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Filling the Energy Information Gap in Africa

Green Jobs

Energizing Rural Africa

Financing Technology Innovation



Africa Spotlight

Nigeria * Zambia



SPROUTING GREEN JOBS

The World Green Economy Summit outlined strategic plans for a green economy, which help reduce pressure on natural resources and spur economic growth through the creation of green jobs

In a legacy economy, the annual growth would allow predictions on the number of jobs created. The conventional labor market, especially in mature economies of the “western world” would allow for little uptake of jobs in the market, either as staff turnover or from the population qualifying for retirement. Altogether, growth and job opportunities would allow for a limited opportunity of youth entering the job market due to the lack of experience and adversity to risk.

However, the job outlook is changing. And change is gold. Actually, change is green. As the world transitions to a resource efficient, low carbon and inclusive green economy, a new range of green jobs are being created and new skills are being sought, as businesses are forced to transform the way they operate to respond to growing changes in the population and condition of the climate. The World Green Economy Summit (WGES) 2017 has underlined and outlined strategic plans for a green economy, which help reduce pressure on natural resources and spur economic growth through the creation of green jobs. A report from the International Renewable Energy Agency (IRENA) indicates that the global renewable energy sector employed 9.8 million people in 2016. Solar photovoltaic (PV) represents the largest employer with 3.1 million jobs, up 12% from 2015, clearly demonstrating the growth in the green energy sector.

Green economy promotes a triple bottom line: sustaining and advancing economic, environmental and social well-being. It facilitates green jobs which are central to enabling sustainable development and responding to global challenges for this generation, as well as future ones. Furthermore, green economy allows for youth to take the lead in many technology-centric platforms.

Green collar jobs, which would be jobs that include the expected solar panel or wind turbine worker and engineer, will be matched by additional new roles to be created across a far more diverse range of businesses. As part of the Dubai Industrial Strategy 2030, an initiative which aims to make the city a global platform for knowledge-based and sustainable businesses, 277,000 jobs are planned in the coming period, from which a large proportion are expected to be green jobs.

In principle, green jobs can be found in all sectors of an economy and all sectors and jobs can potentially become greener. Whether in a call center, a hospital, retail or engineering, the transition to an inclusive green economy will present numerous opportunities to assess and address the impact economic activities have on the environment and call for transformation of the behavior of individuals, institutions and society at large.

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The creation of inclusive economies is at the core of promoting green economies that are low-carbon, resilient and sustainable. While significant progress has been achieved over the past two decades, poverty remains a world-wide challenge and enhancing minorities and women’s participation in the green economy will be key in ensuring all can contribute to and benefit from this transition.

As the world adopts a wide range of policies that aim at encouraging the creation of green jobs, Dubai demonstrates leadership by adopting national “green growth” and “low carbon” strategies. These support the Dubai Plan 2021, Dubai Clean Energy Strategy 2050, for Dubai to have the lowest carbon footprint in the world by 2050, and the Dubai Carbon Abatement Strategy to cut carbon emissions by 16% by 2021. At WGES 2017, participants not only had information about the varied opportunities available regarding green jobs, but also had direct access to explore sector specific jobs.

Clean energy expansion is generating thousands of new jobs while meeting climate and economic goals. With this tremendous opportunity, the UAE, and Dubai in particular, is demonstrating the region’s leadership position in generating employment in this field for both men and women alike. The expanding green energy job sector is a result of the country scaling up renewables to enhance access in the face of rising energy demands.

With countries of the world redefining and setting the universal sustainable development agenda, WGES 2017 has presented economic models that promote inclusive and sustainable economic growth. In addition, the Summit presented how green jobs provide multiple benefits to the region by attracting and scaling up green local and foreign investment and technologies, decreasing waste and emissions, encouraging resource efficiency and ultimately improving the quality of life and ensuring sustainable societies.

Providing straightforward solutions and opportunities in green jobs, WGES 2017 focused on ‘Driving Innovation, Leading Change’. [AEA](#)

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Khobab Wind Farm,
Final WTG lifting

Source: Mainsream Renewable Power

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Publisher's Note

M E S S A G E
F R O M T H E P U B L I S H E R



Acquisitions have been prevalent over 2017 in the alternative energy sector, most interestingly with oil and gas majors taking stakes or outright buying renewable energy companies. One oil firm taking aim at the renewable sector is French-major Total. The company picked up a few interests this year to boost its presence in the RE sector. Most recently, Total became an indirect shareholder of EREN RE with an interest of 23%. Already heavily invested in solar products in Africa, this transaction will allow the company to enter the wind sector. Total states the purchase of an Eren RE stake was “to accelerate its growth in the production of power from renewable sources.” Total also purchased French energy efficiency company GreenFlex in September.

In addition to the Total purchases, there was the July announcement by the North American arm of Royal Dutch Shell that it had made a bid for Texas-based MP2 Energy. The bid signals Shell’s growing interest in the power sector, including renewable energy and energy management services. This announcement was followed a week later with the oil giant’s plans to budget \$1 billion per year for its New Energies division. Shell CEO Ben Van Beurden said that the \$1 billion per year for clean energies will help speed a transition toward renewable power and electric cars.

European utilities are on a buying spree as well. This can be seen in the number of acquisitions made by Enel, Engie, E.ON and others over the year. The utilities are now putting more emphasis on the renewable energy sector as wind and solar power become more affordable, rather than their traditional power activities. It’s obvious they view renewable energy as the future to their sustainability.

It will be interesting to watch how all of these acquisitions, partnerships and new strategies unfold in 2018 and beyond. Be sure to read our March/April issue for updates in our feature which will delve into this topic in greater detail.

In this issue Nigeria and Zambia feature in the Country Focus where an overview of their very busy renewable energy industries are provided. Be sure to catch the latest on RE’s employment outlook in our Green Jobs feature. And turn the pages to find all the latest news from around the globe as well as some exciting new technology developments. As always, your comments and suggestions are welcome and can be sent to info@AE-Africa.com.

Dianne Sutherland
Publisher

Siemens/GECOL to Up Libyan Power Output

Siemens signed contracts with Libya's state-owned utility General Electricity Company of Libya (GECOL) to expand Libya's power generation capacity by approximately 1.3 GW. Under these contracts Siemens will build a 650-MW open cycle power plant in Misrata, equipped with two F-class gas turbines, and a 690-MW open cycle power plant in Tripoli West, equipped with four E-class gas turbines. The total volume of EPC contracts, including long-term service agreements, is in the range of €700 million.



Source: Siemens

Siemens turbine rotor

“Around 30% of Libya's installed power generation capacity is based on Siemens technology that delivers electricity for two million people,” said Willi Meixner, CEO of Siemens' Power and Gas Division. “After completion, the power plants in Misrata and Tripoli West will help the

country to solve the ongoing challenges caused by frequent and unpredictable power cuts,” added Meixner.

Funding Secured for Solar Plant in Burkina Faso

EREN Renewable Energy entered into an agreement with Banque Internationale pour le Commerce, l'Industrie et l'Artisanat du Burkina (BICIAB), a local BNP Paribas Group subsidiary, to provide financing for the 15 MWp solar power plant under construction in Burkina Faso.

A XOF 9.2-billion loan, equivalent to around \$16.5 million, was granted to Essakane Solar, the project venture that owns the power plant. The funding comes in the form of a senior limited-recourse loan. The Essakane Solar project was developed jointly by Africa Energy Management Platform (AEMP) and EREN RE. Wärtsilä was awarded the contract for the construction, which began in May 2017, with a commissioning date scheduled in Q1 of next year. The project will help to reduce the mine's fuel consumption by about six million liters of diesel per year and lower its annual CO₂ emissions by around 18,500 tons.

The Essakane Solar power plant is located on the site of the IAMGOLD Essakane SA gold mine. Essakane Solar and IAMGOLD entered into a PPA in March 2017. The solar power plant will be connected to the mine's heavy fuel plant to make it the world's largest hybrid solar photovoltaic-diesel facility.

As part of an ambitious local development policy, the project will create 40 new operational jobs and devote a percentage of its revenues to local development.

