

POWERING AFRICA INTO THE FUTURE

Examining Africa's energy landscape today, for tomorrow



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POWERING AFRICA INTO THE FUTURE

In partnership with POWER-GEN & DistribuTECH Africa and IOA, we are delighted to introduce the inaugural 'POWERING Africa into the Future' report to the market. We have taken a snapshot of what we believe will be affecting the Sub-Saharan African (SSA) power sector.

"The single biggest issue in Africa is that we as a continent have ample energy resources but very little power. It is tempting to hold up a particular energy technology, such as nuclear or renewables, as the solution. To do so would be to miss the point. We need to be asking how much of each is appropriate; and identify the optimal energy mix based on needs and available resources."

*Knox Msebenzi, Nuclear Industry Association of South Africa (NIASA) MD and
POWER-GEN & DistribuTECH Africa Advisory Board Member*

It is these ideas that will be explored in the POWER-GEN & DistribuTECH Africa conference and exhibition, taking place on the 18-20 July 2017, Sandton Convention Centre, Johannesburg.



END TO END POWER TECHNOLOGY & KNOWLEDGE

POWER-GEN & DistribuTECH Africa is the platform for industry experts and key players to come together to exchange knowledge and encounter technology capable of creating a brighter future for African power.

End to End it is the must attend event for the African power sector

CONFERENCE & EXHIBITION
18-20 JULY 2017

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JOHANNESBURG, SOUTH AFRICA



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100+
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259

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INVESTING IN RENEWABLE ENERGY TECHNOLOGIES

Expert interviews with Kadri Nassiep and Rob Short

Kadri Nassiep is the Chief Executive Officer of the South African National Energy Development Institute (SANEDI). After 11 years at Eskom, in 2003 he joined the Department of Minerals and Energy as the Chief Director for Energy Planning where he was responsible for development of policy, strategy, legislation and regulation supporting the implementation of energy efficiency and renewable energy.



Rob Short is an independent advisor in the environmental, climate change and renewable energy sectors, and a senior consultant with In On Africa (IOA). He has worked in South, Southern and East Africa on programmes in both the public and private sectors. He was previously the Development Bank of Southern Africa's environmental specialist and is currently working on climate change related projects in the agricultural and water sectors.



How has the renewable energy market developed over the last few years? What are some of the main trends that are beginning to shape out the industry in 2017?

Nassiep: Well I think there was a lot optimism I would suggest, going back about 3 or 4 years ago brought on by the introduction of the South African government's Renewable Energy IPP program, and I think at that juncture you know the competitor bidding process that was introduced by government was in itself possibly optimistic, but I think at the time the justification would have been that we would drive prices down, and if that was the objective then it certainly contributed to a reduction in price from Round 1 to a Round 5 scenario. However, we have seen that the program is vulnerable to Eskom's reluctance now to sign further agreements because of perceived surplus capacity as well as an interest in pursuing the nuclear program, and we have also not built up a critical mass of skills to support the industry in the country and that extends to localisation of technology.

Short: The renewable energy sector has shown significant growth in the last few years. The International Renewable Energy Agency (IRENA) reported that there was an 8.7% increase globally in renewable energy capacity, with 12.1% renewable energy capacity growth in Africa. The main trend driving the market will be the need to further drive down costs to ensure they are, and remain, competitive with other fossil-fuel based technologies and nuclear. Climate change mitigation will continue to be a strong driver for the renewable energy sector, despite the United States withdrawing from the Paris agreement.



The Droogfontein solar plant is one of the largest in Africa and generates power for 19,000 South African homes. Photo courtesy of MainstreamRP/Flickr

Costs of solar and wind energies have been decreasing in the last few years, however investing in renewable energies is still viewed with scepticism by some. What do you think are a few of the biggest impediments to securing financing for renewable energy projects and how can these be overcome?



Nassiep: The biggest impediment is going to be power purchase agreements (PPAs) that are signed by government. We've seen that when government has indicated their willingness to create opportunities through PPAs, investors have come to the table, and there have been a variety of financial instruments like bonds, equity and debt finance, that have come in to actually support the funding of these projects. In cases it's been grant funding that's been raised as well, so you have a combination of financing instruments that have come in to support these projects on the back of certainty that has been created by specified funding calls for proposals in terms of the various rounds, where the determinations have been made, followed up by reaching preferred bidder status.



Short: The scepticism about investing in renewable energy is in my opinion virtually non-existent. For some financial institutions - for example in South Africa - it has been one of their major sectors for financing over the last few years. The technologies have matured and investors are more comfortable with assessing the risks associated with them. The need for government policy consistency is a key issue that needs further attention whether it is, for example, with regard to the signing of power purchase agreements or ensuring there is sufficient investment in a country's grid to allow for new grid connections. Governments in Africa are creating more supportive enabling environments for renewables, as part of their overarching objectives to improve energy access and security.

What have been some of the objections to implementing renewable energies like solar and wind across Africa? The main counter-argument would rest in terms of baseload capacity that these renewable energies cannot provide, however is this really the case?



Nassiep: That's a flawed argument let's put it this way. You can design an energy system that can take a significant amount of renewable energy. I'll give you the example of Spain which is a model used consistently. What they do is dispatch the wind and solar as it becomes available, and then they will follow with gas because you can ramp up and down quickly with gas. So in effect you have very good forecasting models that will tell you within an hour when you are going to have specific wind-speed - obviously giving indication of the power output for a particular wind turbine and I have seen it in action - so the reality is you could design the system with a relative degree of confidence, even a high degree of confidence, and it will tell you that you can generate during this period of time with wind for example, and then you can as I said follow with gas.



Short: The baseload argument reflects a more difficult challenge as a result of the variability of several renewable energy sources. The solution is investing further in the grid to manage this and understanding that there will need to be a combination of renewable energy sources to ensure a stable electricity supply. In most countries in Africa there has been a consistent lack of investment in the grid and the emergence of renewable energy sources and their characteristics, has brought this further into focus. The need for further funding in this area has led to work investigating how the private sector can be encouraged to invest in this type of infrastructure.

What have been some of the global success cases in which renewable energies have been integrated into central grids, and how can Africa learn from this process?

Nassiep: The classic examples are your German and Danish markets, but I mean even look at the UAE as an example they are the ones that are putting a PV plant now at \$0.03 kilowatt hour. We've seen from Ivanpar in the US from a CSP point of view, that you can do CSP competitively as well which has always been a challenge and we've seen even in South Africa the price dropped substantially as the market evolves. The growth in CSP has been limited internationally simply because of the overwhelming growth in PV. With CSP the technology is a bit more complex and the application is better suited to South Africa because we have high insulation in terms of radiation levels, and we potentially have the need to generate maybe 20 hours a day so we can actually store thermal energy until such time that we need to generate power with it.

Short: Existing systems in Europe provide the best examples of how renewable energies have been incorporated into the grid. There is no "silver bullet" that leads to this process being successful. There are a number of key elements though. These include government taking the lead on providing an enabling policy and regulatory environment for the development of the sector which can involve the provision of government guarantees for power purchase agreements that will encourage investment. The development of the grid also needs to reflect a need for flexibility to effectively manage the different sources of renewable energy and their characteristics. The need for greater innovation in this area, not just on the generation side, is key and also leads to changes that need to be effectively managed in the institutions that have responsibility for ensuring the grid functions as required.



