AFRICA ENERGY INDABA

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ACRONYMS AND ABBREVIATIONS USED THROUGHOUT THE CONFERENCE

AFD	French Development Agency
AU	African Union
BRICS	Brazil, Russia, India, China and South Africa
B-BBEE	Broad-Based Black Economic Empowerment
CEF	Central Energy Fund
Comelec	Comité Maghrebin de l'Electricité
COMESA	Common Market for Eastern and Southern Africa
CSP	Concentrated Solar Power
DFIs	Development Finance Institutions
DoE	Department of Energy
dti	Department of Trade and Industry
DRC	Democratic Republic of Congo
EAC	East African Community
East London IDZ	East London Industrial Development Zone
ECOWAS	Economic Community of West African States
EPP	Electricity Pricing Policy
ERA	Electricity Regulation Act
ESI	Electricity Supply Industry
EWSETA	Energy and Water Sector Education and Training Authority
FMO	Dutch Development Bank
FDI	Foreign Direct Investments
GW	Gigawatt
GDP	Gross Domestic Product
HVDC	High Voltage Direct Current
IPP	Independent Power Producers
KWh	Kilowatt per hour
LNG	Liquefied Natural Gas
MCEP	Manufacturing Competitiveness Enhancement Programme
MOU	Memorandum of Understanding
MOZISA	Mozambique–Zimbabwe–South Africa
MW	Megawatts
MYPD	Multiyear Price Determination Methodology
NCPC-SA	National Cleaner Production Centre for South Africa
NDP	National Development Plan
NERSA	National Electricity Regulator of South Africa
NGP	New Growth Path
O&M	Operation and Maintenance

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PCD	Pollution Control Dam
PIDA	Programme for Infrastructure Development in Africa
PPA	Power Purchase Agreements
PPP	Public private partnerships
QCTO	Quality Council for Trades and Occupations
RCA	Regulatory Clearing Account
REIPPP	Renewable Energy Independent Power Producer's Programme
SAPP	SADC Power Pool
SATRI	Sam Tambani Research Institute
SMMEs	Small, Medium and Micro Enterprises
SAPIA	South African Petroleum Industry Association
SADC	Southern African Development Community
SOE	State-Owned Enterprise
SDGs	Sustainable Development Goals
UN	United Nations
US	United States
ZESA	Zimbabwe Electricity Supply Authority

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KEYNOTE ADDRESS 1

Speaker: Deputy Director General, Wolsey Otto Barnard, South Africa Department of Energy

The newly-adopted 17 Sustainable Development Goals (SDGs) focus on the attainment of specific goals related to socio-economic development. SDG 7 focuses on the provision of sustainable and reliable energy to all, and issues dealing with energy must focus around this seventh goal. In their current form all SDGs focus on building productive capacity and give more weight to economic and environmental factors. All economic policies of South Africa's economy, ranging from the National Development Plan (NDP), the New Growth Path (NGP) and the Nine-Point Plan, all focus on sustainable economic development. It is important to recognise how energy is integrated into the country's economic development plans.

Energy plays an important part in the revitalisation of the South African economy as addressed in the nine-point plan. In fact, all economic development plans of various countries are integrated with sustainable energy production. The primary purpose of South Africa's energy system is to contribute to better socio-economic development. In fact it is a key factor.

Since last year, the global economic sphere in which South Africa operates has changed dramatically. The price of crude oil has fallen to USD30 a barrel, due to the United States (US) becoming a net exporter of oil from shale sources, and with OPEC deciding to target the market share with no focus on the oil price. The decline of the oil price and falling commodity prices, coupled with the drought situation in the Southern African Development Community (SADC) region, has hit the South African economy badly.

The 2015 Ernst and Young Oil and Gas Investment Report notes that oil and gas deals struck in Africa on the upstream side have dropped by 33%, with the monetary value also dropping by 67%, from USD11 billion to USD3.5 billion. In 2015, the downstream side saw only a slight number of good deals struck in Africa.

The low oil and gas prices have impacted negatively on African economies that export oil. South Africa as a net importer of oil has not benefitted much from the decline of oil prices, due to the weak state of the local economy and the strengthening dollar. These challenges in the oil and gas industry in Africa are compounded by the economic downswing, with weak commodity prices, and oil refineries running at a loss.

These have had an adverse effect on Africa's economies. African countries are finding it difficult to pay back dollar-denominated loans to Western creditor institutions, due to the high interest rates of the strengthening dollar. Compounding this is the weak commodity prices, which mean less revenue from exports that have slowed down gross domestic product (GDP) growth. As such, the risk of a debt crisis in the majority of African countries is a real possibility.

Energy in Africa is needed to stimulate economic development and operating in a bad global environment (as we are seeing in 2016) has the capacity to slow economic growth. The weakening global economy, especially in Africa, has a negative effect on energy infrastructure investment and development. Upstream and downstream oil and gas investments in Africa are slowing down, which is not good for Africa's development.

There has been a slight increase in electricity infrastructure investment in Africa with regard to transmission and distribution. Access to electricity energy and the quality of supply are big energy infrastructure drivers in Africa, and investment in transmission and distribution are driving investment in the electricity sector in Africa. Moreover, there have been interlinking processes, either within micro distribution networks or within regional countries. Over the past few years, Africa has seen increases in investment in small power projects for generating power.

Sub-Saharan Africa is one the most energy-deficient places in the world. 620 million people lack access to energy and USD225 billion is needed to build energy infrastructure that can provide access to offset the energy deficit in Sub-Saharan Africa. Increasing energy access in Sub-Saharan African countries requires regional integration and cooperation. Reducing the massive energy deficit in Africa requires the following steps: first, regional cooperation and integration is needed to invest in huge energy projects. Second, there is a need to move away from single source energy generation to broad-based energy generation. Third, flexible legal and policy frameworks are needed for managing electricity or energy. This will open up investment, since governments lack the financial resources to run energy projects in Africa. Finally, there is a need for interlinked regional planning to implement energy projects.

Africa is rich in diverse sources of renewable energy and there is a need to tap even harder into renewable energy production using sun, wind, water, geothermal energy, etc. In South Africa, the Renewable Energy Independent Power Producer's Procurement Programme (REIPPPP) produces 7 000 MW from 92 projects in the country; currently 2 300 MW of green power is supplied to the grid.

Great strides are being made to develop renewable energy in countries in Africa, such as Morocco, where one of the largest wind farms in Africa generates close to 300 MW and or Egypt, Algeria and Tunisia, who are developing solar power generation plants. In Sub-Saharan Africa Kenya is a prominent leader in geothermal energy projects, producing 375 MW of geothermal energy.

In countries such as Nigeria, Ethiopia, and Ghana there is a concerted drive to increase renewable energy production. Energy infrastructure is a critical building block for increasing energy access, which will help build African economies. The future energy needs of Africa can be addressed by unlocking Africa's energy potential. Broadening Africa's energy mix is a top priority for African governments as a robust foundation for increasing energy access and ensuring steady sustainable economic growth in the continent.

PLENARY PANEL: REGIONAL INTEGRATION

Moderator: Dr Christopher Frei, Secretary General, World Energy Council

Panel Members: Minister Samuel Udenge, Zimbabwe Energy and Power Development Department
Minister Dora Siliya, Zambia Energy and Water Development Department
Dr Elham Mahmoud Ahmed Ibrahim, Commissioner, African Union Commission
Dr Reuel Khoza, Chairman, Globeleq

Key Questions:

- Does Africa need regional integration, and why?
- What programmes are in place to achieve regional integration?
- What are the key challenges which need to be overcome?

Key Points:

- Africa has tremendous energy resources and regional integration is necessary to unlock the huge potential of the reserves.
- PIDA's (Programme for Infrastructure Development in Africa) objective is to accelerate implementation of regional and continental infrastructure.
- Access to energy needs to be underpinned by robust continental energy leadership in Africa.

Synopsis:

Regional integration is needed in Africa for the attainment of economic development and prosperity. The African Union (AU) vision speaks of having 'an integrated, peaceful and prosperous Africa, managed by its people and playing its active role in the global arena'. Regional integration, especially in the energy sector, is required to provide energy access and to address the challenges of energy provision, such as the low capacity for energy infrastructure investment and the non-reliability and non-affordability of electricity systems (amongst other factors).

The demand of energy in Africa is expected to surge to 6% annually, in stark comparison to the average generation of energy in Africa for the last 25 years, which stands at a paltry 1.4%. Secondly, Africa currently generates 140 GW of power production. By 2040, the expected power production needed to provide adequate energy access is 700 GW.

Regional energy projects are the answer to meeting the 700 GW energy production requirements. Africa has tremendous energy resources, such as the hydro-electric power potential in the Democratic Republic of the Congo (DRC), which stands at 42% in Africa. South Africa has 95% of Africa's coal reserves. North Africa and West Africa have the majority of oil and gas reserves. Therefore,

regional integration is the optimum way to unlock the huge potential of these reserves.

Currently, AU regional power pools are working to realise the integration processes inherent in regional power projects. The AU plans for energy access are centred on three axes: for regional big projects, such as generation and transmission networks for renewable energy and energy efficiency; to use all available resources in the continent, and to have a diversified energy mix for Africa.

The AU has the Programme for Infrastructure Development in Africa (PIDA) plan for the continental development of the energy sector among three other sectors. The PIDA energy plan consists of the development of regional and continental energy projects. The plan has three phases: the first extends to 2020 for short and priority projects; the second between 2020 and 2030, and the third phase extends between 2030 and 2040.

Creating greater energy access in Zambia is a challenge due to inadequate government financial resources. Private investment is needed to build energy infrastructure, but the challenge in attracting investment is the lack of a robust regulatory framework that discourages investors. Secondly, tackling the energy deficit in Zambia will require regional integration.

For example, in the northern part of the country (which has abundant water) Zambia is working with the DRC to develop a joint energy project. In tackling Africa's energy deficit there is a need to address the grid infrastructure beyond the nation. Zambia has an energy production capacity of over 2 000 MW nationwide and can also export power within the SADC Power Pool (SAPP). However, the grid infrastructure for facilitating the export of power is limited and cannot cope with the energy demands of the population increases in the SADC region.

Zambia's efforts to import power from South Africa are hampered by the weak grid infrastructure that cannot support a steady flow of power from South Africa to Zambia. The ZIZABONA Transmission Initiative Energy Transmission Project (involving Zambia, South Africa, Botswana and Namibia) promises to solve such grid infrastructure problems. The ZIZABONA Transmission Project allows Zimbabwe, Zambia, Botswana and Namibia to export or import more power and to trade energy with one another (and with the wider SAPP area, South Africa in particular), and secondly to ease congestion on the North–South transmission corridor through Zimbabwe to South Africa. ZIZABONA is expected to carry 600 MW of power to connect power from South Africa to Kenya; already work has been done to connect Zambia to Malawi and Tanzania, and also to Mozambique.

Leadership is needed through the AU to ensure that feasibility studies are done as fast as possible, to bring private sector funders on board to fund projects such as ZIZABONA. There are also the challenges of due processes at national level, and at regional levels, which need to be overcome to make these projects viable. Regional integration has played a key role in energy infrastructure development in Southern Africa. For example, the Kariba Dam was constructed by Zimbabwe and Zambia. The ongoing construction of the Batoka Gorge 2 400 MW Hydro Electric power project, which is built across the border between Zambia and Zimbabwe, is another example of a regional project involving Zambia and Zimbabwe.

Regional integration in energy projects ensures that transmission of power is strengthened from country to country to ensure better energy access to communities in the region. The Mozambique–Zimbabwe–South Africa (MOZISA) Energy Project is another example of a regional energy project where network connectivity to the regional power grid in the SADC region will be improved significantly. MOZISA has contributions from each of the three countries utilities: Electricicade de Moçambique; Eskom of South Africa', and the Zimbabwe Electricity Supply Authority (ZESA).

Power generation and transmission projects between countries improve energy access for many communities and can boost regional economic development. In 2015, as a result of regional power projects, the West African region recorded the fastest growth rates in the world. It is of prime importance to stabilise the SADC power pool (SAPP) to harness the benefits that accrue from regional power cooperation.