Africa GreenTec Commissions Solar Container

The start-up Africa GreenTec successfully commissioned its first solar container in the Tahoua region of Niger. The container relies on a mobile 41-kWp PV installation and a 60-kWh battery storage system to provide electricity to the village of Amaloul Nomade, which is not connected to the national grid.

The start-up of the solar container allows the residents of the village to work and learn, even after dark. The construction, transport and

installation of the 40-foot solar container was made possible by private investors and the International Climate Initiative (IKI).

As 90% of African refugee routes pass through Niger, the German government decided to focus on Niger as well as Mali in its efforts to mitigate the causes of flight to Europe. The Niger commissioning follows the successful start-up of Africa GreenTec's project in Mali in 2014.

The solar container is being installed as part of a program to promote climate partnerships with the private sector, which is being conducted by the German Investment and Development Company (*Deutsche Investitions- und Entwicklungsgesellschaft mbH*) as part of the IKI. The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety is supporting the initiative on the basis of a decision by the German Bundestag.

Off Grid Projects for Nigeria

Nigeria is seeing more off grid solar projects. One project recently announced is being developed by a partnership made up of Pan Africa Solar and BBOXX. The project will see an 80-MW utility scale PV power plant constructed in the town of Kankia in Katsina state.

The project focuses on a stable state in the north of the country, where due to lack of available hydro resources and gas supply, renewables are the only long-term sustainable option. The project will integrate panels mounted on tilting structures that track the path of the sun throughout the day, constructed on 210 hectares of land.

Another project brings Pan Africa Solar and BBOXX together again, this time in the Kano State in northern Nigeria. The second project is supplying distributed energy services.

BBOXX's VP of Business Development, Anshul Patel said, “...To date, 2,000 people have been impacted by our work in Kano, and the business is currently in the process of scaling its operations. The partnership between BBOXX and PAS is instrumental in leveraging expertise in the off-grid business combined with local market knowledge to successfully scale operations with a goal of electrifying one million people by 2020.”

Ghana to Export Power

Burkina Faso will be receiving power from Ghana, according to the Ghanaian electricity minister Boakye Agyarko. Ghana will now export 100 MW of electricity to its neighbor once the construction of a transmission line from Bolgatanga in Ghana linking the two countries is complete.

“We already supply a small amount of energy in Burkina Faso since 2003 (0.5 MW). We increased this amount to 9.2 MW in 2013. But now that Burkina Faso has started to implement its development agenda and has increased energy needs, we have reached an agreement to provide 100 MW of energy,” said Agyarko.

He also called on West African power pool officials to coordinate power distribution to help reduce the cost of electricity in the region.

Vinci Energies to Deliver Solar PV to Senegal

Senegal will prevent an estimated 18,919 tons of CO₂ from being discharged into the atmosphere when planned solar PV plants are

installed. According to reports, Vinci Energies will install eight PV power plants in the West African country over a period of 10 months.

Vinci Energies was selected through its energy transition brand, Omexom, by the National Electricity Company of Senegal (Senelec), for this project which is scheduled to be delivered in July 2018.

The project will cost an estimated €26.8 million, which will be provided by German bank KfW and Senelec.

Zimbabwe to Inaugurate Kariba Hydropower

Zimbabwe will see the first unit of the Kariba hydropower plant inaugurated by the country's new president, Emmerson Mnangagwa, on December 24. The project will be able to supply 150 MW of power to the national grid.



Source: Kariba

Kariba dam

The commissioning of this project will reduce the energy deficit of the country that forces the country to import energy. Zimbabwe has a production of 900 MW for a demand of 1,400 MW.

The project to expand the plant will be completed in two stages and will add a total of 300 MW to the grid. The work will be undertaken by Chinese firm Sinohydro.

Burkina Faso Inaugurates Solar Project

Burkina Faso saw its Zagatouli solar power station inaugurated at the end of November. The power station was inaugurated by the president of France, Emmanuel Macron and Roch Marc Christian Kaboré, President of Burkina Faso. The project was financed by the government of Burkina Faso, a grant of €25 million from the EU, and a loan of €22.5 million from the French Development Agency (AFD).

The Zagatouli solar power station is an innovative project that will provide electricity to 660,000 people in the country. The project consists of 129,600 solar panels on an area of 60 hectares, the equivalent of 84 football fields. The Zagatouli solar power plant will provide clean energy to 660,000 people while reducing the cost of production by four.

The commissioning of this plant represents an emissions savings of 26,000 tonnes of CO₂ per year. Its construction, carried out by the company CEGELEC (Vinci group) and local companies lasted barely more than a year and mobilized up to 400 employees. The plant will eventually be operated by the national electricity company (SONABEL).

Wärtsilä Awarded PV Plant in Nigeria

Wärtsilä received a letter of award for a 95,3 MWp (75 MWac) solar PV power plant in Nigeria. The award comes from Pan Africa Solar and will be Wärtsilä's first utility-scale solar PV project exclusively for an on-grid application.

When operational, the plant will be the largest in Nigeria; and one of the largest on the continent. The 75 MWac output to the grid is expected

to serve approximately 1.1 million households with electricity. It will be a major contributor of economic benefits to the local communities in Katsina State, in northern Nigeria.

The technology includes photovoltaic modules with single axis trackers, optimizing the energy yield produced by the plant. The power plant will also have an important stabilizing effect on the national grid.

AfDB to Finance Rehabilitation of Power System in Ethiopia

The AfDB has approved a loan and a grant amounting to \$97.79 million for the rehabilitation of power systems in Ethiopia. The \$83.64 million loan and \$14.15 million grant from the African Development Fund (ADF), the concessional window of the AfDB Group will be used to finance the rehabilitation and upgrading of power transmission and distribution systems in the capital, Addis Ababa.

The project, to be completed in three years, involves rehabilitation and construction of 545 km of medium voltage lines, replacement and installation of 582 distribution transformers, 14 primary substations and establishment of supervisory control and data acquisition system (SCADA) for operations and control. It also includes upgrading nine existing high voltage substations and construction of one 132 KV, 3.8-km double circuit km overhead line.

The project will support Ethiopia government's efforts to remove constraints on the electricity infrastructure; meet growing demand in the capital city and its environs; replace obsolete equipment to reduce energy losses and overloads, all which aim to improve the quality of electricity supply. It will also address the connection backlogs due to inadequate distribution capacity.

Lumos and MTN Light up Nigerian Homes

Lumos Mobile Electricity Service deployed its 60,000th Y'ello Box. The Y'ello Box is an at-home solar electricity device that lets users gain access to reliable electricity at an affordable price. The Lumos service is combining the power of the sun and a MTN mobile phone to bring a new type of power to Nigeria.

This significant milestone means more than 300,000 people right across Nigeria are now benefitting from affordable, reliable, clean electricity, thanks to the ability Lumos Mobile Electricity service to unleash the power of the mobile.

Lumos Mobile Electricity Service operates in partnership with MTN. Once MTN customers have joined the service, they pay their monthly subscription fee for power from their MTN mobile phones' air account by texting a simple code. There is no need for mobile money, bank accounts or expensive machines. This is quick, easy, affordable, quiet and clean.

Coach of Black Stars to Invest in Solar Panel Manufacturing

Kwesi Appiah, the coach of Ghana's national football team, the Black Stars, revealed that there are plans to build a solar equipment plant in the Ashaiman area of the Greater Region, Accra.

The facility, worth €14.5 million, will produce solar panels for the local market and create at least 500 direct jobs for Ashaiman youth. The project is supported by the German government.

De Aar Wind Farm Connected to Grid

South Africa's Northern Cape saw the De Aar Wind Power Project successfully commissioned and connected to the grid, adding 100 MW to the country's power generating capacity.



Source: De Aar

De Aar wind farm

The wind farm was developed by China Longyuan Power Group Corp. partnered with Mulilo Renewable Energy. The contract was won in 2015 under the third round of South Africa's REIPPPP.