Over 5,000 MW of power are generated by Denmark's windmills accounting for 40% of the country's total electricity generation. Photo courtesy Wiki Commons

What do you think are some of the inhibiting factors to stimulating the development of nascent renewable technologies that can be made attractive and affordable within local markets, while also making them globally competitive?

Nassiep: Skills, funding for R&D, and funding for demonstration in particular, because there are emerging technologies that need to be tested properly and then a business case built around them and that's not there yet. South Africa also has an industry in terms of research capability and that's not getting enough support. Traditionally, it used to be Eskom and nowadays it's more the CSIR that are leading the way in that space, but it needs a coordinated response because renewable energies can in fact play a big role in the energy market, there's no question about that. Waste-to-energy technology also needs to be demonstrated.

Short: This question is not unique to the renewable energy sector in Africa. It reflects the general lack of support for entrepreneurship on the continent and the lack of research capacity. This can only be solved by national governments through investing in their research capacities and ensuring support mechanisms exist to commercialise these technologies. The numerous incubator and innovation programmes that are being implemented in several countries are part of the solution e.g. the World Bank supported Climate Innovation Centres. However there needs to be more co-ordination between the different elements of the innovation value chain that ultimately leads to commercial technologies being developed.

SESSION PREVIEW - FINANCE & INVESTMENT PANEL

14:00-15:00 Tuesday 18 July 2017, POWER-GEN & DistribuTECH Africa

The Finance & Investment Panel will set the scene for the rest of the POWER-GEN & DistribuTECH Africa conference by tackling an issue that resonates with all those involved in the electricity supply industry, namely how to secure investment or finance in projects be they new generation facilities, offgrid solutions or metering rollouts in renewable or conventional projects.

All African utilities face this issue and in many cases it is a primary concern that they have in structuring projects to minimise risk and attract lenders. Equally, IPP developers face challenges in Africa and would welcome knowledge about the sources of finance available and the most effective way to package projects. The panel will draw in expertise from a range of sources of lending including local banks, multilateral lenders, grantors and position them in a panel alongside project developers or utility CFOs.

Speakers include:



Scott Brodsky
Partner
Oppenheimer Partners
South Africa



Liezel C Harmse
Senior Operations
Officer, RDGS
African Development
Bank Group



Mark Moriarty
Co-Founder
CMS
United States



Erik Granskog
Managing Director
GE Capital
- Energy Services



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STRATEGIES FOR SUSTAINABLE ENERGY INITIATIVES

The current trajectory of global electricity markets is one of decentralisation, whereby state-owned utility companies no longer enforce a closed-loop system in which they control all aspects of generation, distribution and transmission. As independents enter along each portion of the energy value chain, they will have to position themselves in accordance with their own capabilities and key differentiating service offering. A first step for any utility service provider in formulating sustainable energy initiatives is to evaluate their current standing within their respective market and assess their key deliverables to the consumer. Depending on what the core strengths of a given entity are, it will prove important to decide which areas can be maximised for their potential and which will need to be more refined and worked upon to deliver greater value.

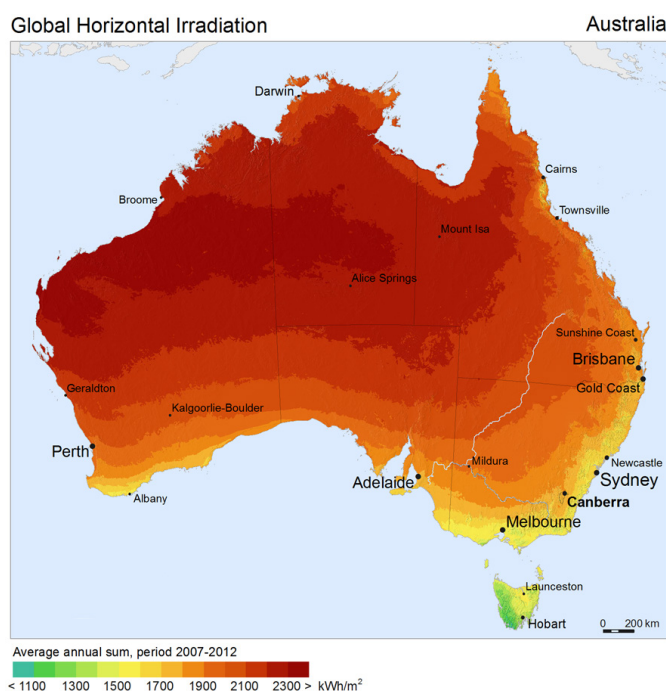
Successful energy market models for sustainable industry

Case study 1: Australia's privatised power market

The Australian electricity market model is arguably one of the best in the world due to its decentralised and liberalised nature. The development of the National Electricity Market (NEM), first conceptualised in the early 1990s, gave the potential for the country's GDP to increase, if certain steps were taken in adjusting the trajectory of power generation in the country. Research conducted by the Productivity Commission – the government's independent research and advisory body – found that GDP stood the potential to increase if the following steps within the electricity market were taken:

1. Restructuring of the supply industry and separating the generation and retail aspects from the more monopolistic transmission and distribution systems.
2. Introducing greater competition within the generation and retail space, through the granting of access in transmission and distribution systems.
3. Selling publicly owned portions of generation, transmission and distribution to the private sector.
4. Enhancing and extending already interconnected systems to include greater geographical areas.

This gradual decentralisation of the country's energy market has opened up room for new entrants, such as Mojo Power, to explore options in providing lower kilowatt hour electricity costs through a monthly subscription model. It also allows users to access wholesale electricity



Australia's vast sunbathed territory positions it well to capture on the large-scale solar potential for energy generation. Image courtesy GIS

rates, while giving them the option to access remote monitoring services for consumption patterns and advice on efficiency strategies. Models such as those of Mojo Power are beginning to cut into the profits of larger companies as they provide consumers with the ability to integrate alternative sources of energy at reduced costs and maximise consumption efficiency. Though large-scale solar farms are still few in number, independent consumer integration is higher, with 15% of the population now utilising solar PV for power generation.

Case study 2: Germany's Energiewende toward renewable energy

Similar to the Australian market model, the electricity market in Germany has been fully liberalised since the late 1990s, with over 800 service providers being evident in various capacity as of 2013. Despite the overarching trend of opening up the market, four companies – Over 5,000 MW of power are generated by Denmark's windmills accounting for 40% of the country's total electricity generation. Photo courtesy Wiki Commons

Through the implementation of greater energy efficiency mechanisms in line with Germany's Energiewende policies, the country has aimed to decrease its overall energy intensity by 20% by 2020. Subsidies in the form of feed-in tariffs have boosted the participation of renewables, but have also raised the burden on households and, to a degree, industry until grid parity is achieved through renewable sources. Nonetheless, Germany's power grid has become considerably more efficient and sustainable through the introduction of additional renewable sources, such as solar PV and wind, and restructuring grid operations to allow for greater market competitiveness.