Comprehensive continental leadership is needed to drive Africa's energy agenda forward; as long as leadership lacks the vision of driving the energy agenda forward, Africa's growth will continue to be stunted. This vision needs to be disaggregated into regional focus or regional integration for better implementation. The Cabora Bassa Dam is an obvious example, with its 2 000 MW capacity. In order for Cabora Bassa to be used to its fullest potential, the north bank must be developed. To develop the north bank, it is necessary to develop upstream, where the Kariba Dam comes in. In fact, both the Cabora Bassa Dam and Kariba Dam projects must operate in synchronisation. The value of the regional emphasis holds true for almost all energy projects in Africa.

The implementation of the Grand Inga Regional HEP project has been hampered by the lack of political will. Political will in the five countries where the project is situated will drive the Inga III project forward. This will also stimulate the Grand Inga project moving ahead, which is needed to provide energy access for many African energy-deficit nations. Cost-reflective tariffs are important in power projects. There should be sufficient economic returns that can guarantee project investments, especially for the private sector. These tariffs must be cost reflective and reasonably set – to encourage private investors. As such, there should be adequate economic

returns to the private investor. Governments must ensure that tariffs set must reflect adequate economic returns to attract investors. Subsidies in this regard must be scrapped because they tend to negate the economic dividends to investors.

The cost reflectivity of tariffs is underpinned by three efficiency factors. Firstly, efficiency in terms of the well-functioning trusted regulatory environment that does its work properly. Secondly, efficiency within the energy utility. And lastly, efficiency in revenue collection. If these three efficiencies are deficient, cost reflectivity becomes a pipe dream.

PLENARY PANEL 1: LEADERSHIP AND TALENT

Moderator: Dr Miriam Altman, Head of Strategy, Telkom

Panel Members: Eng. Gloria Magombo, CEO, ZERA
Kiren Maharaj, CEO and Managing Partner, Black Swan Advisory
Andrew M Herscowitz, Coordinator, Power Africa
Julian Lopez Garrido, South Africa Country Manager, Abengoa
Dr Louis van Pletsen, Founding Partner, Quantum Power

Key Questions:

- Can Africa strengthen its leadership position in setting a foundation for providing energy access?
- What kind of vision is needed in Africa to promote the development of sustainable energy industries?
- What kind of energy leadership in Africa is needed to formulate policy decision that fosters economic growth and certainty?
- To what extent can talent be harnessed in Africa to groom the energy leaders of the future, who can run the energy sectors of African countries?

Key Points:

- Strategic vision and competent leadership in the energy sectors of African countries is needed in providing universal energy access in Africa.
- The availability is a necessary ingredient in supporting the development of energy in Africa.
- Developing local skills in communities where energy projects are situated helps build the energy skills pool of African countries.
- Competent regulatory frameworks are important instruments that guarantee the flow of funding to develop energy projects in Africa.

Synopsis:

Africa faces a daunting task of providing energy access with 700 million people out of a billion people, who have no access to electricity, or who only have access to some form of electricity (which equals just one fifth of the global consumption average). Africa's youthful population, its sizeable middle class and the growing size of its 51 cities (with more than a million inhabitants), and vast rural swathes unconnected to electricity make it a potential place to invest in energy infrastructure.

However, the potential for investing in energy in ways that can guarantee energy access to millions of people in Africa is reliant on the quality of the vision and leadership needed in pushing the energy agenda forward in the quest for providing energy access. The nature of vision and leadership required to provide energy access is predicated on answers to questions such as: should power projects be planned on a country by country basis, or on a regional basis? Is money best spent on regional projects or in developing individual power sources? Is the leadership at the policy level, or at the project level?

Inevitably, skills are needed in the development of energy projects in Africa; fortunately, since the 2008 financial crisis a significant number of African skilled labourers are returning from Europe to the continent, to man power projects. Power projects are typically large, capital-intensive projects that need specific skills, such as engineering skills that can be procured from the international market. In the process of developing these projects, the local skills base benefits from the training offered by the projects for future project.

Most projects involve the participation of a local partner and as such it is important to have processes of local skills transfer to benefit the local people.

Along with leadership and vision, achieving universal energy access in Africa is predicated on people with skills. People are the resources and have skills needed in developing projects. Skills are needed in the energy industry, in negotiating energy deals, such as nuclear and biogas energy deals. Power Africa is actively engaged in boosting energy skills development in Africa and recently helped roll out a Power Purchase Agreement Guidebook that gives instructions in negotiating power purchase agreements (PPA) in Africa. Power Africa is also creating the Energy Institute in the US, which will train African leaders in the energy sector so that they can use their skills and capacities in building the energy industries at home. Power Africa has also helped launch the Women in African Power Initiative in 2015. This initiative is a network dedicated to advancing the role and representation of women within the energy sector in Africa.

International benchmarks, as set out in SDG 7, spell the need to provide universal energy access by 2030 and the need to use renewable energy in the energy mix of countries. SDG 7 provides the vision that Africa must embrace, and Africa's leadership must translate this vision into implementable targets and work towards fulfilling them.

Energy access in Africa is underpinned by robust energy leadership in African countries, as was shown in the successful implementation of the REIPPP Programme in South Africa. The existence of exemplary leadership in driving the REIPPP Programme to full operational capacity, where all power to the grid processes were completed in fewer than 36 months, provides a valuable learning template from which lessons can be learnt and applied in the African energy development context.

Increasing the participation of local companies in the energy sector is good for building leadership in the energy sector. The REIPPP Programme used 24% of local procurement processes and local skills, and this number will be raised to 40% in the next phase of the REIPPP Programme. In the second round of the REIPPP Programme, some of the projects were actually developed by South African companies themselves.

Private sector participation in the energy sector in the SADC region has increased in the past five to 10 years. The REIPPPP in South Africa is a good example of private sector participation and as such there is an opportunity to grow the energy industry tremendously. The key question is does Africa have the right leaders, working in tandem with the proper regulatory frameworks to allow the initial marriage of the private sector with the public sector to maintain the momentum that will sustain the provision of universal energy access in Africa?

There are plenty of energy regulatory bodies that have been established in many African countries. This, and the restructuring of the energy industry to allow for the provision of Independent Power Producers (IPP) in many African countries, is a sign that there is commitment by the leadership of African countries to open up the energy sector and allow other players to come in. To what extent have the processes and services of energy regulators in African countries helped facilitate the flow of external funding into the African countries to help build the energy infrastructure that African countries require?

Transparent and consistent regulatory and legal policy frameworks are able to address the risks inherent in the energy sectors of African countries. Most of the external funding for energy projects in Africa comes in the form of foreign direct investments (FDIs) and long-term transparent, consistent policy frameworks established as part of energy sector, which address various risks sufficiently and can attract the investment needed to bankroll power projects in Africa.

The existence of oil and gas reserves in Southern Africa, and the processes of mining and producing power using cleaner technologies involve issues of sustainability and cost reflectivity. One of the major issues of energy provision deals with issues of cost reflective tariffs, which is a key determinant in unlocking investments in the energy sector.

Along with cost reflectivity, it is important to address the structure of the energy sector in African countries. Does the single buyer model exhibited in vertically integrated utilities take away the risks for those who want to come in with their own individual power plants, given that they are able to pay for that power, or should the sector be opened further to allow hybrid systems that allow for the management of the risk related to unbankable African utilities? These are some of the issues that need to be addressed in dealing with the long-term planning of providing energy access in Africa, along with issues of the leadership in the energy sector, which is a key factor in providing energy access.

The energy industry is quite complex and has several facets to it, such as policy, legal, technical, and sustainability aspects, among others. In order to attract and retain young talent in the energy industry, and to groom leadership (especially in the strategic positions in this energy space), there is a need to create an interesting and exciting environment in this industry.

The availability of technical skills is important in addressing the energy needs of Africa, as well as being able to work with stakeholders across other sectors. Triple skill leadership is required in the energy industry where energy leaders must be competent in working

with the three sectors of business, government and society, and crafting solutions across these three spheres. Developing people in triple leadership skills needed in energy projects requires encouraging them to work across cross-cutting multi-sectoral energy projects in a bid to develop the skills of energy leaders operating in the industry.

PANEL 2: FINANCING ENERGY DEVELOPMENT IN AFRICA

Sponsored by Garuda Finance

Moderator: Rentia Van Tonder, Head of Renewable Energy, Power and Infrastructure, Standard Bank

Panel Members: Martha Stein-Sochas, Regional Director, AFD Group (French Development Agency)
Rick Angiuoni, Director, Africa, EXIM Bank
Rajen Pillay, CEO, Garuda Finance
Dominik Thumfart, Managing Director: Infrastructure & Energy, Deutsche Bank

Key Questions:

- What are the successful financing models for private, public and private public partnerships (PPPs)?
- What are the challenges faced by governments in procuring funding of energy projects in Africa?
- What key factors determine energy project bankability in Africa?
- What role do non-traditional funding sources have to play in funding energy projects in Africa?
- How can small power projects be successfully funded outside the ambit of traditional funding sources?

Key Points:

- Competent project preparation processes guarantee the bankability of energy projects in Africa.
- A mix of traditional and non-traditional funding sources is important in financing both small and big renewable energy projects in Africa.
- Cash flow visibility is a highly rated determinant for procuring funding from financial institutions for energy projects in Africa.
- The socio-economic and development impacts of energy projects are key factors in determining the bankability of these projects in Africa.
- Innovative pay-as-you-go solutions are the perfect solution to facilitating the roll out of small off-grid renewable energy projects in the rural areas of Africa.

Synopsis:

The energy sector in Africa is facing two challenges: firstly, to develop renewable energies at scales that are compatible with the needs of Africa, given the enormous potential of energy in Sub-Saharan Africa, and secondly, developing energy access in line with SDG 7. Overcoming these challenges needs private sector funding since Development Finance Institutions (DFIs) manage a small portion of the investment funds that bankroll energy infrastructure projects in Africa.

Seventy percent of power project funding comes from DFIs and 30% from commercial banks. Although DFIs are heavily involved in the energy sector, private sector funding is needed to fund energy development in Africa given the estimates of over USD800 billion needed to bridge the deficits in energy infrastructure Africa by 2030.

Attracting private sector investment for energy development is bedevilled by barriers, such as the lack of sound institutional and regulatory frameworks. Where most African countries have started to develop regulatory frameworks conducive for the development of renewable energies, these frameworks are not developed in ways that can fully address the various risks inherent in the energy sectors of African countries.

DFIs can help in framing the regulatory frameworks to attract funding, DFI grants are available in helping governments frame and define renewable energy regulatory frameworks. DFIs also provide technical assistance to governments and electricity regulators in setting up tariff structures that are socially acceptable, do not hinder economic development and are conducive to the development of renewable energies.

The other challenge of attracting private sector investment is inadequate project preparation. Adequate project preparation is needed to prepare a project for bankability purposes, to be acceptable to an energy developer or investor. Poorly prepared projects where not all the bases of projects (e.g. marketing, technical, etc.) are covered equally cannot be funded and are rejected by banks because they are not simply bankable.

DFIs can provide funding and technical support needed for project preparation processes and for conducting feasibility studies. Project preparation is very important for bankers to consider financing energy projects. Any shortfall in project preparation will not attract funding at all. Despite the falling costs of renewable energy production, the costs of renewable energy development still remain higher than general electricity generation. As such, investments in these projects are prohibitive. Low interest funding from DFIs can alleviate this challenge or barrier.

Another challenge with regard to funding is risk perception and risk mitigation. Most projects in Africa are perceived to be high risk, which is not true in most cases. Negative perceptions cloud the judgement of most private sector investors interested in developing energy projects in Africa. There is the lack of risk-mitigation tools and mechanisms in Africa. DFIs can play a role in reducing the negative perceptions of the risks to attract investors.

There is plenty of money available to finance energy power projects in Africa, from commercial banks, equity funds, and export credit agencies, among others. Traditional sources of finance cannot fund the huge investment costs needed to meet Africa's energy deficit – which range between USD500 billion to a trillion dollars (according to a recent PricewaterhouseCoopers report). Export Credit Agency funding as non-traditional funding can play a crucial role in bankrolling power projects in Africa.