Gambia Plans to Increase Power Generation

Gambia's national water and electricity company, NAWEC, launched a new roadmap to provide a solution to the energy crisis in the country. The strategy, unveiled by Baba Fatajo, CEO of NAWEC, plans to improve the power supply system by ensuring a generation of 70 MW by the beginning of next year.

In addition, it aims to increase investment in generation, transmission and distribution, and aims to encourage independent power generation projects between 2018 and 2020 to increase power generation capacity to 300 MW by 2020.

Two New Wind Farms for Egypt

In Egypt, Elsewedy Electric Company and Marubeni Corp. are looking to build two wind farms. Both farms are to have a 500 MW capacity, according to reports. The companies are currently negotiating for land with the New and Renewable Energy Authority (NREA).

The companies signed a MoU for the wind farms in March 2017. The plants will be built according to the build, own, operate framework. After finalizing a decision on location, the companies will negotiate financing for the project.

AfDB Approves Loan for Cameroon Hydropower

The Board of Directors of the AfDB approved on November 28 a senior loan of €150 million which, together with the support of other financial partners, will be used to finance the 420-MW Nachtigal hydropower project in Cameroon. The loan is firmly in line with the AfDB's initiative to promote renewable energies, whose share of the electricity generation portfolio has increased from 14% between 2007 and 2011 to 70% between 2012 and 2017.

The Nachtigal hydropower project is expected to enter service in 2022, increasing the country's capacity by 30%. The 420-MW run-of-river hydroelectric power plant, jointly designed and developed by Cameroon, EDF International-Electricité de France and the International Finance Corporation, is an essential component of Cameroon's National Development Plan for the electricity sector.

Building Energy Donates to Tororo

Building Energy, operator of a 10-MWp solar plant in Tororo, Uganda is helping the community in the region of the plants. The firm is supporting the Tororo local community with a donation of construction materials, furniture, textbooks and agricultural equipment to the Asinget Community School.

The Asinget Community School has been provided with chairs, desks and text books for its 114 school children, as well as construction materials such as bricks, cement, sand, doors and windows, for the construction of a new school.

In addition to the donations, Building Energy has provided the local community with access to some land, seeds and tools to help young people and families begin a modern experimental cultivation farming initiative. The EAIF (Emerging Africa Infrastructure Fund) directors visited the Asinget Community School previously and also donated funds for textbooks and some instructional materials as part of the Building Energy commitment and development towards the Tororo Community Development Plan of the Project.

Building Energy's Tororo solar plant consists of 32,240 PV panels distributed over a 14-hectare site. The facility is designed to generate around 16 GWh of energy annually. Not only will the solar park cover the community's needs, it will also foster industrial development in the city of Tororo, while at the same time saving atmospheric emissions of more than 7,200 tons of CO₂ per year.

Globeleq Increases Stakes in South Africa RE

Globeleq increased its shareholding in the Jeffreys Bay Wind Farm, De Aar Solar and Droogfontein Solar power projects in South Africa, by acquiring Mainstream Renewable Power's minority shareholdings in the three plants. Globeleq will fund the acquisition through a mix of internal funds and available credit facilities.

"This is a natural progression for Globeleq in South Africa and reinforces our ongoing commitment to powering Africa's growth," Paul Hanrahan, CEO for Globeleq said. "Globeleq is one of the few IPPs on the continent who has the experience and capabilities to develop, manage and operate a range of generating technologies including gas and renewables, which are vital components in the future energy mix on the continent." He continued: "As a strategic and long-term investor, Globeleq is also an ideal partner to other developers who may prefer to recycle capital and exit their projects."

Through subsidiary, Globeleq South Africa Management Services Ltd., the company has been operating the renewable plants since 2014 when they achieved commercial operation in Round 1 of the government of South Africa's Renewable Energy IPP Procurement Program. Mainstream Renewable Power was the initial developer and managed construction of the three plants. In addition to management and operation of the power plants, Globeleq supports unique scholarship and internship programs to develop skills and contribute to the renewable energy industry on the African continent.

NNPC Signs MoU for Bioethanol Plant

NNPC, Nigeria's state-run oil firm, signed a MoU with the Kebbi state government (KBSG) to build a bioethanol plant. The plant is expected to use cassava and sugarcane as its feedstock. According to a statement from NNPC, the plant will have a capacity to produce 84 million liters of bioethanol per year.

Speaking at the signing, chief executive Maikanti Baru said the project will involve the development of 20,000 hectares of an integrated plantation and plant complex. The Nigerian government is investing in biofuels as it reduces its dependence on oil and diversifies its economy.

Loeriesfontein and Khobab Achieve Commercial Operations

South Africa's Loeriesfontein and Khobab wind farms commenced their 20-year commercial operations, a milestone they have achieved on schedule, on budget and without a single lost-time incident. The facilities have a generation capacity of 140 MW each.



Source: Loeriesfontein

Loeriesfontein Wind Farm construction The two neighboring wind farms combined make up the largest single expanse of wind turbines in the country. Situated in the Northern Cape the wind farms comprise a total of 122 wind turbine generators, spanning 6,653 hectares. Collectively, the wind farms will power circa 240,000 South African households, positively impacting the country's economy and its people.

The two wind farms were developed by Mainstream Renewable Power which also managed the construction process and will oversee the operations and maintenance of the plants. The Loeriesfontein and Khobab wind farms are owned by a consortium led by Lekela Power.

GE Reaches Half Way Point of Medupi Power Plant Construction

General Electric Steam Power Systems received a Final Acceptance Certificate from Eskom for the successful testing and transitioning of Medupi Power Station Unit 4. Upon completion, the power station will produce a total of 4,800 MW and will be sufficient to meet the electricity needs of 3.5 million households in the country.

"This is a major milestone for GE and our customer Eskom as Unit 4 will be the third unit out of six units to be transferred to commercial operation marking the half way point of completing the project," a company statement said.

Once completed in 2020, Medupi will be the fourth-largest coal-fired power plant in the world and the largest in Africa. GE's scope includes six full EPC turbine islands, air cooled condensers, plus overall project and construction management.

Parliament Ratifies Bumbuna Hydropower Agreements

The parliament of Sierra Leone has ratified the 25-year power purchase agreement and implementation agreements between the government and Joule Africa. The ratifying of the agreements marks an important milestone in the development of the Bumbuna II hydropower project which, when completed, will provide much-needed all-year round power to Sierra Leone.

Under the conditions of the agreement, local project company Seli Hydropower, jointly owned by Joule Africa and its local partner Energy Services Company (ESCO), will build an extension to the existing 50-MW hydro station, Bumbuna I, situated in the northeast of the country, adding a further 143 MW of power capacity.

Construction on the extension should start in the second half of 2018 with operations forecast to start four years later. Seli Hydropower, will be responsible for building, owning and operating Bumbuna II and will also be responsible for operating Bumbuna I.

Algeria and Libya Discuss Power Exports

Sonelgaz and GECOL, the state-run utilities of Algeria and Libya respectively, have entered discussions for the export of Algerian power into Libya, according to Sonelgaz CEO Mohamed Arkab in an APS news agency report.

"We have an excess of national production in electrical energy, notably in winter. In this period, our Libyan brothers need this energy. We are studying the possibilities of a high-voltage electrical connection between Algeria and Libya through Tunisia to export our energy and offer our services through these cables," said Arkab on the sidelines of the meeting.

Arkab said that the visit was about relaunching a study that started in 2010 by the two countries that was delayed due to the political crisis in Libya. "Several projects are frozen in Libya, others haven't yet taken off. So, we want to be the first to be present in the Libyan market," he underlined.

Libya maintains a power deficit due mainly to damage and lack of maintenance to its power infrastructure, as well as an increase in demand. Algeria on the other hand has been able to construct power plants, power lines, power substations, gas pipelines for gas supply, as well as the manufacture of some equipment in country. Arkab said that with the acquired abilities, it is time to start the operations of exporting services, studies and equipment manufactured in Algeria.

Egypt to Launch Solar Tender

Solar firms should expect to see tenders launched by Egypt's Ministry of Electricity in Q1 2018. The tenders are aimed at adding a combined capacity of 500 MW of power.