Control of the German power grid is still concentrated among a few major utility companies. Image courtesy Global Change Now

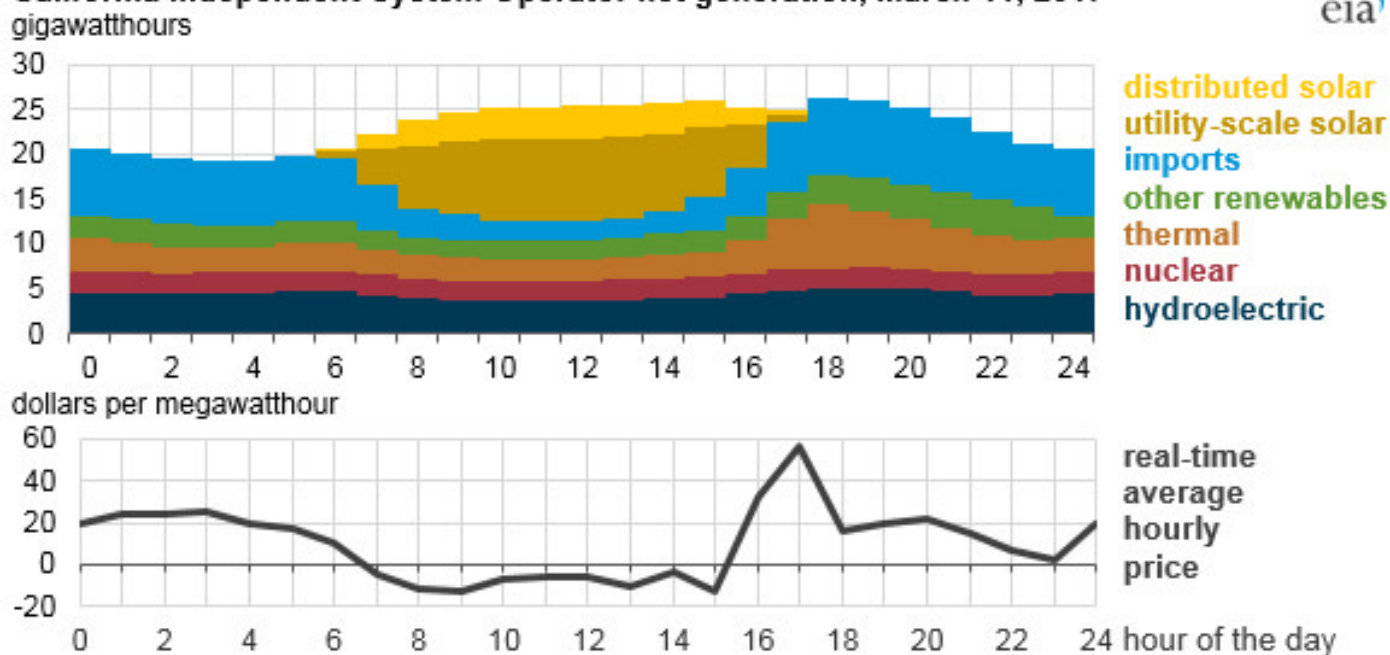
Case study 3: Dichotomy in US energy models

As noted, costs of electricity in Germany are considerably higher than in the US, though US energy consumption is around three times higher per household than in Germany. New efficiency standards in the US have, however, increased the need for more efficient energy use, especially for home appliances. Many US states have, resultantly, adopted energy efficiency standards that push utility companies to assist their consumers in being more efficient with their energy use.

Holistically, the US power sector has considerably larger obstacles that need to be overcome, given how diverse the structure of the energy market is and the various governing policies. Currently, over half of the country is serviced by generators bidding against one another in wholesale markets, while around 40% of the market is conventional state-regulated utilities that are in control of both generation and transmission. A far smaller portion of the market is made of utilities owned by either the government or private customers with some being generators and nearly all serving the retail market.

Going forward, the US market is likely to get more organised, considering how fractured it is at present. Some, like the California Independent System Operator (CAISO), have opened up the electricity market to various utilities within the grid, which enables energy companies to buy low cost power from a number of different geographic locales, depending on costs at a given point in time. Similar initiatives are also being implemented in other ISO service providers across the country. However, close to half of the electricity traded in the US is still done within state-regulated markets as opposed to wholesale platforms like CAISO, which minimises the ability for energy utilities to purchase at spot prices and drive down generation costs.

California Independent System Operator net generation, March 11, 2017



The California power market makes considerable use of renewable energy, while also diversifying types of energy source according to the time of day. Image courtesy US EIA/Flickr

Positioning Africa toward energy industry sustainability

A potential first step for African countries could be the larger participation of private companies in the retail segment of the African energy market by selling power at more competitive prices to consumers through product bundling or value-added services. The digitalisation of this portion of the market will also work well in urban areas and allow customers to monitor their power consumption while implementing strategies to increase efficiency. A feasible approach for the transmission and distribution space could look to allow for private actors to partner with existing companies in managing transmission and distribution networks, and provide better wholesale prices to the retail segment through the increased ability to draw on additional power sources at competitive prices during peak demand. A potential solution to initiating more participation in the generation space is to stimulate the greater rollout of micro-grid capacity, while also working on strategies to increase the transmission and distribution capability of central grids to interchangeably draw power from off-grid generation sites. During peak times this would allow consumers to access necessary power with less interruption, while also enabling them to tap into more price competitive sources, such as solar or wind.

SESSION PREVIEW - MARKET MODELS FOR INDUSTRY SUSTAINABILITY

16:15-17:45 Tuesday, 18 July 2017, POWER-GEN & DistribuTECH Africa

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Access to affordable secure electricity is critical for the development of Africa's economy. When it comes to how Africa approaches the development of its electricity infrastructure, no one approach is right for all. Governments face balancing between central control and allowing a free market approach. The 'Market Models for Industry Sustainability' session explores contrasting approaches from Nigeria, Ghana and South Africa.

Speakers include:



Multi-objective electricity generation expansion planning: A South African case study
Warrick Pierce
Energy Consultant
Aurecon, South Africa



Appropriate Generation Technologies
Uba Sani Kibiy
Mechanical Engineer
National Board for Technology Incubation, Federal Ministry of Science and Technology, Nigeria



A New Business Improvement Framework For Power Utilities
Ricky Swanepoel
Chief Technologist
Engineering Group Technology
Eskom, South Africa

PRESENTATION PREVIEW: A NEW BUSINESS IMPROVEMENT FRAMEWORK FOR POWER UTILITIES

Ricky Swanepoel, Eskom.

In 2016, Gartner predicted the emergence of an entirely new class

of business models based on smart machine technologies, advanced analytics and big data. Rickey's presentation shares a new business improvement framework centered around Plant Design Basis and Integrated Plant Information –the IPI-BIM Framework and outcome of operational implementation of the IPI-BIM Framework at two power plants. The IPI-BIM is the first business model that closely aligns to this emerging new class of business models by providing a sound, integrated platform for advanced analytics and improved information delivery and visualisation. Most popular business improvement models (e.g. Baldrige and EFQM) center their framework and approaches on business process improvement – thus on people, process and technology aspects of the business.

PRESENTATION PREVIEW: MULTI-OBJECTIVE ELECTRICITY GENERATION EXPANSION PLANNING: A SOUTH AFRICAN CASE STUDY

Warrick Pierce, Aurecon, SA.

Since 2008 there have been supply shortages/constraints due to lack of investment and poor maintenance within the South African electricity supply industry. These constraints continue today. Electricity Generation Expansion Planning (GEP) focuses on supply options with a holistic approach, which accounts for the technical nature of the electricity sector and also considers social, economic and environmental issues. In this study a multi-objective GEP is undertaken to identify optimal large-scale electricity infrastructure solutions for South Africa over the period 2015 to 2030.

