from 1-2nd October 2015.

The meeting will take a detailed look at the opportunities available for gas developers and private sector investors as a result of the country's growing power demands. Debate solutions to the challenges of raising finance, delivering an efficient transmission infrastructure and the supporting industry, and the global LNG trends which could realise the country's vision of a stable and sufficient power supply.

www.southafrica-gasoptions.com



POWERING AFRICA: TANZANIA 7–9 December 2016 | Dar es Salaam

EnergyNet are delighted to present the 3rd annual Powering Africa: Tanzania meeting this December in Dar es Salaam. This meeting will provide detailed insights into the investment opportunites in Tanzania's power sector in 2015, following on from the success of the 2014 meeting where senior officials from the Ministry of Energy & Minerals, TANESCO, EWURA, TPDC and the Dar es Salaam Stock Exchange invited regional and international power experts to join them in timely discussions regarding the future role of the recently unbundled state utility TANESCO.

www.poweringafrica-tanzania.com

10TH ANNUAL POWERING AFRICA: FINANCE OPTIONS 25-26 January 2017 | Dubai

PA:FO 2016 will be celebrating its 10th birthday in style on 1-2 December 2016 in Dubai.

This year the high level 2 day meeting will bring Heads of Utilities and project developers from across Africa to present live projects seeking partners and investors.

Moving the meeting to Dubai will for the first time bring a truly global delegation of the biggest investors and project partners from the Middle East, Europe, USA and Asia in interactive discussions with project developers on financing structures to move projects forward.

www.poweringafrica-finance.com

3RD ANNUAL POWERING AFRICA: SUMMIT 8-10 March 2017 | Washington

The Powering Africa: Summit is a platform to showcase power, trade and infrastructure opportunities across the continent, engaging principle decision makers from the American and African public and private sectors to explore how project bankability can be increased. Obama's Power Africa initiative has helped map the way for project investment, giving a platform to global investment funds and the role they can play in driving forward the development of Africa's power sector. This year's Summit will focus on the successes of the private sector including America's private equity houses, sovereign wealth funds and America's power house family wealth funds.

www.poweringafrica-summit.com

EnergyNet has been producing investment forums and executive dialogues for Africa's power sector for the last 18 years - in Europe, the USA, China and across the African continent.

We work with 23 different governments and national utilities to facilitate investment summits where international investors can build relationships with credible African public sector stakeholders to advance access to power.

Best known for the Africa Energy Forum, the longest running meeting place for senior level decision makers in Africa's power sector taking place in Europe each year, EnergyNet also produces the Powering Africa: Series- in-country investment meetings which provide a more detailed perspective on the investment landscape and power generation potential of countries such as Nigeria, Mozambique, Tanzania, Ghana Ethiopia, South Africa and Egypt.

Our team spend over 220 days a year travelling to meet stakeholders across Africa, so relationships and investor insights are both our business and our passion.

For information on sponsoring, speaking and attending our meetings, please contact
Amy Offord on +44 (0)20 7384 8068 or email **amy.offord@energynet.co.uk**

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WEST AFRICAN POWER PLAY - CONNECTED AND COMMITTED

Written by: Engerati Analyst
info@engerati.com

West Africa is composed of 15 member nations with a regional population of just over 334.6 million - representing approximately one-third of the entire sub-Saharan African population. Since the turn of century, West Africa connected over 50 million people to the grid, with a resulting struggle to generate enough energy to meet demand. Governments of the Economic Community Of West African States (ECOWAS) have recognised that energy poverty poses a significant risk to the development of the region and have committed to improving energy services. Today we are beginning to see the effects of this commitment.

The work of the ECOWAS Center for Renewable Energy and Energy Efficiency (ECREEE) has seen a drastic increase in the number of renewable projects in West Africa. However, the abundance of natural gas reserves in the region means gas-fired power remains the dominant source of generation.

We are now also seeing power markets looking towards imported gas as a fuel source - probably as a direct result of the falling cost of Liquefied Natural Gas (LNG). The governments of the West African nations are, however, still prone to taking a short-term view and are continuing to back coal-fired power projects across the region - with coal remaining the cheapest option against the more expensive

ONE FIFTH OF ALL AFRICANS CALL NIGERIA HOME

LNG. While the coal and gas industries remain top priorities, the West African region, like South Africa, is continuing in its attempts to shed its global polluter title. There has been momentum gathering behind carbon dioxide reduction in recent years, even in the developing markets of West Africa.

Furthermore, the West African Power Pool is increasingly becoming an area of exciting trade opportunity. The true potential of the region lies in cementing trade relationships between nations and encouraging more interest in investment - with an end-game of improving the lives of West African citizens and businesses by promoting economic development.

Nowhere has this been more effective than within the countries of the the Gambia River Basin Development Organization (OMVG) Interconnection Project - specifically Senegal, Guinea, Gambia and Guinea Bissau. The primary objective of the project is to build cooperation and regional integration by constructing and delivering renewable and low-cost energy to the four countries. A long-standing dependence on oil-based thermal generation meant the cost of electricity in the OMVG countries was notoriously high; by introducing a mix of thermal and sustainable cost-effective energy in the area - such as Guinea's untapped 6000MW of hydropower potential - it is hoped these countries, along with the rest of West Africa, will thrive.