Despite the availability of funding for energy projects in Africa, projects for various reasons fail to access the liquidity to finance these projects due to the enormous size of energy projects, and their long duration complicates the financing mix required to fund them. Secondly, even small power projects need big balance sheets and building into a saleable project proposition aimed at raising USD100 million is a challenge. Further down the line, most projects run out of liquidity and therefore cannot move ahead as planned. One way of getting sufficient finance is to get an equity investor to take up a slice of the company's shares and improve the debt-equity ratio to make things look better for attracting funding, and then approach DFIs and commercial banks for funding.

A key factor bankers look at in financing energy projects, is the high visibility of the cash flow. Bankers critically analyse the cash flow that returns to the lenders, as well as other factors, such as the presence of an off-take agreement when the energy project starts; the nature of the regulatory regime; whether there is an Operation and Maintenance (O&M) strategy in place, the quality of the power-generating equipment, etc.

Diverse sources of capital have appeared on capital markets due to the maturation of international markets dealing in financing power, gas, energy, and transportation infrastructure. Following on the heels of this is the recycling of finance capital for projects, or refinancing in cases when funding to the project from banks reaches saturation point. In this case, projects are refinanced using finance from the bond market, for example, and a host of other financial innovations, such as funded and unfunded mezzanine debt tranches from institutions, and liquidity facilities that bridge feed-in tariffs in case those payments are not met on time.

Size means very little in financing projects; what matters is for the project to remain financially viable and the investor to get sufficient returns on his investment. However, small projects tend to be more exposed to greater risk over the length of projects, more than big projects. Small projects are also more susceptible to macroeconomic changes and fluctuations.

The securitisation of solar revenues is one financial innovation used in South Africa, for example thousands of small scale finances, such as roof top solar energy, are rated as a pool in order to get financing such as car loans, etc.

DFIs, commercial banks and private investment for bankrolling energy projects aimed at increasing energy access in Africa becomes a risky proposition when there are low rates of return for these projects. In places such as rural areas with low population densities, providing energy access is a challenge using off-grid power systems, not to mention the ability of rural communities to pay for the energy.

An optimal solution that addresses the ability to pay is the pay-as-you-go model that can be adapted to people's incomes. One successful application of this model is the Inkupa Model – developed in Kenya. It combines a banking model linked to the solar roof top pay-as-you-go model. There are over 300 000 households that use this model in Kenya, and 500 households are signing up every week.

The sustainability of energy projects in Africa will most likely come in the form of adaptable models like the Inkupa Model, and off-

grid energy solutions for energy access. Off-grid energy solutions are perfectly adapted for those people in far-flung areas, such as villages or rural areas. How can DFIs finance small energy projects, as opposed to the big ones? Such small projects must show economic value, they must exhibit viable cash flows and must demonstrate long term sustainability. Provided these elements are met they can be financed by DFIs.

PANEL 3: ENERGY WATER – THE HYDRO OPPORTUNITIES IN AFRICA

Moderator: Karin Ireton: Sustainability Consultant

Panel Members: Dr Manuel Loren, Research & Development and Business Development, Smart Hydro Power
Andy Eaton, International Hydro Sales Manager, Gilbert Gilkes & Gordon
Christina Ulardic, Head Market Development Africa, Swiss Re
Bohuslav Barta, Specialist Consultant, Energy and Water Resources Engineering

Key Questions:

- What are the challenges facing large hydro power plant development in Sub-Saharan Africa?
- What is the role of regional bodies (e.g. African Union, Regional Water Authorities) in promoting successful cross border/ shared resource rivers in hydro power development?
- Are we so focused on the massive opportunities (e.g. Grand Inga) that we are blind to the many opportunities for mini and micro hydro projects?
- Are we exploiting the opportunities to simultaneously address the provision of both energy and water services?

Key Points:

- One of the biggest challenges faced by large hydro power plant development in Sub-Saharan Africa is costs.
- At the moment, the concern is more to do with finding funders rather than with regional bodies.
- Banks are averse to investing in hydro as the investment only pays dividends after a number of years.
- Water purification plants address the provision of energy and water services.

Synopsis:

In every grid, the amount of electricity produced depends on the demand. Demand for electricity is met via one of the following methods:

- Massive overproduction,
- Energy storage using batteries
- Diversification of production, e.g. using solar and hydropower in tandem
- Generators and renewable systems, e.g. biogas

It is possible to influence demand. However, this practice is only possible on a small grid. Using wastewater from mines – in the process of energy generation – has great potential. However, in order to achieve this milestone, it is necessary to educate mines through consortia.

Right now, the challenge with regard to getting hydros online is financing. DFI could be key to getting other financiers on board. Small hydros in Africa have a twofold benefit: that of providing electricity, as well as jobs for the unemployed.

Andy Eaton highlighted the benefits of mini and micro hydros:

- Construction time is very short, and
- There is no heavy impact on the environment.

There are 600 million people in Africa without power. Hydropower is designed to be affordable, but unfortunately the investment made in hydropower only pays back after a number of years. This makes banks quite averse to investing in these schemes. Christina Ulardic mentioned some of the challenges that could be faced by smaller hydro projects:

- Where electricity is produced is not necessarily where it is needed.
- Organisational activities become more difficult on smaller projects.

In South Africa, traditionally water and electricity have been seen as wholly separate entities, which haven't promoted the development of hydropower. There is massive potential for hydropower generation in South Africa and – in 2002 – rivers to target for hydropower generation were identified. The comment was made that many towns, in the Drakensburg, are part of the hydro.

Large-scale hydros do use a lot more water because of evaporation. However, it is a fallacy that hydros consume water at the expense of consumption, for example with drinking and cooking. The point was made that the hydros 'borrow' the water for a matter of seconds, put it through the turbine, and then return it to the environment. There is a huge opportunity in terms of water purification plants in South Africa as they will service the water and energy sectors.

PANEL 4: PROJECT BANKABILITY

Moderator: Brian Statham, Chairman, SANEA

Panel Members: Admassu Tadesse, President and Chief Executive, PTA Bank
Marc Partridge, Managing Director, Gazprombank
Bhatvik Vallabhjee, Director Power, Utilities and Infrastructure, Barclays Africa
Frederik van den Bosch, Manager MASSIF, Blending & CD,

Key Questions:

- How can energy projects be de-risked to increase robust energy infrastructure in Africa?
- What are the challenges that face energy project bankability in Africa?
- What processes do banks apply in determining energy project bankability?
- How important are non-financial factors in determining the bankability of energy projects in Africa?

Key Points:

- Stress-testing processes of energy projects to determine financial viability is a key feature of project bankability.
- The strength of cash flow returns is a decisive factor behind the funding of energy projects.
- The ability of energy utilities and companies in honouring power purchasing agreements (PPAs) underpins energy project bankability testing processes.
- Socio-economic and development impacts of energy projects are key factors in determining the bankability of energy projects in Africa.

Synopsis:

Bank financing of infrastructure projects within the Brazil, Russia, India, China and South Africa (BRICS) structure is underpinned by factors such as the presence of the regulatory environment; the favourability of the geo-political environment; the economic viability of the project; the overall project profitability, and how the project will be implemented. All these factors determine whether the project is bankable or not.

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Commercial banks typically apply rigorous stress tests to gauge the bankability of projects. Stress testing involves assessing the quality of the sponsors; the track record in running such projects; the strength of the balance sheet; the state of the technology; the readiness of the project, the nature of off-take contracts to assess whether it is contracted power or merchant power; the quality of the off take – if it is of a good credit quality; the kind of credit enhancement that exists to carry the project forward for the long-term period, as well as environmental and socio-economic issues.

Assessing the bankability of Energy Performance Certificate Register contracts involves looking at the track record of companies; the strength of the balance sheet; the risk allocation processes, and the robustness of the cash flows.

When it comes to bankability, the size of the energy project does not matter, because all due processes of bankability testing apply to big and small projects. Most of the dynamics of bankability have to do with the PPA. Importantly, the ability of the utility to honour the PPA itself, the availability of liquidity arrangements, as well as arrangements around tariffs, are key factors determining bankability of energy projects. The strength of the regulatory framework is also a key factor that determines project bankability.

There are two sides to the term 'bankability'. Firstly, bankability starts with the investor, or investing company. It is critical for these companies to be acquainted with the know-how associated with energy project financing and a firm understanding of fiscal issues associated with energy projects. Secondly, there are those banks that have various financial products that they offer in financing projects.

Commercial banks need to know the client's needs, and adapt their products to those needs. Unfortunately, BASEL III's stringent banking regulations tend to limit what banks can do with prospective clients; development banks are therefore a much better option for clients than commercial banks.

Development banks determine the bankability of projects by looking at cash flow returns, as well as developmental impacts and market development. Small projects are difficult to put together in terms of organising finance for them, compared to large projects. Other factors that development banks consider are the environmental, social and governance concerns. The financial sustainability of projects is important as well as the social and environmental acceptability of projects in the communities where they are situated. Banks can do an even better job of financing – if they can work in partnership with a diverse array of stakeholders from various sectors; such collaborations play a critical role in developing energy projects in Africa.

Stress-testing processes for small projects for bankability purposes is difficult compared to big projects. For small projects that are financially viable a less complicated approach would be to get sponsors with assets that can be used as collateral for the project, and as such take the risk. This was the case in Mongolia where the entire rolling stock of the country was pledged as security to secure financing from the Russian Eximprom Bank. Other simplified means can be bilateral or multi-lateral funding that can be sourced to fund small projects.

Project wisdom is valuable in project bankability. Project wisdom is about the blending of the project with the correct blend of stakeholders or players who can ensure a better resolution of issues when problems arise. Project wisdom is also about enlisting local capital in the energy project, using means such as listing the project on the stock exchange to acquire equity. This not only shares the risk with shareholders but also widens the ownership of the project.

PANEL 5: ENERGY WATER FOOD NEXUS

Moderator: Barry Bredenkamp, Energy Efficiency Senior Manager, SANEDI

Panel Members: Jean-Eudes Moncomble, Conseil Français de l'Energie, World Energy Council France
Dr John Purchase, CEO, AGBIZ
Dr Latsoucabé Fall, Regional Manager for Africa, World Energy Council
Sean Thomas, CEO, Bio2Watt
Wendy Green, CEO, Fusion Global

Key Questions:

- How resilient is Africa to extreme weather events and how will this affect the availability of water and food?
- Successful generation technologies that have inherently reduced water requirements, and the role that governments can play in planning their energy mix to ensure sustainable use of water resources
- Food security in the wake of a bioenergy revival.
- Concerns for Sub-Saharan Africa. How do decision makers find the balance between the competing needs for water, food and energy?

Key Points:

- Africa needs to become more resilient to extreme water conditions if food and water are going to remain available to citizens.
- The biogas plant at Bio2Waste at Bronkhorstspruit uses water from the pollution control dams of nearby farmers in order to process waste.
- Strict regulation of energy and water needs to be instituted in order to ensure food security going forward.

Synopsis:

A flaw in the water and energy sectors is that these two operate in silos. In other words, there is no cooperation between these two sectors, when in fact these industries should be working hand in hand. The water and energy sectors are facing a crisis and it is necessary to change the way the business of power and water is approached in order for these problems to be addressed.

In order to withstand the effects of the extreme weather conditions that are happening on a global scale, Africa needs to put an effective risk management programme in place to improve security of supply. The right blend of technology, in terms of water and energy, needs to be adopted for the African continent. Dr Fall suggested that diversification is key and that renewable solutions be seriously looked at. At the same time, Africa's energy and water infrastructure need to be overhauled and government needs to have a long-term vision in terms of these two sectors.