POWER PLANT TECHNOLOGY

Digital grids are being gradually adopted by utility companies across various markets with an aim to increase operational control. Distribution management systems are also being upgraded to include dynamic switching, geared towards improving supply reliability while also optimising voltage control and grid efficiency. Data capture has similarly become ever more important through increased digital capabilities within the grid.

Greater emphasis is being placed on analysing data pertaining to consumption patterns, while also providing insight on supply trends and competitor behaviour. Such utility analytics are beginning to emerge in areas of strategic enterprise systems for governance, which seek to utilise available data to guide asset health management, grid performance and future system planning.

Making greater use of digitalisation within the energy space is also creating a platform for the co-ordination and management of generation, distribution and storage of energy, which can be used in optimising operations. This management of generation enhances the ability for utility providers to deliver power at peak times and divert that power in off-peak periods. The ability to capture data and analyse it will also necessarily become a two-way arrangement with consumers also being granted the ability to interact with this data.

This will aid in the ability for consumers to optimise their energy consumption through value-added services that retail companies participating in the energy space could provide. In this regard, mobile applications will be a key asset for utilities that will drive customer engagement to a new level.

The tech behind the revolution

Various technologies, such as supervisory control and data acquisition (SCADA), smart meters and mobile applications, are able to work with electrical grids and provide data analysis and assessment to cater for energy demand. This increased communication in the energy value chain and better optimisation of energy management platforms results in a more streamlined process of energy generation, transmission and distribution that, in the long term, greatly increases grid efficiency.

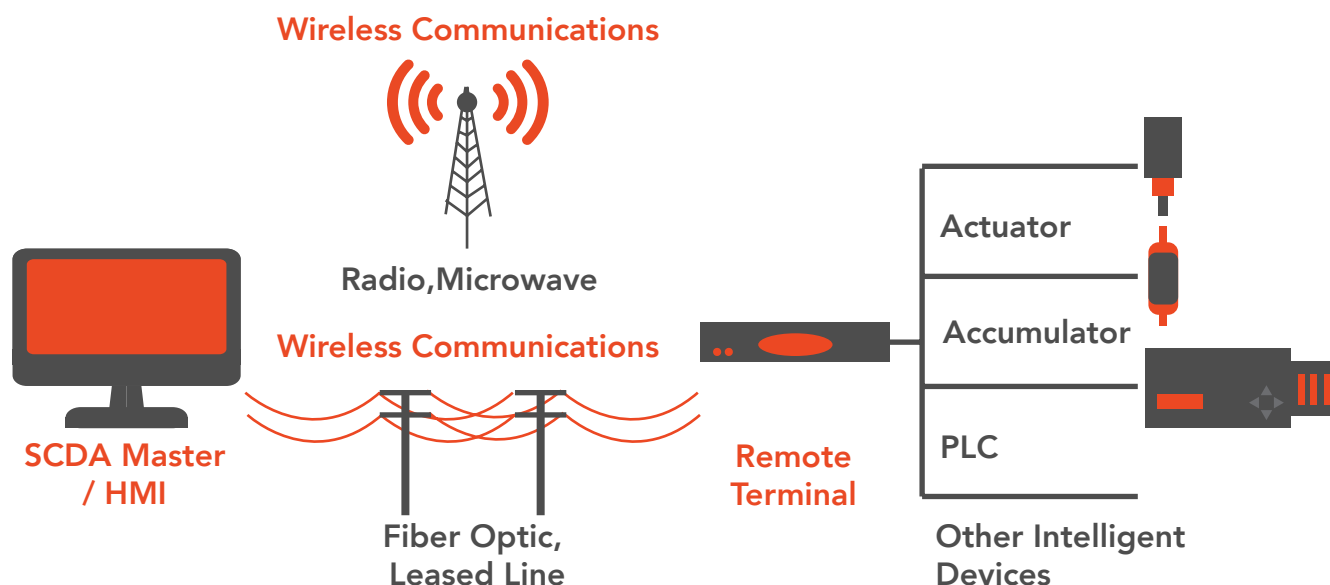
1. Supervisory Control and Data Acquisition

In recent years, the Supervisory Control and Data Acquisition (SCADA) system has become increasingly popular for the collection of data across industries. Initially used as an automation control system within manufacturing, SCADA is fast becoming a preferred method of data gathering within the energy sector, given its ability to collect real-time data from remote locations and optimise operational equipment.

Grid automation is another added benefit of the SCADA system, as it assists in minimising power distribution and transmission losses. Other added benefits of SCADA include:

- ability to restore power following an outage,
- re-routing power from excess capacity areas to overloaded areas,
- trend analysis of historical power consumption data, and
- reduction in required manual labour through the relocation of affected sections remotely.

GENERAL SCADA SYSTEM LAYOUT



Through the use of wireless communications, SCADA systems are better-positioned for implementation in the field in optimising power delivery to match demand. Image recreated from original courtesy Wiki Commons

The oil and gas industry is another energy sub-sector where SCADA is becoming more widely used, especially in upstream environments and shale fields. Similar to its power grid applications, SCADA is able to enforce better control and co-ordination of complex sites that aids in decreasing costs to produce oil or gas.

Major corporates within the energy space who currently utilise the SCADA system in various capacity include ABB, Emerson Electric, General Electric and Schneider Electric, among others.

2. Smart metering

The entry of smarter metering devices has enabled utility companies to track consumption and prepare customer billing accordingly. Through the use of smart meters, utility companies are also better prepared to provide adequate power to various areas and allow generation to be driven by consumer demand. Similarly, they can adjust rates of power generation depending on the amount of power consumed over a certain period. For consumers, smart metering provides the ability to regulate household power consumption within affordability parameters.

A 2015 report by BI Intelligence, the research arm of Business Insider, noted that the installed base of smart meters across the world would rise from 450 million in 2015 to 930 million by 2020. Through this widespread adoption of smart meters, utility companies are projected to save some US\$ 150 billion by 2035 through more streamlined generation and consumption of power.

As with SCADA, smart meters are expected to have a considerable impact on the oil and gas sector to provide in-depth data on performance across multiple drilling sites. BI Intelligence notes that by 2020 there may be close to 5 million IoT devices in use within the oil and gas sector, up from just under 350,000 in 2015.



Tanzania is already moving forward with implementing smart metering devices, especially in rural areas where pre-paid electricity through micro-grids is taking root as a preferred source of power. Photo courtesy of DfID/Flickr

3. Smart phones and mobile applications

When looking at the retail portion of the energy sector, smart phones and mobile applications have had a tremendous impact on the ability of consumers to interact with their utility accounts and even pay them on the go. This is directly tied to the advent of smart meters, which allow consumers to monitor their consumption in this way. Data collected by smart meters is now available to consumers through mobile applications, while also allowing consumer-facing utility companies to provide more streamlined online-based product offerings. Energy and utility companies across the world are making increasing use of combining smart metering with mobile applications in offering a range of online services. Customers of Genesis Energy, New Zealand's largest electricity and gas retailer, are able to download the Genesis Energy mobile application, which includes functions such as monitoring electricity usage and accessing utility bill estimates, viewing usage from an hourly to a monthly basis, and paying bills through credit or debit cards. Others, like General Electric, have aimed to increase efficiency and collaboration in the field through their GE Digital platform.