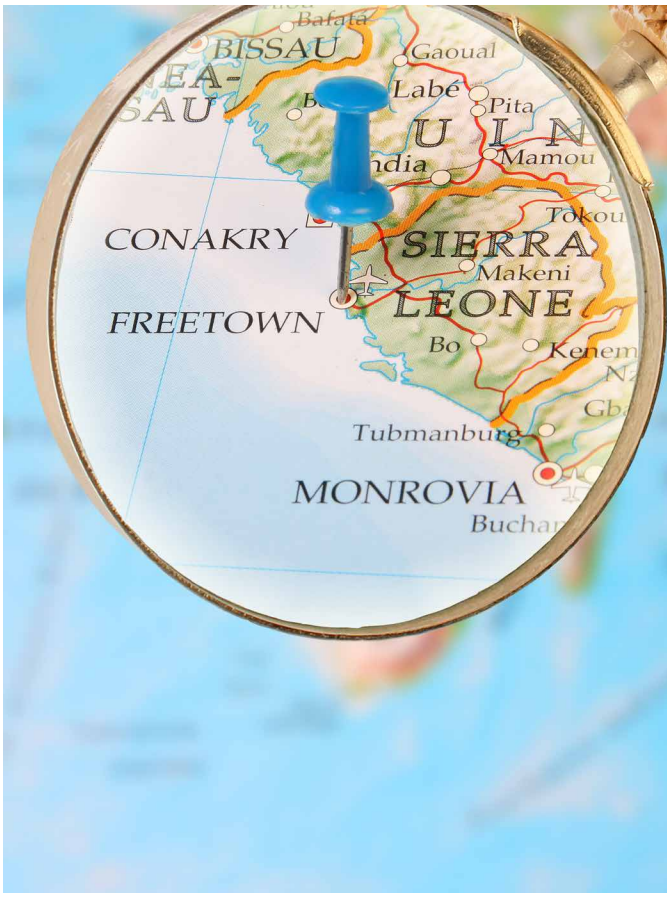
'Regional power trade is critical in West Africa', says Colin Bruce, the World Bank director of Regional Integration for Africa. 'By grouping together the energy demands of the four countries, the OMVG Interconnection transmission lines will enable larger and more efficient generation of electricity, which is essential for business development, job creation, income generation, and international competitiveness'. The project will include the installation of fibre optic cables to improve public communications in the OMVG. A US$200 million IDA credit has also been approved by the World Bank to support the construction of transmission lines to interconnect the four OMVG countries - a nod to the increasing private sector investments flooding into the region.

Nigeria's Energy Sector - Hanging in the Balance

Nigeria is the demographic powerhouse that half of West Africans and one fifth of all Africans call home, with a population which roughly doubles every 25 years. But being the 'giants of Africa' has come at a cost to the nation's energy industry. Despite the Nigerian government's success dealing with the structural and ownership issues in the power sector - which included the unbundling and privatisation of generation and distribution - over the last two years the Nigerian Electricity Supply Industry (NESI) has struggled with financial viability, gas and transmission issues. Today it is clear that the effort put into reforming Nigeria's energy sector will be rendered useless unless the new government can deal with these issues simultaneously. Even Nigeria's privatisation of distribution and generation companies is standing on the edge of success or failure.

The country is in desperate need of a functioning power sector that can provide larger amounts of cheaper and cleaner energy to support its ever growing number of homes and industries. Nigeria's power sector has a long history of underinvestment in every segment, from generation to transmission and distribution.

Factor in low tariffs, poor regulatory oversight and weak governance and Nigeria's vision of a stable and secure grid falls further and further away from its mark. In 2015 about 40% of the population was connected to the grid, with only 20% for rural



households and the average Nigerian received around 3 hours of electricity from the grid per day.

Following the 2016 elections, Nigeria's new government won't be starting from scratch. A good regulatory and industry structure is now in place, and distribution companies (Discos) and generation companies (Gencos) have found themselves in private hands, funded through loans from the country's banking sector, and slowly implementing the much needed corporate, billing and technical improvements. Nigeria also has existing thermal and hydroelectric power plants, as well as a series of new Nigerian National Integrated Power Project (NIPP) plants.

However, approximately 6GW of the thermal plants are currently not producing power due to insufficient processed gas molecules. This is largely due to historically low levels of investment in the domestic gas to power sector. Nigeria has an abundant, but unreliable, natural gas reserve and a grossly insufficient gas processing capacity. There is not enough gas offshore to provide all the new base load requirements for Nigeria, so an LNG solution is likely needed.

The progress of the Azura Edo IPP is the real beacon of hope for Nigeria. The project will strengthen Nigeria's flagging gas-to-power value chain and deliver much-needed electricity to almost 14 million residential consumers in the country. The power plant will be located 1km from a gas transmission pipeline and will secure long term gas supply at a negotiated price. The increase in the number of new IPPs is clearly proving beneficial on the journey to creating a more sustainable energy sector in Nigeria; but to encourage more interest and investment in the country, existing challenges must be resolved.