According to *Daily News Egypt* sources, Arab and international companies have submitted their offers to the authorities in charge of the sector to build solar power plants of 100 MW to 200 MW. However, they were invited to submit their bids during the future call for tenders that will operate according to the "construction, ownership and operation" (more commonly referred to as build, own, operate) model of the plants.



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World Mourns Victims of Egyptian Mosque Massacre

At least 305 people, including 27 children, attending a Sufi mosque for Friday prayers on November 24 died as a result of a militant attack in Egypt's North Sinai. Over 120 were wounded. According to state media, militants detonated a bomb at the mosque and then gunned down the attendees as they fled. The bombing was at the Al Rawdah mosque in Bir al-Abed, west of El Arish in the North Sinai.

Worshippers were finishing Friday prayers at the mosque when a bomb exploded, according to some witnesses, while other reports say the Imam was just about to begin services. Around 40 gunmen, thought to be associated with a Daesh/ISIS-linked group harboring itself in the Sinai mountains (at press time, neither Daesh or any other group had claimed responsibility for the attack), set up positions outside the mosque's windows and opened fire from different directions as people tried to escape. It was also reported that the terrorists were firing at the ambulances trying to come to the aid of the victims.

Hours after the attack, Egypt's military launched air strikes on targets in mountainous areas around Bir al-Abed, reportedly destroying vehicles and hideouts associated with the attack, the army said without giving the number of militants killed. While the government claims to have hit the militants, it is likely that innocent civilians may have suffered as well. If officials knew where the militants were hiding, they would have struck them down prior to the deadly massacre.

"The armed forces and the police will avenge our martyrs and restore security and stability with the utmost force," Egypt's President Abdel Fattah al-Sisi said in a televised address. "What is happening is an attempt to stop us from our efforts in the fight against terrorism, to destroy our efforts to stop the terrible criminal plan that aims to destroy what is left of our region."

Leaders from around the world spoke out to denounce the cowardly act of terror and offered support to Egyptian authorities.

Meanwhile, Egyptians from the area showed their resiliency in the face of terror and had the mosque cleaned and renovated in time for December 1 Friday prayers.

The *Petroleum Africa* team sends its heartfelt prayers to the families and friends of the victims.

Jubilation in Zim following Mugabe Ousting and Resignation

Long-term Zimbabwean president Robert Mugabe, also known as "Mad Bob" to many of his opponents, was ousted in a bloodless military coup November 15.

Source: UN Photo/Cla Pak



Robert Mugabe in 2014

The ZANU PF took to Twitter denying a coup had taken place. "Zimbabwe has not had a coup.

There has been a decision to intervene because our constitution had been undermined, in the interim Comrade E Mnangagwa will be president of ZANU PF as per the constitution of our revolutionary organization," the tweet said.

The world's oldest leader had been maneuvering to have his 52-yr old wife Grace take over the party nomination ahead of elections scheduled for next year. A battle between the president and former vice-president, Emmerson Mnangagwa, who Mugabe had sacked the week before his own ouster, has been ongoing as Mnangagwa looked to succeed Mugabe as president. Reports had Mnangagwa returning to Zimbabwe the Tuesday evening before the military intervention after reportedly fleeing to South Africa following his firing.

Prior to the takeover, Army Chief General Constantino Chiwenga made an unusual statement saying that the army would intervene to halt party infighting and remove veterans from the political forefront.

Mugabe initially remained defiant despite the takeover, insisting he finish out his term. But as impeachment hearings began the following Wednesday they were suddenly called off when the speaker of parliament read a letter from Mugabe announcing his voluntary resignation. Parliament celebrated while celebrations broke out on streets across the nation on the news of Mugabe's resignation.

At least 67 Dead in Nigeria Suicide Attacks

At least 50 people in northeastern Nigeria died in a November 21 terrorist attack, according to reports from Nigerian police. An apparent teen suicide bomber blew himself up in a mosque in the northeast of the country.

This is the biggest mass killing in Nigeria this year and it is being attributed to militant group

Boko Haram. Abubakar Othman, a police spokesman in Adamawa state, was quoted in a *Reuters* report as saying that the death toll is at least 50, but "there could be more as those seriously injured could add to the figure."

On December 2, at least another 17 people were killed and more than 50 injured in the town of Biu in Borno state when two teenage suicide bombers launched individual attacks in two separate areas of the town market. The two bombers were among the dead.

ANC Members Battle for Presidential Nomination

South Africa's main political party, ANC, saw a record seven ANC leaders battling it out to replace President Jacob Zuma. The Eastern Cape was the first of the big provinces to nominate a



Deputy president and presidential hopeful Cyril Ramaphosa

candidate, overwhelmingly giving the nod to Deputy President Cyril Ramaphosa for president. Ramaphosa was nominated by 423 branches for president, compared to 61 for ANC MP Nkosazana Dlamini Zuma.

Meanwhile, there are also plenty of candidates for the deputy president post. Presidential hopefuls Lindiwe Sisulu and Zweli Mkhize, as well as Mpumalanga Premier David Mabuza, have locked in their places for the deputy president post on the ballot paper of the national elective conference.

Sisulu got the nod from the Northern Cape, while Mkhize was nominated by the Eastern Cape. Both provinces have endorsed Deputy President Cyril Ramaphosa for the top job.

Libyan Community Issues Ultimatums

Libyan locals in the town of Jakharraare are in a dispute with state-run NOC and foreign producer Wintershall. Community elders and

leaders are threatening to shut down all oil fields in the region and close the oil terminals from Sidra to Tobruk.

A meeting between authorities and community representatives on November 15, resulted in representatives giving NOC and Wintershall two months to comply with a number of demands or face the consequence of having production and exports blocked. The demands include the return of NOC to Benghazi, the relocation of the Central Bank of Libya to Benghazi, and the return of all other headquarters, belonging to both businesses and organizations, to Benghazi, such as Libyan Airlines.

The Jakharra elders and leaders are also asking for the inclusion in the new constitution of special rights for towns and communities in oil producing areas. It is unclear as to whether these ultimatums have the support of the Libyan National Army or of the House of Representatives.

UAE Expels former Egyptian PM Shafiq

According to reports, Egyptian ex-Prime Minister Ahmed Shafiq has been deported from the UAE, shortly after saying he wanted to run in the 2018 Egyptian presidential poll.

It was not immediately clear as to why Shafiq was deported from the United Arab Emirates though many reports have tried to tie it to his announcement about next year's elections.

Shafiq has been in the UAE since 2012, following his defeat at the hands of the Muslim Brotherhood candidate Mohammed Morsi in Egypt's post-uprising presidential elections. Upon Morsi's win, Shafiq was faced with corruption charges.

According to a *Reuters* report, a source close to the Shafiq family said he had been arrested at his home and taken by plane to Cairo. One of



Ahmed Shafiq

his aides said that she had seen officials remove Shafiq from his Abu Dhabi home.

The following day, there were reports that Shafiq had been kidnapped upon his arrival at Cairo International Airport with his family saying they had been unable to contact him and suspected foul play. Those reports were put to rest quickly when Shafiq gave a telephone interview on live television.



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World Bank to Focus on RE, Drop Oil & Gas Funding

The World Bank Group is phasing out its funding of oil and gas projects as part of its ongoing support for clean energy. The announcement of the goal was one among many others made by the World Bank at the One Planet Summit in France.

The World Bank Group will no longer finance upstream oil and gas, after 2019, although

there could be exceptions made under certain circumstances.

According to the bank, consideration will be given to financing upstream gas in the poorest countries where there is a clear benefit in terms of energy access for the poor and the project fits within the Paris Agreement commitments.

The exit from upstream funding of oil and gas projects falls in line with the bank's ongoing support to developing countries for the effective implementation of the Paris Agreement's goals. The move is a major departure for the bank who has historically sought to support the extractive industries as a way to aid in the tackling of corruption and exploitation, through proper governance.