How Africa can capture the digital energy potential

On the retail side, Africa registered close to 85% mobile phone penetration in 2016, with expectations of reaching 105% by 2022, as noted by the Ericsson 2016 Global Mobility Report. In South Africa alone, 2016 data shows close to 50% smart phone penetration. Lower-cost smart phones are also penetrating markets more, which will open up opportunity for utility companies to further engage with consumers. Considering Africa lags in terms of electrification rates, the ability for mobile applications to interface with micro- and off-site grids is feasible, with greater rollout likely.

Implementing smart metering within micro-grid solutions for rural areas also has good potential, given that micro-grids are more likely to gain traction in rollout, especially in rural areas that may have to wait years to be connected to central generation, transmission and distribution systems. Rollout of smart metering that is connected to smart phones will allow even distant locations to gain access in monitoring consumption and budgeting for bills ahead of time. Currently, countries such as South Africa, Tanzania and even Zimbabwe are exploring options of implementing smart meters and running pilot projects to test feasibility. Financial resources are an issue in countrywide implementation, with lack of foreign currency and still unresolved technical issues posing challenges.

SCADA systems are also likely to gain greater traction within African markets, with an aim to optimise power delivery and ensure streamlined grid management services. South Africa-based company Powertech System Integrators is already rolling out the system through services such as advanced distribution and asset information management, while others, such as the joint venture between Adroit Technologies and Mitsubishi Electric, have yielded the development of the Mitsubishi Adroit Process Suite that is currently powering the Kelvin Power station in South Africa. Inevitably, the implementation of smart metering, coupled with micro-grids will stimulate the need to integrate distributed systems and advance interchangeable access to power from various areas of oversupply to areas of undersupply.

SESSION PREVIEW: THE DIGITAL TECHNOLOGY REVOLUTION

14:00-15:30 Tuesday, 18 July 2017, POWER-GEN & DistribuTECH Africa

A new wave of digital technologies are emerging promising to transform the operation of power plants and form part of a revolutionary industrial internet of things. Learn about these technologies which have the capability to analyse giant data sets and deliver vital increases in efficiency and performance.

Speakers include:



Leverage the power of technology
("Don't let your plant data rot")
Maanda Ramutumbu
Engineering Management
Consultant
Accenture



Presentation title to be confirmed
Sebastien Desvignes
Global Digital Leader
GE Steam Power Systems & GE
Power Service, Switzerland

PRESENTATION PREVIEW: LEVERAGE THE POWER OF TECHNOLOGY ("DON'T LET YOUR PLANT DATA ROT")

This presentation acknowledges the constraints of old technology and describes key 2017 trends in digital technology and analytics to enhance generation fleet performance.



Digital solutions applied in large fleet monitoring
Mariano Biondo
Head of Operation Engineering -
Service Engineering
Ansaldo Energia, Italy

Accenture Research has selected 4 recent technology trends of relevance to South Africa's industrial plant managers:

- Big Data in the Cloud
- Intelligent Hardware
- Workforce Mobility
- Supply Chain Ecosystems

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With effective industrial plant operations and maintenance critically reliant on access to industry specific knowledge, there are many opportunities for South Africa industrial plant managers to exploit these technology trends.

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Bertha Dlamini POWER-GEN & DistribuTECH Africa brand ambassador and speaker, believes that utilities must embrace change: "Renewables, distributed generation, and smart grids demand new capabilities, competencies and different operating culture. This also demands a regulatory reform. Customers are becoming more independent and the competition for customers will increase. The Smart City agenda introduces another dimension requiring energy utilities or electricity distributing municipalities to become enablers of change: Digital Transformation in urbanisation."

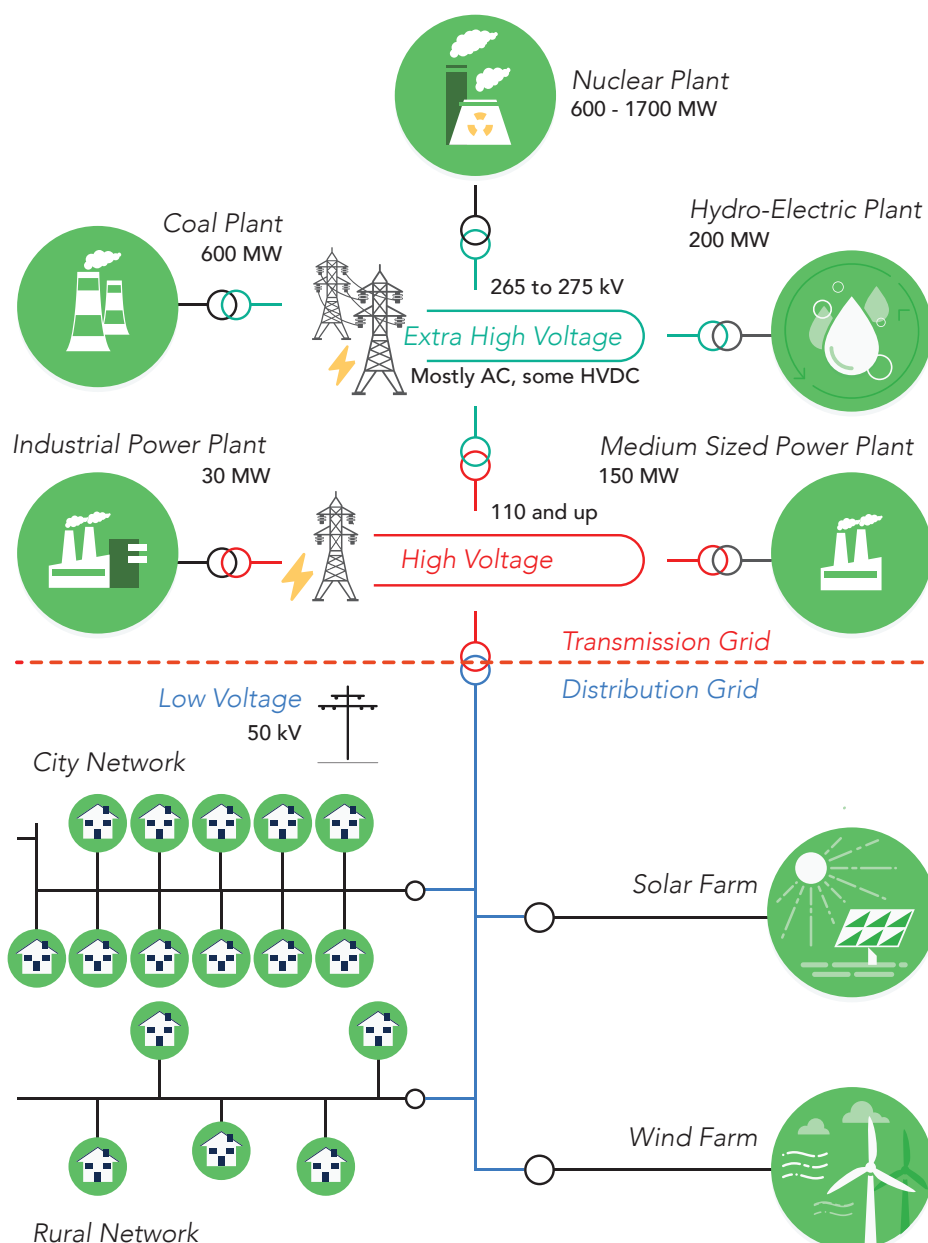
UTILITY MANAGEMENT

A number of key trends have started to shape out the first half of 2017 and will continue to do so into 2018. Five key trends have been assessed as key to watch out for during the remainder of the year and beyond.