Ramping it up in Sierra Leone

In direct contrast to Nigeria - with a population of only 6.5 million, Sierra Leone is a small country with a huge amount of energy potential; although, to date, the country hasn't seen much success with power. Speaking at the Africa Energy Forum in 2014, His Excellency Ambassador Henry O Macauley, Minister of Energy for the Government of Sierra Leone, said that the country was working on a massive ramp up of their capacity, from 100MW to around 1000MW. Sierra Leone is currently sitting pretty on over 1.3 trillion tons of iron ore, not to mention vast natural reserves of other oxides, titanium, gold and diamonds. As a result, they are seeing a growing appetite to produce more power in the country, driven by industry and mining as well as domestic demand.

The question of how to attain such a step up on the grid is now being answered with a co-generation strategy - utilising both coal and renewables, along with the introduction of IPP projects into the country. Unlike 15 years ago when Sierra Leone was in the midst of a civil war, the country today is benefitting from a very high political stability level which has created a solid foundation for businesses to come in and thrive. The country's economy is steadily growing thanks to the injection of private investment and a solid private/public relationship.

However, for a small nation such as Sierra Leone, which doesn't have gas as a natural resource, the cost of transporting gas or LNG is simply too high - leaving coal as the only option. 'These days you have to cover your mouth when you mention coal', was the reaction of His Excellency Ambassador Macauley when asked about Sierra Leone's plans for its coal industry in 2015. However, the demand for power and the level of competitiveness in the industry has lead to an increased amount of innovation in 'clean coal' generation and a lowering of coal emissions to one and a half times that of gas.

Sierra Leone is also embarking on an ambitious renewables programme to bring a bigger mix of thermal and renewable generation to the grid. There is 5000MW of hydro potential in the region and year-round sunshine means there is the opportunity to generate 5KW per hour, per square meter, per day in Sierra Leone. Hydro projects have already seen 50MW generated and further solar and potentially wind projects are in the process of being mapped out. Despite the abundance of renewable resources, it's clear that coal will remain the central resource for Sierra Leone. His Excellency Ambassador Macauley noted that, 'renewable energy is good but it puts a

lot of pressure on your grid flexibility. You need to have a base load that is both reliable and predictable. That is why coal is still important, to be combined with a renewable energy ethos'.

Ghana - Rapidly Electrifying

Ghana is now enjoying an electrification rate which is over three times the average for sub-Saharan Africa. The country's success in this area has largely been due to donor support for grid extensions and the Self Help Electrification Project (SHEP), which connects all communities, enabling them to purchase low voltage poles for a very low fee. However, setting tariffs too low has required enormous subsidies that the Government has been unable to fund in full, leading to backlogs in maintenance, plunging plant availability and severe blackouts - a problem that has long affected the whole African continent.

Ghana's real challenge remains in electrifying its remote and rural communities in the north of the country. These areas, as well as many island bound communities along the Volta Lake, are considered not economically viable to justify the huge upfront costs involved in extending the grid. Projects such as the Ghana Energy Development and Access Project (GEDAP), which began in 2007, are continuing to tackle this issue in Ghana by helping the government to develop a commercially-orientated and sustainable framework to increase access to electricity throughout the country. For rural areas grid extensions are a no go, but there has been an increase in the introduction of off-grid renewable energy options. The GEDAP has focused on providing electricity, through the installation of stand-alone solar systems, to more remote, low income communities who would not likely be served by the grid for at least 5-10 years.

There are now numerous IPPs under development in Ghana which, should the country be able to solve its fiscal crisis and its base load fuel supply, might be the future for the Ghanaian energy industry. Ongoing LNG-to-power projects in Ghana are also expected to further enhance West Africa's existing gas-fired power generation sector. The deliberation of whether Ghana should follow Nigeria's example in privatisation is now the burning question of the year.

KEY PROJECTS IN WEST AFRICA

Ghana - The Nzema solar (PV) power plant:

Due to be completed in October 2016, this will be one of the biggest solar power plants in the world. It is set to increase Ghana's current generating capacity by 6% and will eventually provide 20% of Ghana's target to generate 10% of its total electricity from renewables by 2020. The Nzema plant will be built on a 183- hectare site close to the village of Aiwiaso in Western Ghana and has secured a 50-year lease on the site, planning permission and permission to connect to the grid.

Nigeria - Azura Edo IPP

The $900m, 450MW Azura-Edo power project is a gas-fired open cycle power plant located to the east of Nigeria's commercial capital, Lagos. The natural gas powered electricity generation plant is the first independent power producer (IPP) to be project financed in the country's post-privatisation regime and is funded by a consortium of twenty international banks and equity finance institutions drawn from nine different countries. The project is currently under construction and will be in action by 2018.

GAS TO POWER PROJECTS IN AFRICA: A TALE OF TWO SCALES

Written by; James Allpress, Managing Editor, Gas Strategies
*This is an extract taken from the Africa Energy Yearbook, produced by EnergyNet

The African continent is rich in natural resources – renewables and fossil fuels – from which to produce power far beyond its own needs. Yet its power sector, particularly in the sub-Saharan region, is wholly inadequate and fails to serve the needs of its industrial and commercial base and growing population.