At Bio2Waste's Bronkhorstspruit Biogas Plant, on average 250 tonnes of waste is received on a daily basis. This waste consists of, for example, cattle and paper waste. Approximately 100 m3 of water is necessary to process this waste. As it is not necessary to use clean potable water for waste processing, Bio2Waste employs a strategy of contacting nearby farmers to ask them if the company is able to have access to their Pollution Control Dam (PCD) in order to source the water needed. This is an attractive proposition for the farmers as once the water from the PCD has gone through the plant's digestive processes the farmers will have a higher grade of water with which they are able to irrigate their crops.

In order to develop Africa, it is vital to develop agriculture as people cannot work unless they are fed. Wendy Green made the point that it is crucial that this necessity is brought into companies' investment criteria. An example of this playing out is farmers receiving money from power plants in order to fund agriculture. Desalination, in terms of providing water for agriculture, is going to be critical for agriculture. At the moment, it is not a viable solution owing to high technology costs. However, the comment was made that as food and water become scarcer, the technology costs in terms of desalination will come down.

Each panellist expressed the sentiment that in order for the water and food crisis to be solved, better management of resources and stricter regulations need to be enforced. Dr Purchase stated that as the South African agricultural sector uses approximately 60% of the water resources, it is doubtful that there will be a substantial new allocation of water to this sector. Thus, if agriculture wants to expand, the sector is going to have to adopt stringent water-efficiency measures. The suggestion was put forward that a water regulator – similar to the National Energy Regulator of South Africa (NERSA) – should be put in place. It was also felt that water tariffs would increase.

In terms of reducing energy usage in agriculture, various strategies were discussed. Among these were conservation agriculture – which reduces the carbon footprint – as well as precision agriculture, which uses satellite technology for planting. Fracking has been looked at as an option in the Karoo Basin, which is a very sensitive ecological area, where farmers survive on groundwater. The major stumbling block on the road to making fracking a viable alternative in this area is cost.

NUCLEAR FORUM PANEL: NUCLEAR – THE NEXT STEPS

Breakway sponsored by the Nuclear Industry Association of South Africa (NIASA)

Moderator: Coenraad Bezuidenhout, Managing Director, FTI Consulting

Panellists:
Dr Yves Guenon, Managing Director, AREVA
Viktor Polikarpov, Regional Vice President, Rosatom
Des Muller, Director Nuclear Construction Services, Group 5
Shane Pereira, Business Development Manager, Lesedi Nuclear Services
Gaopalelwe Santswere, Chairman of the South African Young Nuclear Professional Society (SAYNPS)

Key Questions:

- Why should nuclear power generation be prioritised ahead of coal and gas and other energy production methods?
- What is required for South Africa to be prepared for a nuclear industry?
- What is the stage at which the nuclear negotiations with Russia and China are at?

Key Points:

- South Africa has a shortage of base load and only base load supply can meet the demand for an electricity intensive industry.
- Nuclear power supply can meet the demand, however it requires long term planning.
- Technology and safety aspects have increased dramatically since Chernobyl and Fukushima.
- An industry can be created around the supply for nuclear power plants, but it takes time to train an industry and develop the safety standards as required by the licensing.

Synopsis:

A large part of South Africa's economy is based around mines and smelters which are electricity-intensive, and only base load can supply this demand. Alternative supply such as wind and solar energy production can only compliment a base load, however nucle-

ar power supply can meet the base load demand and the panel believes it is the only option for South Africa's future electricity needs.

Nuclear remains the cheapest and cleanest energy production process, it is devoid of carbon dioxide emissions. For example to produce 1GW of power, coal power plants require 2.7million tonnes of coal, but nuclear power plants require 24 tonnes of uranium.

The world currently has over 400 nuclear reactors, a number which will double in 15 years. Nuclear is becoming a global trend in both developed and developing countries.

South Africa's currently installed base load is coal based generation, with some success in renewables, however the coal fleet will need to be substituted at some point due to its age. When the coal stations go offline, base load will need to be substituted with more base load. In addition the coal stations require large quantities of water for cooling however there are numerous areas in the country with severe water shortages, added to this are CO2 emission concerns and climate change responsibilities, it all adds up to coal powered stations not being appropriate for the future of South Africa.

South Africa is currently using energy at the rate used in 2007, therefore there is tremendous energy that is not being served, which has closed down a lot of industry to accommodate this lack in supply. The blackouts seen around the country are due to a shortage of base load capacity, it is not a shortage of peaking power or renewable energy.

South Africa currently has 97 power plants, 32 of which are ageing and need to be renovated, and now four are out of operation. In 20 years electricity production will be a huge problem for South Africa. Country investment in nuclear power can provide 60 to 100 years of power generation.

Renewable energies can be installed and come online very quickly, within a few years, as opposed to nuclear power generation which can take 20 to 30 years from project planning to coming online. Therefore it is critical to start immediately planning a strategy for around 20GW otherwise South Africa will be in a tough situation from 2020 onwards.

There are many contributing factors as to why nuclear power is a long process, including licensing, regulations and safety requirements in the reactors which take a long time to build, and the training and safety regulation of an industry to supply the nuclear power stations. If a decision is taken now to build, power may only come online in 2035.

The panel expressed that the price of nuclear power plants is not simple to cost, price can only be determined at the end of a planning process after examining the exact capacity and type of power plant required.

Generation 2 nuclear reactors currently work fine and probably have another 35 years of production left, but Generation 3 reactors have a lot more safety built into them and many more years left to produce, in some cases up to 60 years of production. This doesn't make Generation 2 and Generation 1 reactors unsafe. Regulations and safety have increased since Chernobyl and Fukushima, but these new reactors are a first-of-a-kind technology that take a long time to build.

South Africa can take advantage of international experience to build with international partners. Localisation of the power industry is an ongoing challenge, for example Kusile and Medupi did not have localisation or development programmes in place due to the urgency of getting online. Nuclear industry can be localised but it takes time to prepare due to safety requirements. However, perhaps South Africa shouldn't be too quick to localise when there are other countries such as China who can run projects within budget and on schedule, and instead focus on small renewable energies as smaller standardised and localised projects.

It is important to note that industrialising the country to supply nuclear power plants gives an impetus to the country to create a new industry, new jobs, new skills, new opportunities for young people to grow and to stir consumption; the more power generated the more power will be demanded.

South Africa has launched a Request For Proposals (RFP) process, and has in mind that they want 9GW to 10GW of power production, and to create a local industry with a strategic partners and a long term fixed price.

There were concerns expressed about the secrecy of the nuclear discussions with government, however the panel explained that the

process was only in early stages and the signing of agreements was normal government procedure, similar agreements were signed with Russia and China which were in short a framework interaction between countries, not a 'deal' or a 'commercial contract'. There are numerous stages and inter government agreements on how to move forward about how to work together, and how to finance big projects, which are stages still to come in the process. Russia was the first to sign the initial agreement. The panel expressed that the South African process was extremely slow and that there was no information to share at the time. In addition the capacity of the plant has not been discussed and therefore the cost had not yet been determined.

The country has to do much to prepare for a nuclear supply chain, which requires more care and consideration than other industries. For example a nuclear powerplant is about half the nuclear piece, which requires an overall safety culture on the entire plant and supply chain. South Africa has some experience and is in some ways fairly high up the supply chain due to its existing nuclear programme, and it would be an opportunity missed should the country not take advantage. In particular, there are massive socio-economic benefits to a nuclear programme which can contribute to the country's unemployed youth, as well as address national objectives. The South African government has been talking about a nuclear programme since 2008 but has not spent anything on preparing an industry to produce nuclear goods.

Africa always talks about regionalisation, but they are difficult relationships to actually establish. Big block nuclear programmes should be a regionalised network, and the panel felt that only a few countries in Africa, including South Africa, were in a position to take on the challenge of such a sized project.

PROJECT PITCHES: ENERGY PROJECT OPPORTUNITIES IN EAST AFRICA

Moderator: Paul Runge, Managing Director, Africa Project Access

Panellists: Innocent Kahika, Shonubi, Musoke & Co.
Soni Hysis, Power Africa
Ed Laubscher, Aberdare Cables

Key Questions:

- What key energy programmes are in planning across Africa?
- What opportunities exist or may emerge in the near future?
- How can Power Africa assist projects?

Key Points:

- Africa Project Access shared information about numerous energy projects and opportunities across Africa.
- Power Africa provides support to countries and international companies.
- There are many examples of small energy production projects which can boost local economies and electrify rural communities.

Synopsis:

Paul Runge presented details of numerous projects and opportunities current and emerging across Africa, an abbreviated list is provided below:

The Eastern African region is currently considered the most active energy community on the continent.

Zambia, Kenya and Tanzania are creating an interconnected infrastructure programme of 500km of 400kV transmission lines, of which three national power utilities are involved in the programme.

Northern Kenya and Uganda have discovered new oil and gas reserves and are in planning for a new oil pipeline corridor due for completion in 2022.

Ethiopia is currently considered a key player in the Eastern Power Pool, funding most projects themselves, and has begun exporting power to Sudan and Djibouti, and is in discussions about exporting to Yemen as well. New plans are underway for Gas Field Development and Pipeline in South East Ethiopia, a Geothermal power plant in Southern Ethiopia, a Waste-to-Energy in Addis Ababa on a 50 year old landfill site which will generate 50MW from waste feedstock of 1,000 tons per day, and many more projects underway.

The Lamu Port development is advancing with many other projects linked to it, including the Lamu coal fired plant on Kenya's northern coast, the Lamu-Nairobi East transmission line, and the Hoima-Lokichar-Lamu transport corridor.
There are many Hydro power projects in planning, however the regulatory environment is not yet supportive, and regulatory bodies are not organised. Large hydro projects are seen to displace people and damage vegetation; smaller hydro projects are more desirable.

The Burundi Hydro Power Plant is a large PPP project in planning phase for 12MW 5km from Bujumbura.

Khobetti geo-thermal power plant where Power Africa is very involved. This project is a trail blazer and will set the way, has amazing numbers of shareholders. Icelanders are involved, as is New Zealand, both countries have experience in geo-thermal.

Kenya has been a leader in geo-thermal projects, with Turkana County in planning for a 140MW Geo Thermal Power Plant.

Tanzania has a critical power shortage, and recently discovered a huge gas deposit in the Rovuma basin, which is leading to a prioritisation of gas to power.

Eastern Uganda is developing the Osukura Phosphate Plant with capacity of 12MW.

Uganda has a small economy which almost collapsed due to power shortages. In 1999 Uganda created a regulator which lead to a further phase in development, with Rwanda and Tanzania following. There was a lot of opposition initially based on environmental issues, but when the government realised exactly how much potential there was the power sector opened up, starting with hydro power projects in the mountainous regions which opened up the market, leading to currently over 40 projects at different stages of development which reduced demand on the national grid, plus outlying areas could be serviced from these mini projects.

There are still many challenges to energy production in Africa, and supply is still extremely short and countries will look at anything to produce power. There is no shortage of coal fired power plants. Some countries such as South Sudan are donor dependant. Regulatory frameworks are often problematic but places such as Ethiopia who are moving ahead fast can be great trail blazers to the industry.

National power companies play an extremely important role mainly because tenders are issued from these utilities, not from the ministry. However the Ministries provide the frameworks that utilities operate within.

Power Africa is a United States Government initiative which partners with the private sector, donors and international finance institutions so as to provide financing mechanisms and assistance on regulatory frameworks. The biggest challenge is building institutional capacity in Sub-Saharan Africa to be able to not only support the goals African countries have set for themselves, but also support the goals of international companies. However a remaining challenge is institutional capacity. Power Africa focuses on maximising

current transactions, for example in East Africa alone they are aware of and tracking over 100 projects, over 100 transactions, and 14,000MW of power generation. In Sub-Saharan Africa Power Africa are tracking over 300 projects and 40,000MW of power generation. iPhone has an app developed by Power Africa to see projects in process, and which ones Power Africa and its partners are supporting.

Power Africa does not take sides, but can assist with hiring specialists which facilitate deals and have convening power to bring all parties to the table including government, private sector, donors, regulatory bodies, and whoever else needs to be involved in the deal to get projects off the ground.

However challenges remain especially in institutional capacity and regulatory environments, and also in cross border trade.