Vestas Wins 250-MW Order in India's First Wind Auction

Vestas' has secured its largest project in India to date. The record order was placed by Ostro Kutch Power Private Ltd. and awarded through India's first wind power auction held in February 2017.

The 250-MW turnkey order follows another 100 MW turnkey project in India earlier this year, taking Vestas' order intake

in the market to more than 480 MW in 2017.

The project will be located in the Kutch district of Gujarat state and includes delivery, installation and commissioning of 125 V110-2.0 MW turbines, as well as the project's civil and electrical works. The turbines will be serviced by Vestas via a 10-year full-scope

Active Output Management 4000 (AOM 4000) service agreement as well as a Vestas Online® Business SCADA solution. Commissioning is expected by the third quarter of 2018.

The wind park will produce enough power to cover the annual electricity consumption of about 5.7 million urban electricity consumers in India.

Siemens Gamesa to Supply 950 MW to Three Offshore Vattenfall Plants

Siemens Gamesa Renewable Energy (SGRE) has been selected by Vattenfall to supply close to 1 GW at three offshore wind power plants being developed in Danish waters.

Specifically, the company has signed an agreement with Vattenfall for the supply of 72 SG 8.0-167DD turbines at the Danish Kriegers Flak offshore wind project – with a total capacity of 600 MW. This will be the largest offshore wind power plant in the Baltic Sea.

The installation of the turbines is scheduled for February 2021 and the commissioning for the end of that same year. In addition, Siemens Gamesa has also been selected as preferred supplier by Vattenfall for the supply of the turbines, for both Vesterhav North (180 MW) and Vesterhav South (170 MW) located near shore at the west-coast of Denmark in the North Sea with a combined capacity of approximately 350 MW.



Source: Siemens Gamesa

Both together will feature 41 SG 8.0-167 DD turbines. Installation of the turbines will start

in 2020 and the commissioning for the end of that same year

DEWA's Water Reservoirs to be Powered by Solar PV

Etihad Energy Services Company (Etihad ESCO) has been awarded the development, and installation of solar photovoltaic (PV) systems to be installed at Dubai Electricity and Water Authority (DEWA) water reservoirs.

The installation of solar PV systems on DEWA's water reservoirs will reduce the Emirate's carbon footprint and increase

the proportion of solar power in Dubai's energy mix.

"The installation of solar PV systems at DEWA water reservoirs comes under the implementation of the vision of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai to transform Dubai into

one of the most sustainable cities in the world. The solar PV systems will promote sustainable development, which will reinforce the UAE's position as one of the most advanced countries for alternative energy," said Ali Al Jassim, CEO of Etihad ESCO.

Etihad ESCO will design the solar PV systems and install them on DEWA's water reservoirs.

First Solar to Supply Pakistan PV Plant

First Solar, Inc. announced that it will supply over 860,000 high-performance thin film modules to power a 100 MW AC utility-scale photovoltaic (PV) solar power plant developed by Zorlu Enerji in Pakistan. The Independent Power Producer (IPP) facility, part of the Quid-e-Azam Solar Park in the country's

Punjab province, is expected to be completed and connected to the electricity grid by the first half of 2018.

When completed, the plant will increase Zorlu Enerji's installed capacity in the country to 156.4 MW, a portfolio that includes a 56.4

MW wind farm completed in 2013. The facility will generate an estimated 180 million kilowatt-hours of electricity per year – sufficient to power approximately 140,000 average homes – for Pakistan's Central Power Purchasing Agency, under a 25-year power purchase agreement.

Hydro Tasmania Fuels Renewable Oasis

One of Australia's most remote communities has been totally powered by clean energy for the very first time. Coober Pedy has traditionally been mainly dependent on diesel generation, but its electricity needs are now being met exclusively by wind and solar power for extended periods.

Hydro Tasmania was appointed by Energy Developments Pty Ltd (EDL) to help transform

the mining town of about 3,500 people into a renewable energy oasis, through the Coober Pedy Renewable Hybrid Project. The initiative was intended to allow Coober Pedy to draw 70% of its energy from solar and wind, on average, with periods of 100% renewable operation.

The project is performing slightly above expectations in its early weeks – with an

average renewable contribution of more than 80% in October, and Coober Pedy running fully on renewable energy for more than half of that time.

The Coober Pedy Renewable Hybrid Project was made possible by an \$18.4 million grant to EDL from the Australian Renewable Energy Agency (ARENA).



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SENER Takes Huelva's Biomass Plant Award

Engineering and technology group SENER has signed a contract with ENCE Energía y Celulosa to build a new low-emission biomass electricity generation plant in its energy complex in Huelva (Spain). The contract signed is a turnkey arrangement whereby SENER will design, supply, build and commission the plant, as well as operate and maintain it during the first years of operation.

The new facility will consist of an electricity generation plant using biomass from the forestry and farming industries. With a 40 MW gross nominal electricity output it will be one of the largest high-efficiency low-emission biomass renewable energy plants in Spain. The plant is projected to enter into operation in the Q3 2019.



Source: SENER

The Huelva plant will be equipped with the best available technologies, similar to the Mérida biomass plant that SENER also

developed successfully as a turnkey project for ENCE.

Siemens Gamesa Secures its Largest Ever Contract in Thailand

Siemens Gamesa Renewable Energy has achieved a new milestone in its positioning in Asia Pacific having secured its largest-ever contract in Thailand, a market in which it is the leading OEM, responsible for more than 50% of the country's total installed capacity.

Specifically, Siemens Gamesa has reached an agreement with a local developer for the supply of 103 of its G126-2.5 MW turbines

(260 MW) at the Hanuman wind complex, being built in the province of Chaiyaphum, in northeast Thailand.

This order also marks a new technical feat as it will entail the installation of Asia's highest wind turbines: with a tower height of 153 meters and a blade length of 62 meters, the turbines will stretch 215 meters tall. This marks a new record for Siemens Gamesa,

which last summer completed the installation of 33 210-meter tall turbines, the previous record holders.

The turbines will be delivered in May 2018 and commissioned towards the end of that year. The company will also operate and maintain the facility. This agreement marks Siemens Gamesa's fourth order in Thailand, where it has already installed 310 MW.

Total Eren Signs LoI for 70 MW Indonesia Wind Farm

Ahead of the One Planet Summit organized in France to promote tangible means to achieve the Paris Agreement targets from 2015, Total Eren announced the signature of a Letter of Intent (LoI) with PT Perusahaan Listrik Negara (PLN), the Indonesian government-owned electricity provider. The LoI covers the power purchase from a 70-MW wind project to be constructed on the southern end of Borneo island.

The large-scale wind power plant dubbed the Tanah Laut project, will be financed, built and operated by Total Eren.

The Tanah Laut project is the first wind project to be signed under the new Ministry of Energy regulation in Indonesia (Permen ESDM 50/2017), issued in August 2017 and aiming at electricity generation cost reduction. The project will be constructed in Tanah Laut, located on Kalimantan, the Indonesian part of

Borneo island. The 20-month wind data gathered by Total Eren through its subsidiary based in Jakarta, PACE Energy, confirmed the high-quality of the wind resource at site.

For the advancement of the project, Total Eren and PACE Energy joined forces with General Electric Indonesia (GE). GE is the project's preferred technology supplier and has supported the project design and conducted the grid connection study.

MidAmerican Places 70 MW Order for Iowa, USA Project

MidAmerican Energy Company, a subsidiary of Berkshire Hathaway Energy and the largest regulated utility owner of wind energy in the U.S., has placed an order for 70 MW of V110-2.0 MW turbines towards the 2,000 MW Wind XI project in Iowa. The turbines will be manufactured at Vestas' four Colorado factories with expected delivery in the second quarter

of 2018, and includes previously purchased Production Tax Credit (PTC) qualifying components.

When fully operational in 2020, alongside other projects, the Wind XI project will help MidAmerican Energy generate an estimated 95% of its annual retail energy load from wind.

The Wind XI project consists of multiple sites in Iowa that will be placed into service between 2017 and 2019.

The order includes supply and commissioning of the wind turbines as well as a multi-year Active Output Management 5000 (AOM5000) service agreement.