No single power generation technology will solve all of Africa's electricity problems. Sub-Saharan Africa is incredibly rich in potential for renewable generation capacity. But Africa's electricity needs measure in gigawatts not megawatts, and few renewables technologies can address the size of the challenge in a speedy manner. Coal is a cheap resource in some countries, but it is challenging to construct and operate. Diesel power generation may be a quick fix for remote regions, or ones blighted by electricity blackouts, but it is expensive. Gas-fired generation is much easier to run and quicker to construct but natural gas is not available everywhere.

For locations where enough power demand exists, either near the coast (which can be served by imported liquefied natural gas) or with access to upstream resource, natural gas to power projects have a significant role to play. This article explores some of the critical elements of successful gas to power projects in Africa and some of the key challenges that face project developers.

Solutions and investment opportunities in power generation are being driven by the varying country situations and are being pursued by different types of developers and investors.

Some countries are pursuing large-scale projects, which require the creation of an entire gas chain and a high degree of alignment between diverse stakeholders. Such projects are complex, require the mobilization of a lot of resources, and can take years to materialise. But because of their scale, they have the potential to transform a country's energy landscape by establishing more widespread supply of gas to power and industry applications, as well as bolstering energy supply security through diversification of energy sources.

Elsewhere solutions are increasingly found on a small-scale, where decentralised plants are located in close proximity to end-user sites. These projects are easier to develop, may avoid many regulatory hurdles and the need to wait for state energy companies to bring forward delayed investments such as grid infrastructure. However such projects can result in the development of the power sector being more incremental.

Large-scale gas-to-power

Gas to power projects require a natural gas supply which, in many African countries, entails putting in place all the components needed for the development of a gas industry: the gas supply (liquefied natural gas imports or domestic upstream gas production), pipeline infrastructure, a power plant, and connection to an electricity grid capable of reaching end users.

In Africa, a particular challenge of large-scale electricity demand and gas supply (and even LNG import potential) is squaring off the often vast physical distances between the two. Natural gas is of little value unless it can be brought from the wellhead to the end user, either as gas or as electrons.

The roles and responsibilities for delivering this chain are distributed across a number of key stakeholders including government, state-owned companies, and the private sector.

Often large-scale developments need to address the chicken and egg conundrum – the need for an existing and reliable natural gas supply to justify the making of investment in power generation, and having sufficient existing and reliable gas demand to justify upfront investments in building the gas supply chain.

The challenge of building a full gas value chain should not be underestimated. The lack of infrastructure can entail not just domestic pipeline or power grids, but also the lack of basic physical systems including transportation, communication, water and electric systems. Other challenges include a lack of technical capability, or regulatory and fiscal regimes that would support exploration and production. As a consequence, huge upstream gas resources remain in the ground across Africa, many awaiting commercially effective monetisation opportunities.

For locations where enough power demand exists near the coast, gas can be imported as LNG for gas to power projects. At present only one country in the whole of Africa – Egypt – imports LNG. And imports began years after the country began producing gas domestically and a base of gas utilization had developed.

Nevertheless, three more countries – South Africa, Morocco and Ghana – are actively looking to develop LNG to power projects. And LNG suppliers talk about there being an unprecedented opportunity for Africa at the present time:

"Now is a great time for an African buyer to buy LNG. The LNG market is changing. Not only is there a lot more supply available, but it is available with much more flexibility", says Frederik Smits van Oyen, VP Origination and Marketing EMEA at Cheniere Energy.

> **"NOW IS A GREAT TIME FOR AN AFRICAN BUYER TO BUY LNG. THE LNG MARKET IS CHANGING. NOT ONLY IS THERE A LOT MORE SUPPLY AVAILABLE, BUT IT IS AVAILABLE WITH MUCH MORE FLEXIBILITY**

Other LNG suppliers talk about their willingness to co-invest in the downstream value chain in emerging markets – the LNG receiving terminal, the pipelines and even in power plants – in order to create a market for their LNG volumes.

"If you look at the global LNG market as a whole (and this is partly caused by US LNG coming into the market), it is becoming a much more flexible market. A market that is much better able to respond to market uncertainty in any downstream markets, including Africa," adds Smits van Oyen.

Even where a country has existing gas resource and infrastructure, successfully reaching a final investment decision (FID) on projects such as the impressive 450 MW Azura-Edo Independent Power Project (IPP) in Nigeria remains the exception rather than the rule.

Securing finance for large-scale projects

Power generation projects across Africa have the same challenge, whether you are talking renewables or thermal generation: the challenge of securing the financing and the sustainable power purchasing agreements (PPAs) to make the projects happen.

Across the continent, there are a significant number of good proposed power projects with technical merit, but they lack the financing.

This has two causes, according to Jerome Boyet, National Executive, Power, South Africa, GE:

"The first is the constrained financial capacity of many state utilities. The second is the lack of regional monetary integration. The latter creates a huge burden on a project's ability to hedge risk. For example, if you are producing electricity in Mozambique and you have a customer in South Africa, your operating costs are in Mozambican Meticals and your sales are in South African Rand. Although you could hedge

the exchange rate if you were just doing a capex project, you can't do that on a 20-year PPA."