A continuous challenge is the size of the project and bringing it to bankability. However the economic impact needs to be a key consideration, for example Kenya developed a project of 12MW which has powered an entire community, generated jobs, boosted the economic prosperity and economic prospects, despite being a relatively small project. Other examples are new innovations, for example, corn husk and anything that is lying around can be used to generate power for 10 to 25 households, which has resulted in housing entrepreneurs coming together to produce small biomass to power plants in small communities. Another example is a sugarcane bio mass project in Uganda, where initially the tariff was a little higher than a similar hydro project and was unacceptable at the time, but when the drought hit in 2005 the sugarcane production at higher tariff became more desirable, and now Uganda has 60MW of sugarcane power production with a potential of 160MW.

Another interesting development is that power transmission companies have become Internet Service Providers (ISPs) by transmitting data along their power lines on behalf of telecommunications companies.

DAY 2: 17 FEBRUARY 2016

PANEL 6: REGIONAL INTERCONNECTION

Moderator: Scott Brodsky, Partner, Macfarlanes

Panel Members: Eng. Alison Chikova, Chief Engineer, Southern African Power Pool (SAPP)
Omar Vajeth, Managing Director, Gold Key Energy
Paul Runge, Managing Director, Africa Project Access
Prof. Abubakar Sambo, Chairman, Nigerian Member Committee of the World Energy Council
Stanley Subramoney, CEO, Menston Holdings

Key Questions:

- What is the state of interconnection in terms of power in Africa?
- What are the requirements and biggest challenges for interconnected power projects?
- What are the potential downfalls of regional, interconnected projects?
- How do regional power projects integrate renewable energy sources?

Key Points:

- Funding is no longer a pressing issue for large (interconnected) power projects.
- The pressing issue for interconnected power projects is the question of risks and how governments and utilities can assist

with sharing the risk equitably.

- A further pressing issue is to find a balance between national needs and interests and regional/continental needs and interests, and to ensure that the former do not undermine projects conducted by regional and continental bodies.

Synopsis:

There is an energy crisis not only in South Africa, but throughout Africa with load shedding in many countries affecting private citizens and businesses. Africa not only needs more generating capacity, but a diversification of generating technologies and stronger transmission systems. For this, regional interconnections are critical.

One argument for regional interconnections is a fear often expressed by utilities that they might end up with too much generating capacity. Strong regional interconnections would enable the surplus in one country to fill a deficit in another.

In the past, the development of the transmission infrastructure in Africa underwent a number of steps. In the early 1950s the first high voltage direct current (HVDC) system was put in place in the DRC, with about 1 700 km of transmission lines. In 1975 a second HVDC system linked Mozambique with South Africa to supply South Africa with electricity. In 1960 Zambia and Zimbabwe were interconnected after the Kariba Dam was put into place.

In 1994 the governments of South Africa, Zimbabwe and Botswana put up transmission lines linking the three countries, which gave birth to the Southern African Power Pool (SAPP). These interconnections were triggered by the drought in 1992, which affected electricity supply in Zimbabwe and Zambia (which relied on hydro power). South Africa relies mainly on coal for power. The diversity of the regional resources played a critical role in developing the interconnections. Connections to Namibia and to Mozambique were later added. These connections have allowed trading between the countries to develop, as well as integrated planning. Currently nine of 12 countries of southern Africa are interconnected; Tanzania, Malawi and Angola are still missing. The ZIZABONA Transmission Project is one such outcome.

At present there are five power pools: Southern Africa, Central Africa, East Africa, West Africa and the Comité Maghrebin de l'Electricité (Comelec). Power pools, such as the southern African one can be very helpful to business because they are open to meet and find solutions. On a similar line, the corridors that link power systems can offer new opportunities such as a natural place for the building of fibre optic lines.

The tripartite agreement between the Common Market for Eastern and Southern Africa (COMESA), the Southern African Development Community (SADC) and the East African Community (EAC), for a free-trade area, is an important basis on which consideration of interconnections between Tanzania and Zambia are now taking place. Eastern and southern Africa have a lot of synergies. Going into the future, Ethiopia is a major player, much bigger than the Inga hydroelectric project in the DRC. It is already exporting power to Sudan and Djibouti, and has signed a major memorandum of understanding (MOU) to deliver power to Kenya. East Africa as a whole is critical for the future.

For successful regional interconnection, you need successful regional integration. In debates that happen around the African Union and 'Africa 50', power is a critical component in this. While one estimate suggests that Africa needs about USD225 billion to overcome energy problems in Africa, it is in fact much higher. Africa needs USD93 billion per annum for the next ten years for infrastructure, of which a large part needs to go to the power sector. In terms of funding, of the USD93 billion, there are about USD60 billion available on the continent, leaving a shortfall of about USD33 billion. Yet, about USD15 billion is wasted on the continent per annum because of inefficiencies, corruption and duplication. So we need to find smart ways of funding projects, creative ways of funding.

A critical question that arises for regional interconnection is the regulatory environment: the question of whether regional interests supersede national interests, or regional ones supersede national ones, etc. Often with cross-border issues, local and political interests come into play and trump regional ones. Thus there are a lot of interregional connections that have been built, but the national infrastructure to use this optimally has not been built. Thus there is the bridge across the Ruvuma River between Mozambique and Tanzania, but neither country is building the feeder road to make the road effective. Similarly, both Mozambique and Tanzania are building gas plants along the Ruvuma River on the very same gas deposit, without any coordination and collaboration. The national interests introduce the risk that regional projects build by. For example, the AU becomes a white elephant because they are not integrated into national plans.

While Africa has enough capacity to generate electricity for the African continent plus export, the question is how to harness the collective across the continent: how to facilitate, how to remove the barriers to large-scale infrastructure projects to make it happen. Various models need to be considered for this: PPPs, public-public partnerships, and smart partnerships.

The Economic Community of West African States (ECOWAS) has a West African Power Pool. First an energy policy for West African states was produced and the Regulatory Framework 2 was established. About one third of the power pool is already operational and even though Nigeria, the largest in that zone, has great shortages itself, it shares this with Niger Republic, Benin and Togo.

West Africa is also developing solar PVs and concentrated solar power in the Senegal/Mali area to put it on grid. This raises the issues of intermittency and storage that are being addressed at the moment. It is expected to take only a few years for this to come on stream. They are also considering wind power plants along the coast.

West Africa also works with interconnection and integration of oil and gas. The West African gas pipeline is partially active already, with 950 km from Nigeria via Benin and Ghana to Côte d'Ivoire, and aims to extend it up to Senegal. In addition there are plans by the AU for a trans-Saharan gas line by the AU from Nigeria through Niger to Algeria and possibly to Europe.

The SAPP has a project advisory section that tries to package projects in ways to attract funding, especially in terms of PPPs. But the private sector is often not attracted by transmission line projects, because of the nature of the transmission line: there is no defined off take, there is no defined generator, no guaranteed cash flow. But there are models that have been successful, such as in Afghanistan or Pakistan and managed to close a project to build 1 300 km lines.

To address the weaknesses in the inter-linkages between regions, there are issues that need to be addressed by governments and those that the utilities need to address. Governments need to deal with issues of policy, cost-effective tariffs, enabling environments. Utilities need to take risks that they can manage, including the foreign exchange risks.

We need to raise questions about large projects, whether these are really feasible and will not become white elephants. We should rather look at smaller projects that can be handled and that can develop momentum.

Another point that needs to be discussed here is the capacity of the utilities. They need to be upskilled, with proper pay and enough people, so they can develop their capacities properly.

What often blocks large infrastructure projects is political leadership. Political cycles often only last four to five years, whereas these projects last several decades.

We are in a unique situation now where we have multiple energy sources available: renewable, biomass, solar, gas apart from coal, hydro and nuclear. Often older sources such as hydro are problematic (as is the case now with hydro power during the drought in South Africa).

African countries also need to ensure that their citizens are well trained and skilled to fit into these value chains of resources, from building the infrastructure to the decommissioning of plants.

Funding is not a problem anymore as it was a few years ago, with even development funding becoming available. There are many more sources of funding. The big issue that marks regional and interconnected projects is the question of intergovernmental MOUs, sovereign guarantees and letters of support. It is the question of which government and which utility takes on which risk. These questions are often very hard to settle and take a long time. The risks are often very large and only governments and utilities are able to carry them.

To de-risk projects, there is a new concept of blended funding, which is a mix of concessional, government and private sector funding. The risk capital comes upfront and the equity capital follows, and it is mixed with mezzanine or senior debt. Often private funding is accused of wanting to take all the profits and pushing all the risk to governments. Blended funding deals exactly with this issue where there is certain risk mitigation in terms of funding, but balances the risk–reward relationship.

Africa does not invest in its own infrastructure and economy. Pension, provident and retirement funds are invested overseas. An environment needs to be created where this capital feels safe here.

The future looks very good in terms of energy in Africa. A new boom of power generation is developing in Africa 30 years after the previous boom. The East African Power Pool is expanding and an interconnection will be established with the Southern African Power Pool. The West African Power Pool will be much closer to completion. This will open up large opportunities in Africa, with enormous challenges. In addition, numerous independent power projects will develop over the next ten years, built by a new generation of people who are not interested in bureaucracy, but who rather want to bring the technology to where it is required. This will see a lot of development in terms of renewable energy. The technological developments in the near future will demand African governments to give up sovereignty to enable the building of this infrastructure. The energy sector will provide the biggest return for investment.

Terrorism has arisen as a new challenge and risk on the ground for the West African Power Pool, yet good governance and dialogue, and not only military might, can address many of these issues.

PANEL 7: ENERGY PRICING AND SUBSIDIES

Session sponsored by Joubert Galpin Searle

Moderator: Dave Wright, Secretary General, SANEA

Panel Members: Tom Kober, Researcher, Policy Studies, ECN
Mike Rossouw, Special Adviser to the IPP Project Office, South African Department of Energy
Alastair Campbell, Managing Director, Vantage Capital
MC Botha, Managing Director, Joubert Galpin Searle (JGS)

Key Questions:

- What are the key determinants behind electricity pricing processes in South Africa?
- What model of electricity pricing can guarantee fairness and transparency to all stakeholders in the energy sector?
- What are the socio-economic advantages and disadvantage of energy subsidies?
- To what extent are universal energy subsidies justifiable in the context of the long-term economic development of African countries?
- What is the value of cost reflective tariffs to private investors and consumers?

Key Points:

- The determination of electricity tariffs is crucial in attracting private investment in the renewable energy sectors of African countries.
- The strength of energy regulatory frameworks is an essential determinant to electricity pricing processes in South Africa.
- Robust regulatory frameworks ensure the proper alignment of cost reflectivity with electricity tariffs.
- Universal energy subsidies are not economically viable in the African economic development context.
- The pressing issue for interconnected power projects is the question of risks and how governments and utilities can

assist with sharing the risk equitably.

- A further pressing issue is to find a balance between national needs and interests and regional/continental needs and interests, and to ensure that the former do not undermine projects conducted by regional and continental bodies.

Synopsis:

Energy pricing and subsidies are hot button issues for governments. Consumers desire low electricity prices while power producers want best prices for their products as reasonable return on their investments. Governments are caught in the middle – trying to balance the needs of consumers and power producers. In South Africa the electricity pricing process is regulated by several pieces of legislation. The constitution guarantees municipalities the right to supply electricity to communities. Secondly, the Electricity Regulation Act (ERA) stipulates that the licensee must recover his full cost and a reasonable return. Determining the reasonable rate of return is determined by the principles of the ERA and electricity pricing policy mechanisms.

The Electricity Pricing Policy (EPP) deals with the financial viability of the energy sector by qualifying the statement in the ERA by saying that the reasonable margin of return must be a risk-adjusted return on appropriate asset values. The pricing of electricity is determined by the multiyear price determination methodology (MYPD methodology), which determines how electricity tariffs are set by Eskom or the municipalities.

The MYPD allows for corrective measures in cases where the tariffs are erroneously set. The Regulatory Clearing Account (RCA) methodology then resets the tariffs correctly, in line with certain assumptions about the economy, etc. The electricity price determinations that come from the MYPD are set for five years, with a tariff that rises at a set rate over that time period. This is to allow predictability for businesses and other institutions to plan forward.