1. Distributed generation is gaining greater traction with decentralisation of power supply building momentum.
2. The growing participation of renewables will stand as a focal development on the back of rising distributed generation.
3. Implementation of digital technologies and grid modernisation are also likely to increase as distributed generation rises.
4. The hydraulic fracking revolution in the US has continued to position gas as a readily available and cheaper source of power that is projected to grow in demand.
5. The changes in technological developments, grid decentralisation and the cheaper and faster sourcing of gas, have resulted in utilities adjusting their business models to cater for the evolution of the global power generation marketplace.

1 Rise in distributed generation

- Rising costs and constant power outages, especially in developing markets, is driving power generation at source of consumption most notably through the use of micro-grids.
- Traditional utilities will need to re-evaluate their role in the market and provide greater value-added services, efficiency in generation and competitive pricing.
- Distributed generation will stimulate investment in grid modernisation technologies to maintain relevance of the traditional centralised power generation model.
- Flexibility in service offering will be key for traditional utility companies, if they are to stay relevant and capture the potential to participate in distributed energy generation.
- Evolving battery technology will also make distributed generation more feasible. Utilities will resultantly need to provide value-add services, such as more efficient solar panels, fuel cells and natural gas generators.



2 Greater participation of renewables

- Governments globally are increasing the adoption of renewable energy.
- Improvements in renewable technologies will increase the ability to more easily incorporate renewables into grid structures, while also providing monitoring and control systems.

The 2015 Paris Agreement put in place voluntary guidelines and targets for countries to reduce carbon emissions.

In order to meet their commitments, signatory nations around the world will need to implement a larger rollout of renewable energy technologies. Photo courtesy Wiki Commons



- The IEA projects that an additional 2,500 GW of renewable energy capacity will be installed globally over the next two decades. Hydropower is projected to lead this drive.
- States in Africa will similarly look to boost the participation of hydropower substantially over the next decade.



The Kariba Dam in South Africa is just one example of the use of hydropower in Africa. Other countries like Ethiopia and the DRC are continuing to push for greater inclusion of hydropower. Photo courtesy IPSNews/Flickr



3 Increase in digitalisation

- The rise in digital technology is likely to play a major role in the power sector across facets of generation, transmission and distribution going forward.
- Increasing availability of technologies such as smart meters, mobile applications and digital control systems such as SCADA, are set to grow in 2017.
- Integration of renewable energy, energy storage, and load balancing will all form part of the greater digitalisation of grids.
- Smart grids will drive down operating costs in customer service, but also in switching processes and customer billing.

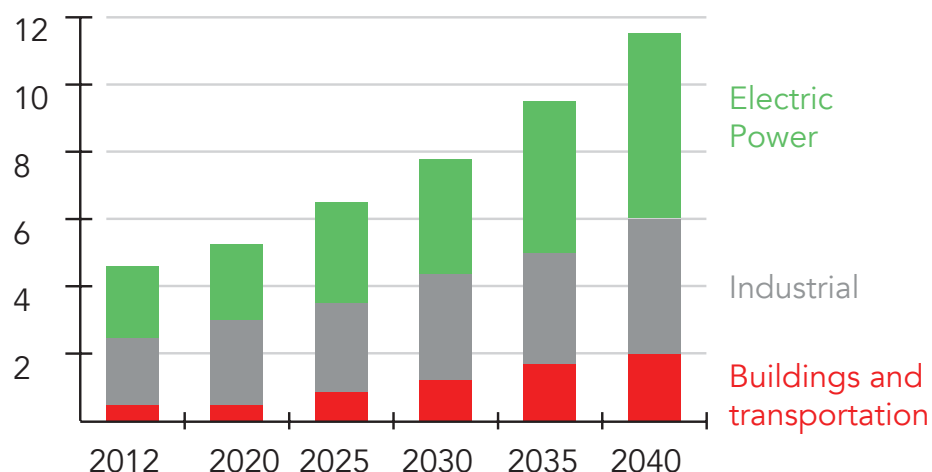
Employing smart meters in households is becoming more common in countries such as the US. Utilising these devices aids not only consumers in managing their power consumption, but also utilities in providing more efficient power supply. Photo courtesy Portland General Electric/Flickr



4 Steady rise of natural gas

- The shale gas revolution in US energy consumption and production will continue to have an influence on energy markets across the world.
- Growth projections in shale gas extraction suggest that gas will surpass coal as a preferred source of energy. Africa's own consumption is projected to double by 2040.
- Rise in gas consumption is anticipated to continue for the remainder of 2017 on the back of increased US extraction.

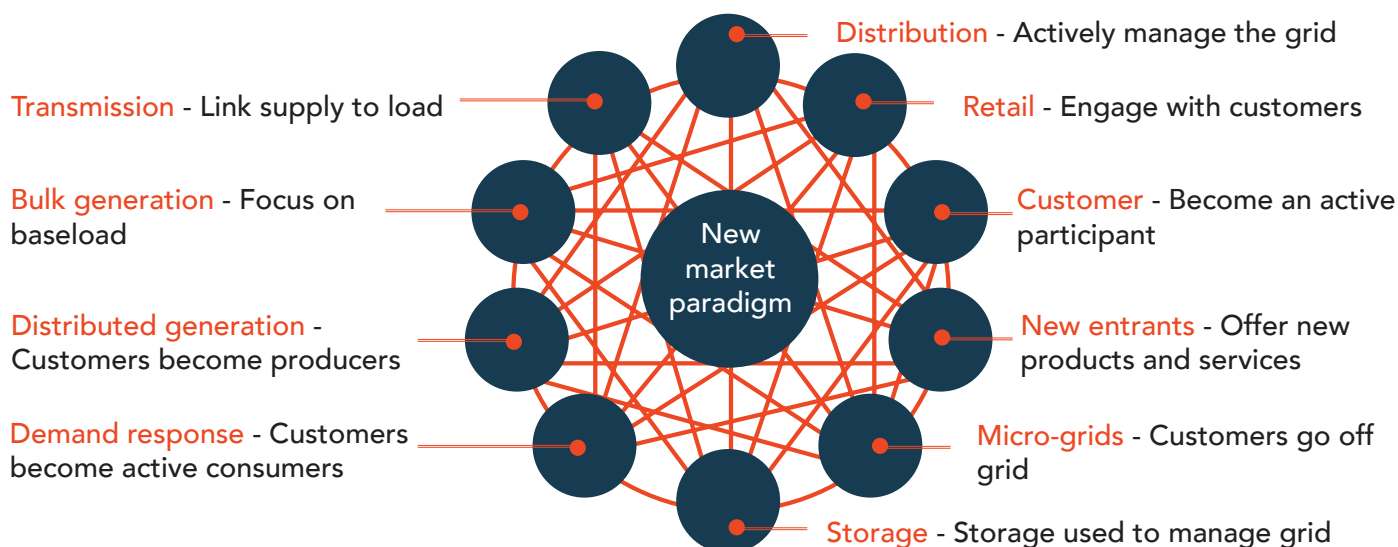
Natural Gas: Africa projections for consumption, 2012-2040



EIA forecasts note that natural gas consumption will continue to rise in Africa, especially in power generation. Image courtesy US EIA

5 Utility business model reform

- Decentralisation of grids will drive utility companies to focus on core differentiators, and move away from centralised models, to niche service and product offerings to stay competitive.
- Digitalisation will increase efficiency in power consumption through the use of technologies, such as smart meters and grid sensors, while also delivering power according to consumption trends.
- Micro-grids are increasing in developing countries,
- Growth of distributed generation through the use of renewable energy will necessitate that utilities adjust to the two-way flow of energy.