The need to manage currency risk also stems from the long-term gas supply contracts to the power plant, which will be dollar denominated in the case of LNG imports, and possibly in the case of domestic production too, where the upstream operator is an international oil company.

The hidden cost of low electricity tariffs

Artificially low electricity prices (because of direct or indirect government subsidy) are an obstacle to the development of new power generation in two major ways, Boyet says:

"Tariffs which are not cost-reflective don't allow assets to be amortised – a huge disincentive to investment. Second, artificially low electricity prices have stymied any drive towards better efficiency and even prevented competition in the primary energy mix. In southern Africa, electricity is by far the cheapest way to get energy. Once you are connected, you don't even consider alternatives. "

Another challenge to creating a big value chain for gas to power projects in Africa (either ones that import LNG or use domestic gas production), is that the majority of the value chain costs are largely fixed. "In Nigeria, for example, the upstream and mid-stream costs, the power plant costs, the electricity transmission and distribution costs are all largely fixed," says Maurice Smith – resident electricity consultant in Nigeria. However, when it comes to selling power to all but the largest end-users, the revenue stream is variable because power is sold on a unit basis.

"This is because customers are unwilling to pay fixed costs for unreliable power, and the Nigerian regulator NERC largely agrees with them," Smith adds. Other African countries face a similar predicament.

This leads on to a wider set of issues around electricity tariffs: non-payment, non-collection, non-billing, and non-metering are all widespread while the electricity tariffs themselves are often set too low and lack, for example, a capital investment proportion. These issues often impact the credit rating of many power companies, undermining their creditworthiness to underpin long-term gas supply contracts.

Coordination across the value chain

Large-scale projects and their associated big chain approach require a high level of coordination. Not just coordination between the myriad parties directly involved in realising the gas to power project. But also coordination with, for example, the gas and electricity network operators.

"Power station developers need to coordinate to ensure there is a reliable gas supply once the plant becomes operational. Likewise, power plant operators cannot assume that a strong connection to the local main electricity substation is enough to ensure they will be able to evacuate all their production. Potential constraints may exist, or develop in an electricity grid – especially one that is poorly maintained and suffering from under-investment – which could mean that the plant is unable to evacuate all its production," says Smith.

Smaller-scale solutions

Large-scale power generation projects in Africa, while transformative when successfully realised, are not always the easiest or best way to address the continent's lack of available power.

"A LOT OF THESE [SMALLER PROJECT] DEALS MIGHT BE DONE OVER A HAND SHAKE AND A DEPOSIT PAID. IT IS LESS CONTRACTUAL THAN IT IS ELSEWHERE, BUT IT DOES TAKE TIME. IT DOES TAKE PERSEVERANCE

Large, centralised power plants that ship out the power through transmission lines suffer from inefficiency: if you don't use all the energy at the point of generation, you end up wasting a lot through heat, and through transmission.

Distributed generation (generating power on-site, rather than centrally) for industrial users offers higher efficiency and a much quicker solution, too. These are typically 0.5 to 5 MW capacity plants, as well as larger independent power plants (IPPs) with 20 to 60 MW capacity.

"With a decentralised method, you have, for example, an industrial facility that's able to pay for its power, pay for the generator, pay for the fuel and do its own generation. Of course, gas is an obvious choice where there is an existing supply and pipeline network, like in Nigeria," says Alex Marshall, Group Marketing & Compliance Manager, Clarke Energy.

The speed with which these projects can be realized is a benefit often overlooked, given the cost to the economy of not having sufficient energy, in terms of forfeited economic activity and implications for the country's sovereign risk profile and related investor confidence.

In terms of the physical challenges for gas to power projects, the main ones concern the availability of gas, but also the predictability of the gas supply, and the speed and development of the gas distribution infrastructure, which is often slow.

A growing number of project developers are seeing distributed generation as an opportunity to monetize gas reserves that may be classed as stranded (i.e gas that has been discovered but not developed) due to the economics, location, or because the supply is not large enough or does not meet the gas quality specifications of the local network.

In terms of managing risks around distributed generation projects, once they are up and running, you clearly need a reliable gas supply, but you also need to provide after-sales support. This includes ensuring the components and machineries are operational; that there is a local inventory for spare parts and consumables. And that you have a local workforce that is well-trained and is able to rapidly respond to needs on-site.

Outlook

There is a huge opportunity for gas to power projects to help address Africa's need for reliable, affordable electricity.

At the small scale, these are already happening despite the challenges: *"A lot of these [smaller project] deals might be done over a hand shake and a deposit paid. It is less contractual than it is elsewhere, but it does take time. It does take perseverance,"* says Clarke Energy's Alex Marshall.

Smaller-scale distributed power generation can provide a much more rapid solution than centralized generation projects. Unit costs can be higher, but where regulatory and financial systems are underdeveloped, and infrastructure is unreliable or simply not available, distributed power can be an attractive solution. And one which can be integrated into larger transmission networks as they develop.