NERSA is the main body that approves the tariffs and licenses of electricity. Electricity has three tiers: generation; transmission, and distribution. Eskom has the generation and transmission license and has been given the distribution license for all areas not covered by municipal licenses. Municipalities have been given distribution licenses for the areas in which they operate.

NERSA approves for Eskom the wholesale tariff that includes the generation and transmission components. The municipalities purchase power from Eskom at the wholesale tariff rate and then distribute the power to consumers. The Eskom distribution tariff to consumers is roughly 25% lower than the municipal distribution tariff to consumers living in the municipal area. The Eskom full cost consists of the primary energy cost and other costs that build up to the tariff. The municipal tariff consists of the Eskom wholesale tariff, plus the administration costs related to the supply of electricity.

Applications for electricity tariffs are split into Eskom and municipality procedures. The MYPD methodology determines these tariffs for a five-year period at 8% escalation, using a consultative process. If the tariffs are incorrect, the regulatory clearing account is used to adjust the tariffs correctly. The municipality tariff application process is different. Eskom publishes the tariffs guidelines, followed by a public consultative process, after which the municipality submits applications for municipal tariffs to NERSA, which then approves the tariffs that will be integrated into the municipal budgeting processes.

Determining the tariff return at a reasonable rate of return is determined by the principles of the ERA and electricity pricing policy mechanisms; as such the tariff return must be risk adjusted and must be calculated in reference to appropriate asset values. Typically, the electricity pricing policy mechanism prohibits the generation of excess cash flows through tariffs. Risk adjusted marginal return considers a type of entity; if it is public, e.g. a state-owned enterprise (SOE) that is low risk, and the return will be less than that of a private entity with high risk. With regard to SOEs, the return is measured with reference to the average cost of capital, which is normally 8–10%.

Electricity pricing is a key determinant in attracting foreign investors in African countries. In this respect, the tariffs fixed by regulatory bodies should have a reasonable rate of return that can attract potential investors in local energy projects. The regulatory frameworks in this case play a big role in setting tariffs. They must be efficient and transparent in the ways they fix tariffs.

There needs to be transparency about tariffs if they are to work efficiently. This is with regard to how they are calculated while looking at how to provide electricity access to the people. With tariffs it is important to assess the willingness to pay the people – as well as the willingness to spend per kilowatt hour. This will determine the technology options that can be used in providing that power, e.g. grid enlargement, decentralised technology options and the nature of financing mechanisms required. Typically, big projects will attract financing as opposed to small projects. However, creative financing options for small rural renewable energy projects in Africa can be procured from the Green Climate Fund.

The electricity supply industry (ESI) in South Africa has changed. Legislation has not kept in touch with these changes. Eskom has three entities that require Eskom to fulfil its mandate (generation, transmission and distribution), in a regulated space that is ring fenced in accordance with the Electricity Regulation Act (ERA) and electricity pricing policies. Power generation is a problem – it is viewed as one single machine, yet there are many machines in the generation space – e.g. nuclear, coal, hydro, pump storage, new

coal and old coal. The REIPPP Programme has different PPAs with an individual producer, unlike Eskom and NERSA operations.

For better efficiency, individual power stations should obtain PPAs for the remainder of their economic lives; PPAs create price transparency, and create efficiency through competitive forces between the power stations and all the players. PPAs between NERSA and power stations can be affected by re-working the relevant pieces of energy legislation to facilitate this. As far as subsidies are concerned, they will always be there but they have to be transparent and need to address the needs of the energy industry and not be used for other purposes.

Since 2008, with the advent of load shedding, the electricity pricing in South Africa has gradually moved to show cost reflectivity. The tariff increases that followed load shedding were cost reflective and enabled the country to get to a realistic level of electricity pricing. This led to the flow of foreign investment into South Africa to fund energy projects, such as the REIPPP Programme – with tariffs that started at ZAR2.75 for PV, coming down to less than a rand in 2016. From the banking perspective of funding energy projects, there has been a move away from an unrealistic comparison of ZAR2.50 tariffs versus a ZAR0.78 tariff for new generation, to a situation where new generation competes on a new cost of power basis that is near grid parity point now.

There are many new types of power generation springing up these days that are economically justifiable and do not need the use of subsidies. Current trends are moving towards 'grid defection' where communities will no longer rely on the grid but other power sources that will not require subsidies. The REIPPPP is a good example of smaller, more manageable and economically justifiable energy solutions that do not need subsidies.

Subsidy usage in Africa amounts to 12% of global spend on subsidies on oil, coal, gas and electricity. Three quarters of these subsidies in Africa are dedicated to oil and oil products and 15% to electricity and the rest to natural gas. Most of the subsidies occur in oil and gas producing nations and they cost government budgets and the GDP a lot. In Algeria, for example, subsidies accumulate to roughly about 10% of the GDP. The electrification of rural areas in Africa involves very expensive technologies like diesel generators – and the fuel is subsidised. This is a very inefficient way of providing energy. Against the long term development of Africa the imposition of subsidies results in escalating government budgets that affect the GDP as well.

Many of these universal subsidies targeted for low income households are not appropriate according to the International Energy Agency's recent report. The report shows that supporting 40% of low income households with one dollar per kilowatt hour requires spending five additional dollars because the higher income households must be subsidised too. As such universal subsidies are highly ineffective.

From the long-term development perspective and climate change there is need for reform for fossil fuel and electricity subsidies. The reform of subsidies can be effective if it is done gradually, say over five to 10 years. There is a serious need to rethink subsidies in terms of better efficiency and to tailor the subsidies to various future energy worlds and operations.

PANEL 8: RENEWABLE ENERGY TECHNOLOGIES, SOLAR, WIND

Moderator: David Jarrett, Managing Consultant, RDJ Consulting

Panel Members:
Aaron Lepold, Deputy Director, Power for All
Alessandro Bertacchini, Sales Area Manager, Turboden
Vicky Basson, CEO, KZN Energy
Shannon Davids, Energy and Water Sector Education and Training Authority (EWSETA)

Key Questions:

- Have renewable energy sources been sufficiently promoted?
- Do decision makers sufficiently understand renewable technologies?

- How do we deal with the expectations of rural communities to achieve similar development standards as urban residents?
- Do renewable energy sources have to be decentralised or can they feed into existing grids?

Key Points:

- Training is one of the main weaknesses of the renewable sector because qualifications are still being developed and there are not enough trained technicians for the various job types in the industry.
- Mini-grid systems are constructed in such a way that they can hook into the grid if this is ever expanded to the area.
- Engineers and middle levels of government, as well as normal citizens, often do not have sufficient understanding of renewable energy sources and their sustainability. They tend to think in terms of the grid as the only reliable source.
- There is a strong perception among citizens in South Africa that everyone needs to have access to the same grid electricity system in order to fulfil the mandate that everyone is equal.
- Energy solutions should be based on detailed examinations of the needs of a customer/community and the best solution should be devised for the particular situation.

Synopsis:

The Energy and Water Sector Education and Training Authority (EWSETA) has the responsibility of ensuring that there are competent skills within the energy sector. They are predominantly in the generation, distribution and transmission space ensuring skills from qualified artisans to power plant controllers, etc. Lately they have become very involved in qualification development because of changing frameworks. They are moving across to a new occupational qualifications development model through the Quality Council for Trades and Occupations (QCTO). They are looking at the new technologically advanced skills that need to be accommodated, such as concentrated solar power (CSP), to get those skills working as many CSP plants are coming online this year.

The biggest challenge is to educate competent technicians within the energy space. Many green technology energy plants are in the process of coming online, which often employ imported technology. This requires the development of local skills for implementation and maintenance in these technologies so as not to remain dependent on outside labour. There need to be programmes for educating labour – and new qualifications need to be developed for these new technologies.

Two qualifications that are being developed are that of an energy efficiency manager and energy audit technician. These technicians would be drawn on to analyse the energy needs of a customer and to advise on the technologies that would be best to provide for those needs. They would advise on what lighting systems to use, how to layer the house to insulate it better, and other ways of greening buildings. Their interventions allow for large savings with few changes. The changes would also not need to be implemented immediately, but could be done incrementally so that the customer could deal with the costs more evenly. On a residential level people often just buy the first product they see, but they do not analyse whether this is the best to cover their needs. There is also space for bodies and government to put in place systems and subsidies by which good devices are identified.

For off-grid installations in the residential sphere, new regulation needs to come in to ensure that what is sold and how it is installed is of the correct quality and is done professionally. It is key to promote, enhance and contribute towards skill development, and assisting South Africa in standardising and centralising our systems. There is also a need to develop these qualifications in ways that they are not linked solely to one specific international product and if that product is removed from the market, these skills are completely useless and superfluous again. So the qualifications need to be developed on a national level.

An important framework for the discussion of renewable energy is whether the applications being implemented are off-grid or on-grid applications, or a combination of the two, and whether they are mini-grids or decentralised grids. These questions affect skill and talent availability, pricing and subsidies. The REIPPs in South Africa aim to feed the produced electricity into the grid.

Renewable energy sources can provide energy sources for schools and clinics, which are not on the grid and cannot do their jobs properly without energy. Thus clinics can store vaccinations and run an x-ray machine with small amounts of energy. Providing

electricity is a form of empowering people. Often they lead to the creation of new small businesses, which attract other businesses, leading to the development of a new small economy. It gives people dignity to live with minimal standards.

There does not yet seem to be a cohesive alignment of policy and resources that looks at the ultimate economic impact of access to renewable electricity. A mini grid can provide 24/7 power, can run a whole village (water pumping, telecommunication antennae, radio station, schools, court, police station, health clinic, and private enterprises), at a fraction of the cost of linking up the community to the grid. (An advantage of a mini grid is that it is constructed in such a way that it can hook into the grid if this is extended to the area at any time in the future.) These types of systems need to be replicated elsewhere so that this approach leads to a paradigm shift and that these types of systems become business as normal. For this there needs to be a clear technology standard and the cost drivers in the industry need to be constrained.

Renewables are not (yet) competing on a level planning field. In ministries, regulators and utilities, especially in Africa, there is a lack of understanding, awareness and appreciation of what renewables can offer and how to integrate them into national plans, and how to integrate them from the bottom up, using decentralised solutions vis-à-vis grid expansion plans. Decision makers and engineers often still focus on base load issues and are of the opinion that the renewable sector is still in its infancy and cannot handle the necessary applications. Yet they do not take into account CSP plans and off-grid solar plans that offer 24/7 electricity supply. There is not enough education on and awareness of renewable technologies at the leadership level, so that leaders cannot make informed decisions. There needs to be clear planning and analysis to determine which technology should be applied where. Financing for decentralised renewable energy needs to be flexible but financiers do not have the mechanisms in place for this.

There is also a lack of understanding by communities themselves of the technology. Communities prefer what they consider the 'real' power off the national grid and do not see that decentralised renewables are the real deal. There is the limit in South Africa that everyone wants to be equal and the perception that the rural areas need to receive the same systems as people have in urban areas to be fair and equitable. People also aspire to achieve these same levels.

Even among more highly-educated communities, there is confusion about the various technologies on offer and their advantages, e.g. the differences between a solar water heater and a solar system, and whether a PV system is going to be grid-tied or used as back-up system. Suppliers often do not accommodate the load of the house when advising their clients. If grid extensions were done on communities in South Africa that are not yet connected, then two problems would arise: firstly, a cost-benefit analysis would show that the extension is not financially viable; and secondly, their load is primarily peak load, not base load, so that decentralised systems could work very well for them. This raises issues of demand-side management and energy efficiency.

The new technologies, like SIM cards in home energy systems, make energy companies more into energy service-providing companies. So they provide light instead of kilowatt hours. This radically changes how systems are designed, which technologies are chosen and their size. To draw optimally on renewable energy sources, it is critical to establish the size of energy need in communities, or by clients. Often there is the issue that a large expensive system is installed when a smaller one would have been completely adequate. While everyone would like a grid connection, the costs to supply this are prohibitive and other technologies can provide them with the level that they need at a much lower cost.