SESSION PREVIEW - KEY INDUSTRY TRENDS

09:00-10:30 Thursday, 20 July 2017, POWER-GEN & DistribuTECH Africa

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The energy sector, and in particular the electricity supply industry in Africa, finds itself in very exciting times. While traditional baseload generators dominated the landscape for many decades, the retirement of ageing plants and the introduction of intermittent renewable energy onto the grid, present unique challenges for utilities. The dynamic nature of the industry compels industry leadership to search for the most applicable business model which will provide sustainability in a specific jurisdiction. While customer centricity is key, the industry remains an infrastructure intensive business that requires prudent capital investments and the ability to generate the required revenue streams to grow the business in a sustainable manner. Globally there are various business models and different market structures in operation, however there is no doubt that private sector participation is becoming more important than ever before.

Africa itself is faced with its own opportunities and challenges including the need to address national priorities, customer access to electricity, generation capacity, and transmission and distribution infrastructure among others. Looking beyond 2017, it is essential that business sustainability and market models be effectively addressed. The prudent deployment of technology to complement the business drivers and resources could become a key business growth and sustainability enabler. To this end there is a need to pursue the deployment of relevant smart grid applications beyond the deployment of smart meters or advanced metering infrastructure. This should lead to enhanced customer participation, improved integrated demand management, as well as improved grid visibility, energy portfolio optimisation and revenue management. Learning from the experience of others within the broader energy sector, will be key in enhancing the success potential.

Willem Johannes De Beer,
Conference Chair, DistribuTECH Africa



Speakers include:



Pricing wheeling services in the Southern African Power Pool
Mutenda Tshipala
Chief Engineer: Transmission Pricing
Eskom, South Africa



Promotion of captive power/ net-metering mechanism as a self healing energy security/ energy sufficiency measure for a country - a Zambian case study
Chisakula Kaputu
Chief Energy Engineer
Sustainable Energy and Environment (Z) LTD, Zambia



The importance of conformity assessment in building a sustainable power sector in Sub Saharan Africa
Joerg Gmeinbauer
Global Market Lead -Power & Utilities
Bureau Veritas S.A, France

AFRICA'S NUCLEAR FUTURE

Nuclear in SA's energy strategy – An expert interview with Professor Jo-Ansie van Wyk

Jo-Ansie van Wyk is a Professor at UNISA's Department of Political Science, and has been a member of the In On Africa (IOA) team since 2008. She has been actively involved in various projects and IOA initiatives during this time. Jo-Ansie has also conducted consultancies for institutions such as the World Bank and UNESCO. Her publications and research experience focus on political leadership in Africa, nuclear diplomacy and energy, environmental politics, and international security.



Could you provide us with a brief overview of South Africa's intended strategy to implement nuclear energy as part of the evolving energy mix in the country?

Van Wyk: I foresee five strategies. One, a political strategy to convince anti-nuclear ANC heavyweights and civil society to support government's nuclear ambitions. Two, a foreign policy strategy in order to mend relations with international vendors. Three, an economic strategy to convince South African economists, the Treasury, credit rating agencies and international investors of the government's choice. Four, a technical strategy to decide which nuclear technology would be most preferable. This may even include a new round of vendor parades. Five, a legal strategy to either appeal the recent Cape High Court judgement on the procurement process or to prevent future legal obstacles.

In your view, what are some of the factors to consider in terms of implementing nuclear energy as part of South Africa's energy mix? What are some of the pros vs the cons to be taken into account going forward?

Van Wyk: The cost and technology preferred. Typically, a nuclear energy expansion plan such as this requires a long-term relationship, and not just a once-off delivery once the power station is operational. A third factor, is the preferences of the South African population. Civil society has opposed the nuclear expansion plans and government has seen that civil society will question every decision.

The recent ruling from the Cape High court noted the need to redo the procurement process for the 9,6GW nuclear programme, and essentially look to create greater transparency in the process. On the back of this ruling, how do you foresee the process of procurement in the nuclear build programme unfolding going forward?

Van Wyk: Government may appeal the decision. I foresee greater legal compliance in future, hence my reference to a political strategy in 1.



Through the BRICS political and economic grouping, speculation arose that Russia would be the preferred service provider for the 9,6GW nuclear build programme. Given the recent Cape High court ruling however, the process may need to be overhauled to create greater transparency. Photo courtesy Kremlin

Could you provide us with some insight on how you envision the costs of nuclear power to be spent over the course of the build programme to provide readers with a clearer view of how the money will be spent?



Van Wyk: I am not a nuclear scientist but huge amounts have been suggested in terms of the cost of the programme. These estimates have predominantly focused on the construction cost and less on the operational cost once the proposed plants become operational.

Given the greater and now significantly cheaper rollout of renewable energy resources across the world, why does the South African government continue to back the nuclear option despite the high costs?



Van Wyk: It seems that this is a political decision and as the full extent of state capture becomes known, it seems that the nuclear programme has been one of the captured areas. Nuclear energy also adds to a state's status and prestige. It means that a state has the financial and technological base to develop and maintain nuclear energy generation and distribution. It also means that a state has an additional source for electricity generation.

From a broader viewpoint, how are nuclear developments across the world influencing South Africa's nuclear strategy?



Van Wyk: Whereas some states (Germany) have decided to terminate nuclear energy generation, other states (Switzerland) will go to a referendum to decide the future of nuclear energy generation. South Africa is also a member of the BRICS grouping. The grouping consists of some of the world's largest nuclear power generators, nuclear energy expansion plans, and nuclear weapons capabilities. As a powerful counterweight to the developed North, BRICS countries are flexing their economic, technological and nuclear muscle. Subsequently, South Africa derives significant status from its membership in the grouping. South Africa is in essence one of the states that intends to proceed with nuclear energy.



At present, the Koeberg Nuclear power station the Western Cape province of South Africa is the only site of its kind in Africa, but depending on future outcomes pertaining to the South African government's nuclear build programme, it may remain the only one still for some time. Photo courtesy JimSher/Flickr



What are some of the key lessons that South Africa can learn from nations that are already utilising considerable amounts of nuclear energy?



Van Wyk: Public consultation is one. The South African government has a poor record when it comes to communicating about its nuclear plans, and nuclear energy, despite the existence of Public Consultation Forums for communities close to nuclear sites. 'Safety first' is another key takeout in terms of the nuclear option. South Africa needs to communicate nuclear energy as a potentially safe and clean energy option. Moreover, a public communication strategy on the government's nuclear safety record should also be introduced. Thirdly, there is a definitive need for transparency. The Cape High Court ruling illustrated the

lack of transparency in the government's approach to nuclear energy and the nuclear energy development programme. Parliament should also hold key decision-makers accountable. Lastly, there are cost considerations to take into account. The development of nuclear energy is very costly and requires a state to engage in a decade long relationship with the vendor(s). Therefore, South Africa needs to be mindful of the cost and relations it intends to engage in.