Large-scale projects, while transformative, present a much greater challenge to realise. Once in place, they will catalyse the development of small-scale projects, as gas becomes more readily available. While the development of upstream resources takes years, LNG imports offer a comparatively quicker route to securing supply. And LNG suppliers appear willing to be commercially innovative to accommodate the needs of emerging markets. Nevertheless, the huge challenge of building a full gas value chain remains.

In the long-term as some countries begin to meet their own domestic power needs through a range of primary energy sources, a key step will be regional grid integration.

"If African countries want access to an electricity supply which is reliable and resilient, they cannot develop generation projects on a purely country-by-country basis," says GE's Boyet. *"They need to cooperate and develop a regional mix of different types of generation. And one that can be shared through regional integration which will make their electricity grids more stable."*

LNG TO POWER IN AFRICA

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*This is an extract taken from the Africa Energy Yearbook, produced by EnergyNet

Enhancing flexible generation across Africa through LNG-to-power

From Egypt to South Africa, Kenya to Morocco, LNG-to-power has been and is being either implemented or considered as an important component in Africa's energy mix. Gas-fired power generation is flexible and relatively environmentally friendly, when compared to coal, so fits well as a necessary source of baseload generation to facilitate the continued growth of renewables across the continent.

Gas-fired power has been the dominant source of generation in West Africa for years due to the abundance of gas reserves. But power markets are increasingly looking to use imported gas as a fuel source, driven by the falling cost of LNG. Whilst the cost of LNG is currently reducing, LNG is not a cheap fuel source. Power from LNG tends to be less expensive than liquid fuels such as diesel (at least it is increasingly becoming de-linked from global oil prices), but it cannot yet compete with coal on cost alone in jurisdictions that do not impose a cost on carbon, meaning that governments take a short term view and back coal-fired power projects. This is being counteracted by the momentum behind carbon dioxide reduction that was achieved at COP21, even in the developing markets of Africa, together with the actions of development financing institutions and multilaterals, whose support is vital for the development of power projects in Africa.

African market demand

In north Africa, Egypt has been regasifying imported LNG using its first floating storage and regasification unit since April 2015. A second FSRU was delivered in September 2015 and it now plans to charter a third FSRU to supply greater volumes of gas for power generation, due to be delivered in late 2016/early 2017. These regasification facilities will act as a bridge to the commercialisation of ENI's supergiant 30 Tcf Zohr gas prospect. To the west, Morocco has made significant progress with its comprehensive LNG-to-power programme, issuing the request for qualification for the procurement of an onshore regasification facility at Jorf Lasfar and 2.4GW of power capacity as part of a single project, to underpin a further 4GW of power generation capacity and to supply of gas for domestic industry.

West Africa's existing gas-fired power generation portfolio is expected to be further enhanced by a number of LNG-to-power projects under development in Ghana. The case for imported LNG in Ghana is made out as a means of enhancing the stability of gas supplies from Ghana's indigenous offshore Jubilee and Offshore Cape Three Points gas reserves. The Ghana

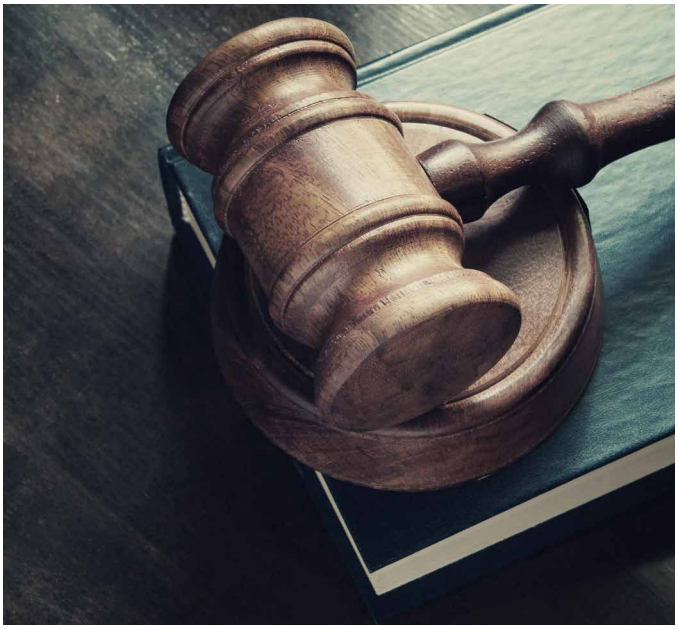
1000 gas-to-power project uses indigenous gas for its first 375MW phase, but then contemplates expansions up to 1300MW through the use of imported LNG.

In Southern Africa, Namibia previously selected the Xaris LNG-to-power project as the winner of a 250MW procurement process before doubts over the project surfaced. The use of LNG as a medium term bridge to domestic gas from the Kudu field would have been quite understandable for Namibia. South Africa's significant power deficit, lack of commercialised domestic gas and proximity to international shipping routes positions it well for the development of LNG-to-power projects, which could easily use Angolan or Mozambican LNG more cost effectively than deliveries by pipeline from Mozambique. The Department of Energy of South Africa (DoE) is pushing ahead with the procurement of between 1000-3000MW of gas-fired power generation. However both South Africa and Namibia would need to overcome the challenges presented by having to meet significant dollar-denominated fuel costs if they were to seek to implement LNG-to-power solutions. In addition, South Africa has built up a significant track record of procuring electricity from renewable sources under a form of power purchase agreement (PPA) that may well not be sufficient to enable investors to bank LNG-to-power projects.