In terms of decentralised systems in South Africa, the Department of Energy currently makes the standard but it is not flexible enough to change in tune with how technologies emerge and change. In some ways this is a form of over-governance. What should be possible is an assessment of the demands of the customer in terms of what they use and need. One of the drawbacks at the moment is still the cost of the appliances to make them compatible with renewable energy sources.

In terms of producers, there are many constraints in implementing green technologies through the red tape, environmental studies, certificates, and regulatory requirements, which even big energy players struggle with. It pushes out the smaller IPPs.

It is essential that when a system is put in place, there must be a concerted approach to promote the project from the top decision level to the bottom end used. This is too much to do for the small companies that are involved.

The decentralised focus is one of the reasons that take-up of renewable energy sources is not as good as it should be, because the technology is seen as not being as good as it should be. The arguments for demand-side management and energy efficiency are

important arguments to moving renewable energy technology forward in a situation where sustainability and green climate become ever more important.

PANEL 9: OIL (UPSTREAM AND MIDSTREAM)

Moderator: Bonang Mohale, Chairman, Shell

Panel Members: Barrisford Petersen, Managing Director, BBP Law
Johnstone Chikwanda, Chairperson, Energy Forum Zambia
Nigel Gwynne-Evans, Chief Director, African Industrial Development, the Department of Trade and Industry (dti)
Avhafani (Fani) Tshifularo, Executive Director, SAPIA

Key Questions:

- What impacts have oil prices had on the development of oil opportunities in Africa?
- What actions should oil producing countries take to reduce the impact of low oil prices on their financial positions?
- What challenges impede the development of gas as an addition to the energy mix of South Africa?

Key Points:

- The decline of oil prices with its negative effects on the South Africa economy needs to be countered by strategic thinking and action.
- Gas to power generation needs to develop urgently in South Africa as a worthy addition to the energy mix of South Africa.
- Transformation is needed in the oil industry in South Africa in order to open the industry to competition from small black-owned companies.

Synopsis:

The low prices of crude oil caused by the US changing from a net importer of oil to a net exporter of oil and the shrinking Chinese economy, as well as the anticipated re-entry of Iranian oil in the market have had an adverse effect on African economies that rely on oil exports; their budgets have suffered significantly and secondly, the benefits of low oil prices to consumers have not materialised due to the strengthening dollar that has weakened local currencies. Worse still the low oil crude prices have had a negative effect on companies in South Africa that have linkages to international oil parent companies such as Exxon-Mobil.

Corporate restructuring in South Africa has become the norm in oil companies, such as Chevron-Texaco and Shell as they cut costs as a result of shrinking oil revenues caused by low-oil crude prices. The only international oil company not affected by low oil prices is the Saudi ARAMCO that has continued producing oil – at a rate of 11 million barrels per day despite the dip in oil prices.

Already, South African companies operating in the oil and gas sectors in Africa and the Middle East have suffered terribly due to the low oil prices. Many have been forced to scale back operations in order to cut their costs of operations in those countries; as a result jobs created in those countries have been lost due to the low oil prices.

Already, ChevronTexaco, trading as Caltex in South Africa, is going to divest its local operations by selling its 75% equity in the local market. There are six refineries in South Africa and if any one of these six goes a week above their planned shutdown this would spell trouble for the economy. All told, these issues place South Africa's energy security at risk.

The low oil prices have impacted South Africa's development outlook negatively. The country's economic growth rate for the past ten years has hovered around 3.5%. For the last two years the country has struggled to attain just 2%. This year the growth rate is estimated to reach 0.8%, on account of negative factors, such as the low prices of crude oil.

To mitigate against the security of oil supply in South Africa, especially since there is only one refinery in the Western Cape, there is a plan to build extra storage capacity, for storing extra fuel stocks. Another important issue in this regard is to establish strategic fuel stocks. The Central Energy Fund (CEF) used to do this so that the country could hold at least 90 days' worth of fuel. This is not the case presently.

The development of the gas market in South Africa with regard to the Gas Utilisation Master Plan is currently being devised by the Department of Energy (DoE), and is envisaged to produce 2 000 MW by 2019. It is estimated that there is 250 years' worth of gas at current production levels. This will create an integrated pipeline infrastructure across South Africa and the southern Africa region and is anticipated to create diverse economic growth opportunities.

The development of the gas is a game changer in the energy industry of South Africa. Firstly, gas is more abundant than coal, and there is 250 years' worth of gas at current production levels in South Africa. Secondly, gas-driven turbines generating electricity operate at half the total cost of coal-fired power stations that generate electricity. In addition, gas emits up to half the greenhouse emissions that coal does. Hence gas is an affordable, available and an acceptable alternative to coal and oil. It is imperative and urgent to start issuing gas licenses in the Karoo, to facilitate the production of gas for power-generation purposes.

In the upstream, the best to be hoped for in the lower-for-longer environment is for international oil companies to have the best commercial terms in the midstream (gas and power). Another issue would be the creation of the gas market – in anticipation of countries in southern Africa finding their own gas, e.g. Namibia. On the downstream side (from refinery down to the entire value chain), the issue is to try and generate cash that is needed for long-term investments.

There is the need to transform the oil and gas industry in South Africa, particularly with regard to the South African Petroleum Industry Association (SAPIA). Transformation in SAPIA will increase the participation of local companies in the oil industry that is currently dominated by seven international oil companies and one national company operating in South Africa. Transformation will allow access to smaller, B-BBEE players to compete in the energy space with the other big players.

This will require enabling the participation of local companies in trading oil in the procurement of crude and other matters. It is in trading that skills transfer happens, e.g. in oil arbitrage issues. There is East Africa crude oil available not far from South Africa, which does not involve much transportation. It is all about deepening oil trading skills. Some companies even make 30% of their revenue in trading only, hence gaining trading expertise in the oil sector would be a potential avenue of entry for B-BEE players.

PANEL 10: GREEN TECHNOLOGIES, STORAGE AND INNOVATION (TIDAL, WAVE, ENERGY STORAGE AND INNOVATION)

Moderator: Jason Schäffler, Managing Director, Nano Energy

Panel Members:
Ndivhuho Raphulu, Director, National Cleaner Production Centre - South Africa (NCPC-SA)
Dr Martin Kaggwa, Research Director, Sam Tambani Research Institute (SATRI)
Fiona Wilson, Manager, Clinton Foundation
Frank Spencer, Business Development – Renewables, Consolidated Power Projects
Chris Ettmayr, Renewable Energy Sector manager, East London Industrial Development Zone (East London IDZ)

Key Questions:

- Does the migration to green technologies make environmental and economic sense? To whom?
- What kind of new inequalities are created by green technologies?
- How do individual Africans make sense of green technologies? And how will the individual African be convinced of green technology if not by the environmental argument?

Key Points:

- There are big hurdles for innovators to get their products onto the market – industrial manufacturing clusters with assistance for taking a product to the commercial stage might assist here.
- Government support for training and incentives for innovations are required.
- The unintended costs of green technology need to be considered in planning and implementation.
- This might require increased implementation of training programmes for those losing jobs in the old energy sector.

Synopsis:

Industrial estates play an important role in strengthening and growing local business and taking inventions and ideas to the commercial stage. It is very intimidating for an investor with a commercially ready product to start producing. Industrial estates can provide an intermediary step, namely a manufacturing cluster. In this manner, an idea goes from the inventor through a cluster and then only to a stand-alone company. Yet, there is still a need for government support and incentives to create a stimulating environment for innovation.

The energy market will develop in a similar way in Africa in a similarly revolutionary way that the telecoms industry developed in the 1990s, with the cell phone market. The big parallel lies in the fact that the big grids, the big power stations, the big power lines and the power pools will no longer be needed as the technology makes it possible to deploy energy services at any scale: at the level of a house, a village, an industrial park with distributed energy generation services. Africa will not build grids in the traditional way but it will build decentralised architectures.

The technology can do this, the pricing is about right, but the models are not proven, the financiers are hesitant to take up these kinds of projects. The projects are small and financiers might be looking for big projects for big returns. The idea of pay-as-you-go for electricity is seen as risky, but is successful in the telecoms space.

The issue of storage always gets flagged when it comes to distributed generation and renewable energy. Yet, there are case studies of off-grid plants that were built in Botswana and Kenya that run on solar PV battery prime, with diesel as back up for financial reasons. Because of the remote location diesel was too expensive. They are running reliably with a stable fixed price.

An important element in green technology is climate change resiliency: building resiliency for communities and energy systems as a whole. This is especially necessary in island states, which are very vulnerable to climate change. So it is not just an issue of bringing down costs, but of creating energy independence for island countries and durable energy sources, which are resilient to extreme weather events.

There are some exciting developments in renewable energy technologies, such as the tidal-wave floating-solar micro-grid storage. The National Cleaner Production Centre for South Africa (NCPC-SA) is under the Department of Trade and Industry (dti). All work in manufacturing can be described in terms of four themes: energy, water, material, and waste. The work of the NCPC is divided in terms

of these themes. One project it is involved in is the Switch Africa Green project, which is working within the sustainable development goals. Another is the Equal Innovation project, which aims at addressing concerns about the carbon footprint in the wine and fruit industry.

The NCPC-SA is working with the AU Technical Committee on Environment on Sustainable Consumption and Production to set up a continent-wide knowledge management system. This is an electronic library of activities within the green economy and sustainable development, innovation and research. The aim is to have this as a portal open to everyone across the continent to access information on projects on offer, so that you can make an informed decision about the feasibility, viability and technical ability required to run and implement a successful project.

There are a number of incentive schemes and products by the South African government to support this innovation on the continent. For example, the Technology and Innovation Agency looks at intellectual property issues in the industry. The NCPC-SA has a Manufacturing Competitiveness Enhancement Incentive Programme (MCEP). The '12i' tax allowance programme is a tax incentive for energy projects. The Technology Localisation Centre looks at how to take innovative projects or technologies in energy, bring them into South Africa, and make them grow new markets and industries. The idea is that the NCPC-SA plays a role of facilitation and coordination. It can offer training, and it provides advice to government and industry on how to make informed decisions for investments.

The introduction of green technologies also needs to take into account and address further potential negative effects that the technology can have. These effects need to be managed and included into the plans of countries and the continent when transitioning to green technology. Firstly, there is a general belief that green technology makes sense without qualification and this does indeed apply in terms of the environment. This sense is felt more strongly at a global and national level, but it does not necessarily make sense to the individual somewhere on the African continent. In fact, there is a disjoint between the national/continental level and the individual level. The average African will clearly take advantage of the better environment created through green technologies, but it is not such a big motivation for him to do everything in his power to use green technology in his own life, even carrying costs, for the ulterior motive of saving the environment. So while it may be good at a macro-level to invest in green technology, the motivation to invest in it may not be as strong at the micro-level. As long as energy is not a source for generating income for the individual in Africa, the economic motivation to migrate to green technology will remain weak. They may not be as convinced of the green argument as proponents of the industry. One manner in which green technology may begin to make sense for the individual African could be exactly on the basis of the daily energy needs that he has: Africa spends USD17 billion per annum on light sources, such as candles and paraffin. It would thus make complete commercial sense for the individual to replace these consumable energy sources with more durable green energy sources.

If you want human impact by green technology, local knowledge systems need to be integrated into green technologies. There is a lot of understanding of green energy in local communities, yet this is not known because it sits in rural areas. Integrating new technologies into the existing knowledge system will make them more accessible.

Secondly, in terms of labour, the transition to green technology can have unintended consequences, which need to be considered as they pose a risk for why these technologies might not succeed. Green technologies destroy jobs as they will most probably create others. The question is to establish who is at risk, whether these job losses are feasible, and whether anything can be done to ensure that workers can migrate from previous jobs to new ones (e.g. those who used to work in the coal sector in South Africa)? Thus, will the green technology absorb all workers that had previously been employed? Often the new skills that are created are very high-level skills, but those that are lost are low-skilled jobs.