Financing Innovative Technology Solutions to Power Africa

New off-grid energy solutions hold the potential to provide much of Africa's currently marginalized rural population with access to affordable electricity. To date, however, funding off-grid solutions on a sufficiently large scale has inhibited the potential of these solutions to transform Africa's rural economy, a statement from the Stanbic Bank said.

In Kenya, approximately 50% of the population has access to electricity. In rural areas, it is as low as 5% – with fire wood accounting for 77% of the total energy consumed. In Uganda, approximately 14% of the population has access to electricity. This slips to 7% in rural areas where the bulk of electricity is supplied by generators, car batteries or solar photovoltaic units not on the national grid.



Stephen Lovell

“Beyond electricity generation, building and maintaining extensive and expensive distribution networks in Africa's often large and sparsely populated countries does not make practical or economic sense,” says Stephen Lovell, Head, Corporate Financing Solutions, East Africa for Stanbic Bank.

Since a large portion of Africa's population lives in remote and rural areas, receiving power from the grid could still be decades away.

Business models for at-home off-grid power supply have been in existence for some time, particularly in the United States. The ability to take from or supply power into the grid (and pay or get paid for the energy consumed or supplied), coupled with favorable tax treatment on the structure, has created a competitive market for off-grid power solutions.

Africa differs fundamentally from the US in the sense that off-grid in its truest sense, needs to be just that, “and also affordable for households with very low disposable income,” says Lovell. As such, the cost of the basic technology (a few solar panels, light bulbs, a battery and phone charger) has to be reasonable, and be part of the overall budget

a customer can afford. “This is critical if investment in this innovative technology is to be financed by commercial banks,” he adds.

In East Africa, the combination of innovative technology and finance have come together in a landmark off-grid solar transaction with the prospect to transform African growth.

Stanbic Bank's arranging of \$55 million funding in Kenya and Uganda for M-Kopa, the world's leading off-grid pay-as-you-go energy company, shows “how rapidly and effectively new disruptive off-grid energy solutions can provide affordable energy when coupled with innovative financing solutions,” says Mr Lovell.

What's exciting about the M-Kopa transaction, the largest off grid debt funding arranged by a commercial bank in Africa, is that very soon payment records, and hence default rates, will become known to other funders who should be able to lend on a portfolio basis to more off-grid energy suppliers. “This will rapidly increase the acquisition of this energy technology in Africa, placing affordable at-home off-grid power generating capacity in individual's hands,” said Lovell. Since various sources of research confirm a positive correlation between energy use and economic growth, off-grid solutions are expected to have a measurable positive impact on the broader economy.

The improved affordability of the technology, with most solar units being the size of an A4 piece of paper, has resulted in businesses like M-Kopa no longer having to rely solely on equity funding like other start-ups. Instead, the affordability of the product, along with the scale of take up, means that M-Kopa has been able to expand its funding sources to include substantial commercial bank finance.

“For Stanbic Bank, supporting M-Kopa in raising their single largest debt funding ever, entirely against their own balance sheet, was a landmark transaction in a new and rapidly changing sector,” said Lovell. By helping M-Kopa evolve and grow their funding to include significant commercial bank lending, “Stanbic Bank proved a critical enabler in bringing innovative finance to an industry crucial for economic growth in Africa,” Lovell ended with. **AEA**



PAY-AS-YOU-GO

Energizing Rural Africa

PayGo Explained

Pay-as-you-go (PayGo) solutions have taken sub-Saharan Africa by storm over the past decade, and, particularly, in the last few years. This unique solution allows rural users without access to the national grid, or even a mini-grid, to access electricity, greatly improving the quality of life. These pay-as-you-go schemes are almost exclusively powered by solar solutions.

The greatest benefit is that it provides power for adequate lighting by evening which allows children additional study time and provides greater domestic productivity. Many of the rural are agricultural workers, meaning most of their daylight hours are spent in the field, making potentially productive hours at home spent either by candlelight, kerosene lamps, or worse yet, darkness. Solar home lighting eliminates health dangers posed by traditional methods and allows for greater security.

Another benefit is the ability to charge small appliances such as cell phones at home, eliminating the need to travel (sometimes for miles) and pay for the service. Some PayGo services have expanded to include packages that even bring television or radio into the home, attainable and affordable for the rural poor.

The concept is simple. The price set for accessing the solar-generated electricity is set equal to or lower than the equivalent price for kerosene. The customer pays by mobile transfer through one of many payment solutions offered in various markets, such as Tmoney in Togo or MTN in Nigeria. On average, after two years the customer then owns their home solar solution outright.

The Programs

BBOXX

BBOXX is active in more than one African country. Most recently, in Togo, the CIZO initiative made a significant stride forward as BBOXX officially launched its operations. In November, President Faure Gnassingbé, visited one of BBOXX's first customers in the rural town of Awagomè, to mark the start of the company's roll out of its smart solar home systems.

Customers in Kenya and Rwanda usually earn US\$100-\$200 per month and spend \$8-12 on energy expenditure such as purchasing kerosene, batteries, and charging their phones. BBOXX prices its direct sales units to match these existing energy costs, spreading the cost of a solar system over time to widen its customer base, enabling the masses to purchase clean renewable solar energy.

Following a tender process, BBOXX was awarded a contract to work with the government of Togo to roll out 300,000 of its solar home systems in the country by 2022. The company has already imported its products and will begin selling and

installing its systems in people's homes immediately, with an initial target of installing 10,000 units in the next 12 months.

The innovative partnership is part of the government's aim to dramatically improve access to electricity for the people of Togo, particularly in rural areas. The mission of CIZO is to bring electricity to more than two million citizens by 2022. It will also provide the adoption of mobile payment solutions across rural areas, helping to improve the financial inclusion of rural communities.

BBOXX will work with La Poste, the largest distribution network in the country, to sell and distribute its solar home systems bundled with small electrical goods, such as televisions and radios. BBOXX will also be opening shops within La Poste's locations.

BBOXX customers will be able to pay for their solar system usage in a "pay-as-you-go" fashion, using mobile payments solutions such as TMoney or Flooz. They will also have access to the company's proactive customer service, which through remote monitoring solves issues such as battery depletion before they become a problem for customers. BBOXX's operations in Togo have been in part financed by capital raised via Union Togolaise de Banque, a local bank.

BBOXX also offers its variety of products in other African countries including Kenya and Rwanda, as well as in developing nations worldwide, where it looks to expand its already established distribution networks. The company also has distribution partners in Cameroon, Nigeria and South Africa with plans to reach more.

Mobisol

Mobisol is another company which is looking to provide clean home energy to the rural African market, predominantly focused on East Africa. In November the company announced that it had "successfully installed a capacity of 10 MW and electrified over 500,000 people in East Africa to date." Its efforts have offset 50,000 tons of CO₂ equivalent per year through its smart rent-to-own solar systems, benefitting communities in Tanzania, Rwanda and Kenya.



Source: BBOXX

Source: Mobisol



“Mobisol provides solar solutions beyond lighting and focuses on the development and supply of large solar systems that power a range of energy-efficient household and productive use appliances. While currently distributing

business appliances such as multiple phone chargers and barber salon packages, the company plans to increase its offering around productive-use appliances for small and medium enterprises in 2018,” the company offered in a recent release.

Further, as part of its commercial strategy, Mobisol has recently grown its workforce to develop a number of B2B partnerships and support solar providers in an additional nine countries through their software suite SolarHub, which builds a digital foundation for pay-as-you-go business models. The company aims to bring partners up to speed fast and increase the scaling of off-grid.

The company’s most recent announcement has it entering the Ethiopian market partnering up with Ethiopian solar service distributor SunTransfer Tech. The pair will endeavor to expedite the government’s aim to provide “equitable and affordable electricity to all Ethiopians by 2025 and foresees the electrification of 35% of the population with off-grid energy – of which 5.4 million households will be provided with Solar Home Systems.”