What legal structures can be used to introduce LNG-to-power?

Fundamentally, the integration of the LNG supply, regasification and power generation components of an LNG-to-power project is very complex. The interrelationship of risks and the existence of multiple sponsor and lender groups gives rise to competing interests that make developing projects challenging at best. If the fuel supplier's delivery obligations are guaranteed to the power generator, and the power producer's obligation to take deliveries of gas are similarly supported, the project becomes much easier to structure. However this rarely represents the commercial reality of power and infrastructure project development – instead sponsors want to structure the projects on a limited recourse basis and avoid significant sponsors support. Therefore lenders must analyse and get comfortable with the entire contractual matrix, including for the portion of the project that they may not actually be lending to. Clearly, the state interposing itself between various aspects of the project may significantly reduce the risks to sponsors and lenders, enhancing bankability and delivery timeframes. But that is equally challenging for economic, constitutional or regulatory reasons.

Integrated model – The purest form of LNG-to-power project would be a single entity that procures both the regasification and power infrastructure under a single financing, importing LNG for the sole purpose of producing power in a dedicated power plant. This is a somewhat high risk solution because it is the least flexible option. Any adverse



performance in the power plant will directly impact the power project company's ability to meet its gas offtake obligations and vice versa. However this might be workable for smaller scale developments – indeed, it was the basis for the 250MW Xaris LNG-to-power project that was planned for Walvis Bay in Namibia. Developers considering this model will need to confirm that the licence conditions for power generation and gas distribution do not prevent cross-collateralisation of assets and, specifically in relation to the gas import infrastructure, that third party access rights do not exist. One interesting feature we have seen from other jurisdictions is that the LNG supply arrangements need not be firm, if supporting lenders can derive sufficient comfort with the long term availability of LNG on a spot basis, and the tariff structure under the PPA enables the power producer to pass through the gas price to the ultimate consumer or offtaker of electricity. This level of flexibility means that LNG can be procured on a spot basis, thereby avoiding significant financial commitments by the gas or power project companies, but exposing the consumer to less certain power prices.

Gas sales model – In a market with multiple consumers of gas, there will likely be more flexibility of gas offtake, making it possible to establish an LNG importation project in which the same entity imports the gas and sells it to customers. The same sponsors might separately develop an independent power project (IPP) on the basis of a long term offtake arrangement for the power (unless market fundamentals would support a merchant project), therefore providing a keystone customer for the gas project. This flexibility of gas offtake is crucial to the success of both the gas project and the power project. If construction of the power project is delayed or the power project is adversely affected by either low demand or poor performance, the gas company can sell gas to alternative customers, thereby mitigating its exposure to take or pay payments (usually on a cargo by cargo basis under LNG sale and purchase agreements

(LNG SPAs)). Whilst this may create an impression that the power offtaker does not need to accept responsibility for take-or-pay costs under the PPA, this is rarely the case. Generally such costs would need to be passed through to the offtaker on terms that are back-to-back with the gas supply arrangements. This risk allocation can only be avoided if there is a large and relatively mature market for gas such as to give investors high levels of certainty as to the long term demand profile for LNG.

Tolling model – An alternative approach would be for the IPP to import LNG itself, under a long term purchase agreement with an LNG shipper, and to buy capacity rights in a regasification facility to convert the LNG to gas. This enables the regasification facility to be financed on the basis of long term stable revenues under the throughput agreement with the IPP (again, potentially developed by the same sponsors as the IPP). Excess regasification capacity can be sold to other IPPs or gas industries. This is likely to be more appropriate where the regulatory regime imposes open access requirements and therefore a portion of any regasification capacity must be reserved for the market (for example, this could be the case in South Africa if Transnet were to be given the right to procure LNG import capacity). It is equally applicable where the power project is the primary driver behind both projects, as opposed to the gas importation and sale business being dominant. This is perhaps the most conventional approach to structuring LNG-to-power projects and might well be the most appropriate solution for Morocco. However Morocco currently appears to be pursuing a fully integrated approach, which fits more closely with its historical requirement for developers to take the fuel supply risk on its other thermal power projects.

Government buyer model – Finally, a solution that might be more appropriate for a country experiencing high growth rates but with potentially uncertain long term demand for imported gas might be for the host government to act as an intermediary between LNG shippers and consumers, including IPPs. In this case the regasification infrastructure could be financed on the basis of a throughput agreement with the utility, and the IPP would purchase gas from the government, or the government could toll its gas through the power plant, whist using excess regasification capacity to stimulate local industry or domestic gas consumption. This is the approach currently being taken in Egypt, were EGAS imports LNG and sells it on to IPPs, and appears to form the basis of the Ghana 1000 project, where GNPC is expected to procure LNG imports. However the government will need to have a relatively high degree of sophistication in order to administer the LNG SPAs, LNG trading arrangements and tolling arrangements. The diversity of domestic industry in South Africa, coupled with the potential high demand for gas, the existing role of Transnet and the conventional risk allocation under Eskom PPAs could well result in this structure being equally appropriate for South Africa.