Additionally, what will be some of the necessary precautions to take into account going forward, to aid in maintaining steady and uninterrupted operations should nuclear energy go ahead in South Africa? How do we ensure that another Three Mile Island, Chernobyl or Fukushima does not recur?

 **Van Wyk:** Transparency and regular international oversight visits to determine safety and security compliance. In addition to this, South Africa's choice of nuclear technology should focus on cost-effective, proven and safe technology. The country should also ensure that it complies with all international and national safety and security requirements.

How do you envision the South African government to include greater localisation as part of the nuclear-build programme, given the skills that are necessary to maintain operational capabilities?

 **Van Wyk:** Government may achieve this with the amendment of BEE legislation, and localisation clauses in international contracts pertaining to the programme. Unless the South African economy grows significantly, the proposed nuclear energy development plan will plunge the country into economic bankruptcy.



The greater inclusion of nuclear energy as part of the energy has been a strong policy agenda of the South African government for a number of years. President Zuma has conducted various site visits to NECSA (pictured) in strengthening the discussion around the role of nuclear energy. Photo courtesy PresidencyZA/Flickr

In light of recent developments within the South African economy – namely the downgrade to junk status – what will be the impact on government's ability to fund the nuclear programme over the coming decades?

 **Van Wyk:** The South African economy needs to grow significantly to finance the nuclear energy programme. South Africa's political environment should also stabilise which could foster investor confidence to invest in the country.

Given everything that has been discussed up to this point, what do you feel is the best way forward?

 **Van Wyk:** I propose the development of various energy sources with nuclear energy development as a future option. Secondly, the outcomes of the ruling party's national conference and election of new leadership, as well as the 2019 elections, are all factors that could determine the future of the country's nuclear energy programme. Thirdly, South Africa should also improve the governance and functionality of Eskom, the state-owned power utility as Eskom is likely to oversee the nuclear energy development plan.

SESSION PREVIEW - ONE DAY NUCLEAR FORUM

11:15-18:00 Wednesday, 19 July 2017, POWER-GEN & DistribuTECH Africa

According to the World Nuclear Association (WNA), countries in the region which are individually planning or considering nuclear power are Ghana, Kenya, Namibia, Nigeria, Senegal, Tanzania, Uganda and Zambia.

South Africa is on the brink of embarking on a new phase of nuclear development, capable of producing power for future decades that can be support energy needs across the region. Understanding why Pretoria regards this as the right move, how it plans to implement the programme, who might supply the technology and what lessons can be learned from nuclear programmes around the world is the goal of POWER-GEN Africa's One Day Nuclear Forum.

By raising awareness and understanding of the key issues affecting this key decision, South Africa can equip itself to make the best choice for its energy future.

Sessions include:

- Unpacking South Africa's Nuclear Strategy
- Nuclear Solutions and Localisation
- How can Africa Best Learn from World Nuclear? - Panel Discussion

The Nuclear
Forum is **Free** for
all Attendees

Speakers include:



Phumzile Tshelane
Chief Executive Officer
The South African Nuclear
Energy Corporation SOC
Limited (NECSA)
South Africa



Knox Msebenzi
Managing Director
Nuclear Industry Association
of South Africa (NIASA)
South Africa



Viktor Polikarpov
Vice President
Rosatom
Russia



Eng Collins Juma
Acting CEO
Kenya Nuclear Electricity
Board
Kenya



George Njenga
Regional Executive
Steam Power Systems,
Sub-Saharan Africa
GE Power
South Africa

Speaker Focus:

George Njenga is the Regional Executive for the GE Steam Power Systems business responsible for Sub Saharan Africa. He is also the regional GE Power Strategic Accounts leader and is based in

Johannesburg South Africa. George has worked with GE for 8 years having joined the company in 2008 as the Country Executive for GE Energy in Eastern Africa for 4 years and later as the GE Distributed Power leader for Sub Saharan Africa for over 3 years. George has over 26 years work experience in the Energy Industry in Africa and Asia which includes 18 years with Chevron downstream.

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DAY 1 - TUESDAY 18TH JULY									
TRACK	09:30 - 11:00	12:30 - 14:00	SESSION 1 14:00 - 15:30	15:30 - 16:15	SESSION 2 16:15 - 17:45	17:45 - 19:30	SESSION 3 09:00 - 10:30	10:30 - 11:15	
STRATEGIES FOR THE ESI <i>Boardroom 2+3</i>	JOINT OPENING KEYNOTE SESSION		FINANCE & INVESTMENT PANEL		Market Models for Industry Sustainability		Decentralised Energy Solutions		
RENEWABLE TECHNOLOGIES & OPPORTUNITIES <i>Bill Gallagher Room</i>					Geothermal Africa		Africa's Solar Future		
UTILITY MANAGEMENT <i>Boardroom 5</i>					Business Efficiency		Asset Creation		
POWER PLANT TECHNOLOGY <i>Boardroom 6+7</i>			THE DIGITAL TECHNOLOGY REVOLUTION		Coal Fired Technology		Plant Operation, Maintenance & Repairs		
ONE DAY NUCLEAR FORUM : AFRICA'S NUCLEAR FUTURE <i>Exhibition Show Floor</i>									

HIGHLIGHTS



TUESDAY
09:30 - 11:00

Joint Opening Keynote Session
Location: Bill Gallagher Room, Level 2
All attendees welcome to attend.



TUESDAY
14:00 - 15:30

Finance & Investment Panel
Location: Bill Gallagher Room, Level 2
Session is open to Conference Delegates

FREE VISITOR ACCESS
ONE DAY NUCLEAR FORUM :
AFRICA'S NUCLEAR FUTURE
Location: Nuclear Theatre,
#A22, Exhibition 1, Level 0

DAY 2 - WEDNESDAY 19TH JULY

DAY 3 - THURSDAY 20TH JULY

SESSION 4 11:15- 12:45	12:45 -14:15	SESSION 5 14:15 - 15:45	15:45 -16:30	SESSION 6 16:30 - 18:00	SESSION 7 09:00 - 10:30	10:30 -11:00	SESSION 8 11:15 - 12:45	13:45 -15:00
Fuel Options for Energy Security		Best Business Practices		Enhancing Skills and Training	New Energy Solutions		CLOSING PANEL: VISIONS OF AFRICA'S ENERGY FUTURE - PROGRESS REPORT	
Energy Storage: Maximizing Potential - Panel Discussion		Bioenergies		Wind, Wave & Water	Grid Integration			
Asset Performance Management		Enterprise Grid Management		Emerging Network Design	Key Industry Trends			
Emissions Control Technologies		Creating and Exploiting Gas Infrastructure		Gas & Diesel Technologies	Gas Turbine Technology			
Unpacking South Africa's Nuclear Strategy		Nuclear Solutions and Localisation		How can Africa Best Learn from World Nuclear? - Panel Discussion				

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THURSDAY
11:15 - 12:45

Closing Panel Discussion
 Location: Bill Gallagher Room, Level 2
 Session is open to Conference Delegates



THURSDAY
13:45-15:00

Best Paper Awards
 Coffee Break Area,
 Exhibition Floor

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