Azuri

UK firm Azuri Technologies was founded in 2012 and in five short years has made a tangible impact on the lives of the rural sub-Saharan African. Its mission was to bring energy to off-grid communities to enrich the lives of those with no access to power at an affordable cost.

Source: Azuri Technologies



Azuri acquired the IndiGo mobile phone technology from Eight19 to facilitate its rapid expansion across sub-Saharan Africa. The IndiGo units use mobile phone technology to turn solar power into a pay-as-you-go service. Already having pilot

distribution schemes in Kenya, Zambia, and Malawi to analyze the potential of the product, Azuri went about the business of rapidly expanding its distribution of the units.

The product helps charge devices like mobile phones, an enormous sector within the African markets. With the pay-as-you-go business model, customers pay an installation fee amounting to around \$10 and purchase a weekly scratch card for input to the device. Customers pay off the technology after around 18 months, which will permanently unlock the device.

Additional Azuri products to hit the African continent include HomeSmart, a machine-learning technology that adapts to each customer’s individual needs guaranteeing light at night, even in

cloudy conditions. In Kenya, the company debuted the Quad solar home system which provides customers with four LED lights, mobile phone charging, and a rechargeable radio at an affordable daily rate of just KES 50.

In December 2016, Azuri launched what might just be the most popular product to date. Azuri, along with home entertainment satellite provider Zuku, debuted a fully integrated pay-as-you-go satellite TV package for rural off-grid consumers in sub-Saharan Africa. The system combines solar home power, TV, satellite dish and Zuku Smart+entertainment. The AzuriTV system, like its other products, targets households outside the power grid by offering affordable TV, anytime, anywhere.

Lumos

Lumos Mobile Electricity Service deployed its 60,000th Y’ello Box. The Y’ello Box is an at-home solar electricity device that lets users gain access to reliable electricity at an a great rate. The Service combines the power of the sun



Source: Lumos

and a MTN mobile phone to bring a new type of power to Nigeria.

Lumos Mobile Electricity Service operates in partnership with MTN. Once MTN customers have signed up, they pay their monthly subscription fee for power from their MTN mobile phone’s air account by texting a simple code. There’s no need for mobile money, bank accounts, or expensive machines. This is quick, easy, affordable, quiet and clean.

This significant milestone means more than 300,000 people right across Nigeria are now benefitting from affordable, reliable, clean electricity, thanks to the ability of Lumos Mobile Electricity service to unleash the power of the mobile.

Conclusion

In this article we have offered only a handful of examples of how pay-as-you-go solutions are having a tangible impact on Africa’s rural citizens. There are many more companies and partnerships executing similar programs and the cumulative result is that millions of Africans are now “lit up” so to speak, enjoying a higher quality of life.

Helping spread awareness and attract investment are the numerous global initiatives that are focused on Africa: the Power Africa initiative by the United States Agency for International Development; the UK Department for International Development’s Energy Africa campaign; the “renewables – Made in Germany” initiative by German development agency GIZ, among many others.

African governments are increasingly establishing renewable energy goals and master plans with both near-, mid-, and long-term goals. Both the corporate world and development agencies have demonstrated a willingness to help with each stage. Until the mid- and long-term projects can be funded and developed, PayGo solar schemes are looking like the solution of choice in the interim. **AEA**

SOLAR-ONLY TOWER SITES

A recipe for success or failure?

The mobile telecommunications landscape has been changing over the past few years, particularly in the world's developing economies. With customers demanding expanded rural network rollout and cost competition putting pressure on capital expenditure and operating expenses, mobile network operators (MNOs) have been looking for ways to reduce their costs – particularly at tower sites where the cost of powering the active telecoms equipment can be prohibitively expensive.

Many MNOs and tower companies have started taking the route of outsourcing their site power requirements to specialist energy service companies while others are choosing to directly invest in new power equipment themselves. Either way, the solution of choice has been to deploy hybrid power systems, using a combination of diesel genset, grid (where available) and renewable energy sources.

But why not simply use 100% solar systems with a battery bank? In many parts of the developing world there is no shortage of sunshine hours; solar-only systems would be cheaper to source; potentially faster to roll out; and would provide a great corporate environmental responsibility story for the operator.

No solar performance guarantees

The problem with this scenario is of course that even in the sunniest parts of the world, there is no guarantee that the sun will always shine and a few overcast days would certainly spell service shutdown. Worse still would be a dust or sand storm – an event that would not only prevent solar energy harvesting while it was happening, but would also reduce the performance of the solar panels after the fact due to the accumulated debris on them.

Keeping the battery bank healthy

A steady system load will constantly be draining the batteries and – notwithstanding the point above about no solar performance guarantees – even in perfect sunny conditions solar energy alone will not be enough to maintain the battery bank at an optimal charge level.

If this continues over time and the batteries are not periodically returned to full charge, their performance and lifetime will both be significantly reduced.

Load fluctuation

This problem will be compounded if the system load fluctuates to a point where the solar panels and battery bank are fundamentally under-dimensioned for the demand they are experiencing. In this case the end result will be short-term network downtime, long-term battery damage and a failure to achieve the objectives we began with of increased customer satisfaction and reduced power-related expenditure.

The hybrid answer

While running tower sites purely on solar power is an admirable goal – both environmentally and economically – it's clear that it simply isn't possible today. Regardless of whether a tower company or an MNO is establishing a new tower site or upgrading an existing one, a hybrid power system (such as Flexenclosure's eSite x10) is the clear answer to being able to balance customers' demands for network reach and reliability and operational demands for reduced site energy costs.

A hybrid power system can combine a renewable energy source such as solar with second source – typically a diesel generator and/or grid





power – that can supply the additional amps required to fully charge the batteries when necessary. The generator will not need to run constantly or be used to supply power directly to the load. Rather, it will simply need to be used for an hour or two a day to keep the batteries charged and healthy.

A hybrid power system that is preconfigured for solar, as well as compact and lightweight, is the ideal solution for ensuring network uptime while maximizing deployment speed and minimizing power costs.

About Author

Riana Donaldson is a successful telecommunications professional, with a career spanning more than 15 years in the industry. Her experience includes general management, project management, technical support, logistics and sales. She has held senior roles based in South Africa and Ghana, with Vodacom and Vodafone. Based in Pretoria, South Africa, Riana is Flexenclosure's regional sales director for Africa and a portion of the Middle East.



Her primary focus is on entering and developing new markets for hybrid power systems. Riana holds a Master's degree in Engineering from the University of Pretoria in South Africa. **AEA**

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Geophysical imaging of Geothermal Resources using Magnetotelluric and Transient Electromagnetic Methods

A case study of Arus-Bogoria Geothermal Prospect in Kenya

Kenya's central rift valley is home to Arus-Bogoria geothermal prospect, well known for its fumaroles, boiling and bubbling springs, mud pools, steam jets, and travertine deposits. Fifty percent of electricity consumed in Kenya is geothermal sourced; so with energy consumption ever-rising, innovative strategies are required to fast track risky upstream development.

The Kenyan government has thus put into place policies, legislation and key institutions aimed at attracting finance for geothermal projects capable of unlocking an untapped potential of what conservative estimates put at 4,000 to 7,000 megawatts.

Any upstream development, of course, starts with exploration. Geophysical methods, particularly electrical resistivity methods, have been the most powerful tools in geothermal exploration. Of these, Transient Electromagnetic and Magnetotelluric methods are important in outlining geothermal resources.

The Magnetotelluric (MT) method has the ability to investigate deep down to tens of kilometers and is thus the exploration method used when it is important to understand the depth of a potential resource. The MT method uses the earth's natural electromagnetic fields to probe the subsurface resistivity structure of the earth. It is thus a passive geophysical exploration method as it relies on the earth's natural electromagnetic waves as its power source. The natural changes in the magnetic fields of the earth induce corresponding fluctuating telluric currents in the earth's subsurface in accordance with Faraday's law. The magnitude of this current depends on the resistivity of the rocks below.