How are the risks managed?

What is project-on-project risk? – In all but one of these scenarios, the regasification and power infrastructure is financed separately and on a limited recourse basis, and in the first two cases, there is a significant interdependency between the projects, thereby creating 'project-on-project' risk. This means that a default by one half of the overall project (e.g. the regasification project) will lead to an inability to generate cash flows in the other half (here, the power project). However the limited recourse nature of both halves means there is no creditworthy entity ultimately backstopping the risk.

A good example of project-on-project risk is delays in construction of one or other component of the project. Conventionally delay liquidated damages payable under a construction contract would be calculated at a rate and with a cap so as to keep debt and equity whole for a reasonable period of foreseeable delay. This approach is satisfactory for the project to which the construction contract relates, but the same level of liquidated damages will not compensate debt and equity on, for example, a downstream power project if the delay is suffered in the upstream regasification project (or vice versa).

This characteristic of many LNG-to-power projects places a higher value on flexibility – the ability to mitigate adverse effects experienced in one element of the project on the other element of the project. In the discussion of different project structures above, one recurring theme is that the more flexibility that can be achieved at either end of the supply chain, the less risk will be assumed by the project overall and therefore the more bankable and attractive the structure will be, leading to lower power prices.

Many markets in Africa that are not accustomed to large scale gas-fired power generation have regulated tariffs that are not sufficiently flexible to either allow the power producer to pass through take-or-pay payments or adjust the price of power based on a variable underlying cost of LNG. It is perhaps

important to appreciate that the price of gas may fluctuate even under long term LNG SPAs (being linked to various indices or commodity prices). Therefore the fuel charge component of the typical tariff for a gas-fired power project will need to vary to accommodate such changes. Regulators need to be comfortable with this and should ensure that the national utility or government buyer's account is the point in the supply chain at which the cash flow impacts of faster changes in fuel costs than the regulated electricity tariff are managed.

How does technology help mitigate risk? – Small to medium scale developments offer the opportunity to utilise floating storage, regasification and unloading (FSRU) vessels as the regasification infrastructure. Capital cost can be minimised by using old vessels, converted for this purpose and the current levels of competition in the vessel chartering market mean that financing new builds or conversions is relatively straightforward and flexible (in terms of the structural requirements of vessel financing lenders). FSRUs are chartered by the entity operating the regasification portion of the project and are generally financed separately from the other infrastructure.

Using a floating regasification solution offers an LNG-to-power project the flexibility to mitigate (in part) construction delays or major equipment breakdown during operations of the power project by delaying the FSRU's delivery date (within reason) or even through redeployment of the vessel as an LNG carrier to generate extra revenue pending completion of the IPP.

Technology can also assist power projects to overcome the risk of non-availability of gas. Most CCGT plants are capable of being configured to operate on liquid fuel as a back-up, when natural gas is unavailable. This flexibility is specifically recognised in the DoE's request for information in relation to early power generation, which helps to mitigate gas availability risk during the initial operations of the gas import facilities. However operating on liquid fuel has adverse effects on plant performance and increases both operation and maintenance costs to varying degrees, depending on the gas turbine technology. Provided this risk is addressed adequately under the PPA, the use of a dual-fuelled plant offers the IPP the ability to mitigate its exposure to delays in completion of the regasification infrastructure and to short term LNG unavailability (throughout the operating period).

Demand risk – A 20-year take or pay contract for LNG is a significant financial commitment. It will generally require the buyer to lift LNG volumes in accordance with a fairly restrictive schedule (essentially imposing a take or pay obligation on the buyer). Dispatch risk almost always lies with the offtaker in any gas-fired IPP in an emerging market (insofar as capacity charges will be payable for availability, regardless of power demand). However the concept of the national utility being responsible for take-or-pay payments arising from the LNG supply chain may be uncomfortable for African power purchasers, but this is common practice in other markets around the world and is an important component of the bankability of LNG-to-power projects. Utilities are responsible for capacity planning and demand forecasting, so to seek to place responsibility for take-or-pay payments with the generator or gas supplier would be contrary to the principle of ensuring that the risk lies with the person best able to manage it. By procuring some or all of their LNG requirements on a short term basis, utilities can make a trade-off between cost and committed volumes that may be desirable and consistent with economic purchase obligations.

Conversely, take-or-pay risk can be mitigated to some extent by having multiple offtakers of gas. This is particularly helpful if the volumes to be delivered by the gas project company to other customers are flexible. It may also be possible for the gas supplier to sell excess LNG cargos on the spot market, thereby mitigating its exposure to take-or-pay payments. This flexibility is subject to redirection rights under the LNG SPA, which are becoming increasingly flexible, thereby enhancing international short-term trade in LNG. There is currently no formal market price for spot cargos of LNG, so it will be challenging for a developer to fully mitigate, and therefore assume, this risk at the outset of a project. An independent developer in control of the full value chain will, however, more likely be able to manage these risks in an efficient manner.

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