Thirdly, technology is exclusive by including some people and excluding others. In Africa, society is very strongly determined by people who are included and many who are excluded. Green technology runs the risk of perpetuating inequalities in society. Lastly, technology can create a dependency syndrome whereby technology is imported without creating local capacity to manage and maintain.

The National Renewable Energy Programme was quite exclusive and marginalised small, medium and micro enterprises (SMMEs), which could not compete for these large projects, as they could not absorb the risk involved. The province of the Eastern Cape has now implemented a list of SMME component suppliers to the renewable energy industry. Yet seeing that the process of renewable energy by the government is already approaching its fifth cycle, this comes rather late.

It takes deliberate action by government and industry to facilitate localisation and skills development. Government has to take deliberate action to influence the industry and use incentives and policy directions to guide further skills development.

Green technologies often do not only generate energy for its own sake, but is integrated into other processes (such as in agriculture or water provision) where there are multiple uses that could increase the attraction of these energy sources for an individual in Africa.

Traditional electrical engineers who are confronted with green technology tend to be consumed by the single question of base load and whether the energy source can provide for bases as well as peaks. They are very concerned about the intermittency of renewables. Renewables are in fact completely competitive on a kilowatt per hour (KWh) basis with other forms of energy. A way to deal with the intermittency is to place batteries into the system. Some of these were very costly in the past, but the prices of these battery systems are coming down.

Often price is taken as the only determinative factor seen to drive decisions by people on what energy source to draw on. Yet there are many other factors that are as critical when applied to the question of energy, such as employment aspects, resilience to climate change, economic independence, and economic robustness of communities.

PANEL 11: UTILISING GAS FINDS IN AFRICA

Moderator: Rodney MacAlister, CEO, Monetizing Gas Africa

Panel Members: Simon Currie, Global Head of Energy, Norton Rose Fulbright
Doug Kuni, CEO, JSK Consult
John Smelcer, Head, Oil & Gas, Webber Wentzel
Mark Tiepelt, Managing Director, Biogas SA
Obakeng Moloabi, Head of Project Developmetn, Pele Green Energy

Key Questions:

- What opportunities exist for the exploitation of gas finds in Africa?
- What are the challenges inherent in the development of gas energy processes in Africa?
- What is needed to move forward with the development of gas in Africa?
- To what extent is biogas development economically viable in the South African context?

Key Points:

- Utilising gas as an energy resource in African countries is reliant on the development of infrastructure in order to facilitate its usage.
- Unresolved policy issues are holding the development of gas to power generation in South Africa.
- Regional integration and cooperation is key to the importation and production of gas to power generation in the Southern Africa region.
- Biogas energy production and generation needs to be fully developed as an addition to the energy mix of South Africa.

Synopsis:

Offshore gas finds off the shores of East and Southern Africa present huge opportunities for gas to enter the energy market of

Southern Africa. The fact that gas has not been developed for power production among other uses in South Africa shows the poor understanding of the role that gas can play in the energy sector in the country. The current impasse around the South African Gas Utilisation Master Plan that has been delayed makes it difficult for IPPs to produce gas for the gas market.

The discovery of huge gas reserves in Africa presents policy dilemmas related to whether the gas should be exported to earn hard cash needed to develop economic and social infrastructure, or use the gas as energy to grow local economies. Further compounding this dilemma is the fact that there is little demand for gas as a commodity in Africa. Many African countries sitting on huge gas reserves have no gas consumption capabilities in their countries at all. Utilising gas comes at a cost of building necessary infrastructure that can support gas usage domestically.

Biogas is severely underutilised in Africa, despite the availability of waste. Up to 3 000 MW could be produced from turning organic waste into gas in South Africa, according to a recent study. The biogas industry in South Africa is still developing and has not reached the stage where it can be integrated into the REIPPP Programme. The initial cost in developing biogas in South Africa is prohibitive and the biogas projects too small to justify incorporation into the REIPPP Programme. The biogas programme does not have a feed-in tariff and as such biogas projects have to work as standalones to operate in the small scale 1–5 MW IPP energy market with a ZAR1.45 KWh tariff, which makes it reliable.

Biogas has much wider applications and benefits, and can contribute significantly to benefits such as job creation, carbon emission mitigation and waste management solutions. Although it is a small sector in South Africa, it has huge potential. Already, there is a 4.5 MW plant in Bronkhorstspruit near Pretoria that provides renewable power for the BMW plat in Pretoria; as a renewable energy resource it can contribute to alleviating peak power problems in Pretoria.

Complex regulatory issues make it difficult to build biogas projects in South Africa; the licensing of biogas production involves navigating a minefield of legislation from six or seven departments, from air emissions licenses, to waste emissions licenses, agricultural licenses, the by-laws, etc. This is by far the biggest hurdle facing the building of biogas plants in South Africa.

There is a very strong case for using gas to produce power in African countries; it is the most strategic use of gas owing to the fact that there is no infrastructure in place that could support the other various uses of gas, as is the case in the US or Europe. Moreover, the falling prices of gas in Africa provides sufficient impetus to develop gas power as a viable energy source.

As such African countries must figure out how to use gas in developing their economies, rather than selling it abroad for hard cash. It can generate power as well as finding use in heating and air conditioning processes (among others). Despite the policy dilemmas faced by countries in Africa regarding whether to export gas to earn hard cash, or use the gas for power generation to build economies, the potential impacts of gas on African economies are quite profound.

A key challenge of developing gas to power production in Africa is the lack of infrastructure in many African countries. The countries with huge reserves of gas cannot exploit it fully due to the lack of infrastructure in place to use it in various ways. Using gas to produce power is the easiest because it is much easier to deploy. The lack of infrastructure, the unpredictability of the policy frameworks – and the lack of regional integration – all pose significant hurdles for gas exploration in Africa.
The fall in gas prices on the world market, and the glut of gas, makes it viable to import gas for power production in African countries. This trend is starting to flourish in countries such as Ghana, Mozambique and Senegal, lending credence to the fact that importing gas to produce power can be used to build energy infrastructure. This is a tremendous opportunity for African countries to use the gas importation to kick start the building of gas infrastructure.

In South Africa, putting up a power plant is laden with policy and regulatory complexities that would take several years to establish a power plant; presently there is no regulatory framework for gas production in South Africa, despite the fact that there are hordes of investors waiting with cash and the capital needed to start gas exploration and production. In the South African context, the uncertainty of gas energy policy makes a strong case for a procurement programme for the gas.

Regional integration and regional cooperation is a key to issues of gas production and importation in Africa. There are two cross-border gas pipelines in Africa – the Loop 1 Sasol pipeline that runs from Mozambique to South Africa and the West Africa gas pipeline that transports natural gas from Nigeria to customers in Ghana, Togo and Benin. Eighty-five percent of the gas carried through this

pipeline is for power generation and the rest is for industrial use. The existence of the gas reserves in Africa necessitates the construction of more infrastructure, e.g. pipelines to facilitate gas exports as well as facilitating domestic use (such as for power production purposes).

South Africa certainly would benefit from liquefied natural gas (LNG) imports using a pipeline from Mozambique that brings Sasol gas to the country. The government of South Africa has indicated using Richards Bay, Saldanha Bay and Coega as LNG terminals to import liquid gas from other countries.

The off takers of the gas imports in South Africa will make the power production projects work. However, the current determinations according to the DoE in terms of 'blocks' are too small for an IPP to import and operate a contract on gas-power production. Bringing in gas in South Africa requires a major player to stand behind the gas to be imported and eventually bring it to the market. This issue needs to be sorted out to facilitate the importation of LNG into South Africa.

KEYNOTE ADDRESS 2:

Speaker: Thava Govender, Group Executive, Eskom

Over the last number of years, energy demand has grown exponentially. Challenges for Africa, going forward, include the fact that a large percentage of the population does not have access to modern energy services. The supply is also intermittent, which makes the energy sector a bad investment.

The vision is to drive research, address carbon challenges, as well as leverage off (and partner with) the BRICS countries and the United Nations (UN). Key issues to address include energy affordability, decentralised electrification solutions, smart technology, as well as new options for the generation of energy.

Efficient infrastructure needs to be developed – in addition to an integrated African power pool – in order to encourage new investment. Resilience needs to be increased to improve investor confidence. An example of this can be seen with the Mozambique project.

There is also an urgent need to develop more base-load power, such as hydropower, clean coal and nuclear power. Currently, Eskom is investing in combinations of power-generating technology at Medupi. Nuclear power is a good option for socio-economic growth as it is a clean power option. Affordable electricity needs to be generated and the skills, with regard to installing and maintaining new energy-generating technologies, need to be transferred to the local population. The fourth industrial revolution is imminent and will signal a fundamental shift in how the population consumes and relates to each other. It is vital to consider how this movement is going to affect Africa in terms of opportunities for agriculture and manufacturing.

PLENARY PANEL 2: WHERE IS THE AFRICAN ENERGY SECTOR HEADING?

Moderator: Arthur Hanna, Senior Managing Director, Accenture

Panel Members:
Dean Oskvig, Vice Chair, North America, World Energy Council
Philippe Joubert, Executive Chairman, Global Electricity Initiative
Dr Christoph Frei, Secretary General, World Energy Council
Dr Karl Rose, Senior Director, World Energy Council
Bonang Mohale, Chairman, Shell

Key Questions:

- What are some of the challenges for the African energy sector?
- Why has Africa been selected as a growth point?
- What is the way forward for energy generation in Africa?

Key Points:

- Skills and talent are among the most significant challenges for the African energy sector.
- An abundance of natural resources and a large population are two of the reasons Africa has been selected as a growth point.
- We need to give entrepreneurs the space to develop energy-generation solutions.

Synopsis:

Investment is needed to build an infrastructure road map for Africa. There is a gap between energy needs, infrastructure and investment in Africa. Policy makers need to make sure that this gap is narrowed. If this does not happen, there will be drastic socio-economic consequences. Tariff mechanisms in many countries do not allow for an adequate rate of return.

There have always been many challenges for the African energy sector. Of these, skills and talent are the most significant. The suggestion was made that people are trained and developed in skills necessary to construct and maintain the energy infrastructure. After this has happened, only then does the infrastructure need to be built. PPPs are going to be critical in developing the electricity infrastructure. Financing and regional integration are also challenges faced by Africa in terms of energy generation.

Africa is not using the resources that it has in order to exploit alternative sources of electricity. For example, the most successful solar power project is in Germany – where there is approximately three months of sun a year – and not in Africa where the sun is visible almost all year round. The problem comes down to a lack of management, as well as resilience. Optimism was expressed about, among others, the following energy-generation technologies: offshore wind and solar technology.

Africa has been selected as a growth point for energy-generating technologies because of:

- growth drivers, such as the approximately 19 million people on the continent who need electricity.
- Natural resources were also seen as growth drivers
- skills and knowledge transfer
- an acceptance of technology.

Government projects are not going to be sufficient in terms of generating sufficient electricity for Africa. It is necessary to create solutions that are developed at a grassroots level and filter up. This is not happening as bureaucracy is stifling entrepreneurship, thus inhibiting people from coming forward with these ideas. A mix of energy-generating solutions – both large and small – is necessary as is the correct allocation of resources.

CLOSING AND SUMMATION

Speaker: Brian A. Statham, Chairman, Africa Energy Indaba; Chairman, South African National Energy Association

In the energy sector, in terms of talent and entrepreneurship, there is too much mentoring and not enough sponsoring. Owing to this lack of finance, infrastructure is ageing and progress is not being made in the energy-generation sector.

It is crucial to adapt energy solutions to the African context so that these address the specific problem rather than force a generic solution on Africa.

Succession plans need to be developed and it is necessary to nurture those who will take over. This does not mean that these individuals will usurp the jobs of their seniors. It just means that when senior, more experienced individuals move on, there is someone there to ensure business continuity. You need to give people space to grow and develop.

A compelling vision of where the energy sector is going to needs to be developed. Inspirational leadership – that gets people excited about their work – is a crucial aspect of this. People need to be accountable for what they do.

DATE FOR THE NEXT AFRICA ENERGY INDABA

21 – 22 FEBRUARY 2017