Both the electric and magnetic fields are measured on the surface of the earth in two orthogonal directions. The impedance tensor gives information about the resistivity structure of the subsurface. High frequency provides information about the near surface whereas the low frequency provides information about deeper-lying structures. The penetration depth of the electromagnetic field below the subsurface is dependent on the conductivity structure of the earth as well as the period. At frequencies higher than 1 Hz, the electromagnetic source originates from lightning discharges in the equatorial belt while low frequencies less than 1 Hz originate from the interaction between the earth's magnetic field and the solar wind.

MT data collection uses a combination of induction coil magnetometers and electric sensors that can detect changes in resistivity to great depths below the surface. The electric sensors are used to determine the electric field, which is derived from measurements of the magnetic fields H_x , H_y and H_z in three orthogonal directions. It follows that at a given period, only two horizontal electric components are necessary to describe any EM field component measured anywhere at the surface.

Another popular method of exploring geothermal resources is the Transient Electromagnetic (TEM) method. In the central loop TEM method, an artificially controlled source is used to create a time-varying magnetic field in the subsurface. The method involves placing a wire loop on the ground and then passing through it a constant current.

This current is switched on and off at known intervals of time. At switch off times, it causes sudden changes in the magnetic field, which then causes current to flow into the earth. The current creates an image of the loops for a very short time. Since there is no source to support the induced current, it dies out generating a new secondary magnetic field that varies with time and which consequently induces a new current in the ground. This current density migrates outwards and downwards into the earth. The receiver coil placed at the center of the loop measures the rate of decay of induced magnetic fields.

The decay rate of the secondary magnetic field and the distribution of current is affected by the electrical resistivity of the rocks, in which case, the fields decay much more quickly on conductive rocks as compared to resistive rocks.

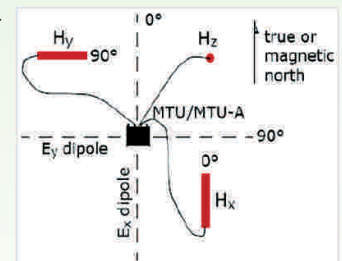


Figure 1: A field array for a 5 channel MT data acquisition system (from Phoenix Geophysics)

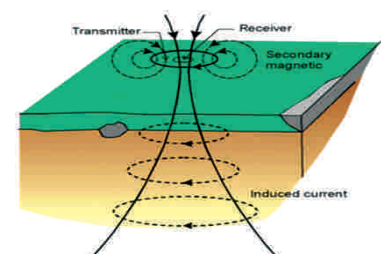


Figure 2: The central loop TEM configuration (from Hersh and Björnsson, 1991)

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SALON INTERNATIONAL DE L'ENERGIE SOLAIRE & DE L'EFFICACITE ENERGETIQUE
INTERNATIONAL EXHIBITION OF SOLAR ENERGY & ENERGY EFFICIENCY

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Electromagnetic distortions though, can affect results. Two to consider: the galvanic distortion which is generated by excess charges and the induction distortion which reflects the inductive interaction between the excess currents. Galvanic distortions occur when currents causing a distortion flow across boundaries in electrical conductivity. Induction effects occur when the currents causing a distortion flow entirely within a bounded region. The major difference between the two is that galvanic distortions occur due to secondary electric field arising from electric charge build-up on boundaries of different conductivities and they persist over the whole frequency range and do not vanish with lowering frequency, whereas the induction distortions result from induced currents within anomalous conductivity bodies which appear at high frequencies and vanish at low frequencies.

A weakness in MT sounding is that inhomogeneities in the uppermost layers may severely distort the electric field and consequently the impedance tensor along with the apparent resistivities. The dominant distortions are of galvanic nature and they extend over the whole range of frequencies, causing static shifts of the apparent resistivity curves. The near-surface inhomogeneities affect the apparent resistivities no matter how low the frequency. In Kenya's Arus-Bogoria field, static shift was corrected by carrying out TEM measurements at MT stations and using the data to perform a joint inversion of the two.

Arus-Bogoria Location, Geological and Tectonic Setting

Arus-Bogoria is located along the central Kenyan Rift Valley 2 kilometers north of the equator and bounded by a narrow graben (a depressed block of the Earth's crust bordered by parallel faults) to the west and a half graben to the east.

Phonolites and basalts are the major lithological units in Arus and cover large areas of the prospect although sediments and tuffs are also apparent. The geology on the eastern zone and western margin are characterized by phonolites that show a discrepancy in their appearance and composition. The phonolites associated with the Bogoria half graben appear greatly dissected by NNE-SSW trending faults leaving steep scarps, which clearly reveal similar alignment. The lavas are evidently fissure eruptions with no association to any central volcano. Eruption centers are however present and appear as bulges along the identified fissure feeder zones.

The general trend of many structures within Arus prospect is NNE-SSW in the east and N-S in the central and western zone. The NNE-SSW normal fault forms a half graben which is significant as many of the Lake Bogoria hot springs fall in its locality. The Molo graben constitutes the N-S trending faults and is within this narrow graben where the fault-controlled Arus steam jets, fumaroles and bubbling springs are found.

Results from Arus-Bogoria Field

The main software used in the interpretation of the data from the Arus-Bogoria field is WinGlink software. It is based on nonlinear conjugate gradient inversion code which is a forward and inverse modeling algorithm developed by Rodi and Mackie (and adapted for the WinGlink).

The forward model is computed using finite difference equations while the inversion seeks to achieve the lowest root mean square error and the smoothest model.

1-D Iso-Resistivity Maps

Contoured resistivity distribution maps based on Occam inversion were prepared using the WinGlink software. The resistivity is colored and contoured in a logarithmic scale. The values used to build up these maps are of two kinds: the values of the parameter at each data collection station and the interpolated values of the same parameter. The general elevation of Arus is about 1300 – 1600 meters above sea level (m.a.s.l). The maps presented here were plotted at a constant depth, which is dimmed to be more representative since electrical resistivity of the subsurface varies with topography.

Resistivity Map at 1000 m.a.s.l

Relatively low resistivity predominantly covers almost the entire study area with a very low resistive zone (marked by resistivity < 8 ohm-m) observed at the central part of Arus, towards the west of the study area. This low resistivity can be interpreted to be related to hydrothermal alteration and also to show the depth of the clay cap around the prospect.

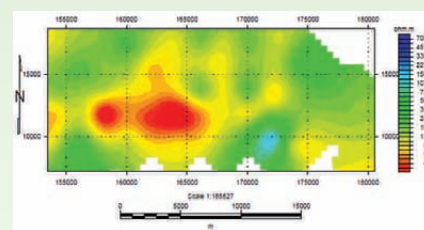


Figure 3: Resistivity map at 1000 m.a.s.l

Resistivity at sea level

This elevation is approximately 1.5 km below the surface. A fairly high resistivity is evident to the south of the prospect area cutting through the center and extending northward. The fairly high resistivity zone is around Molo Sirwe, Mugurin and Mukuyuni and can be attributed to be due to hydrated mineralogy. Low resistivity anomaly is seen on the western part of the prospect area and can be interpreted to be acting as the seal to the geothermal system. Generally the resistivity distribution at sea level delineates the reservoir level around the prospect area.

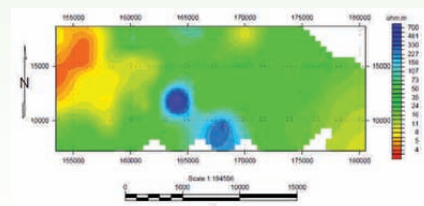


Figure 4: Resistivity map of Arus at sea level

Resistivity at 2500 m.b.s.l

Resistivity map at 2500 m.b.s.l is shown on Figure 5 below. A high resistivity persists throughout the plot. The high resistivity could be related to high temperature mineral

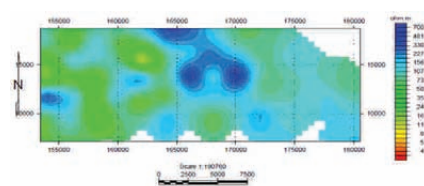


Figure 5: Resistivity map at 2500 m.b.s.l

alteration. The structural control in the middle of the plot aligned in the North-West direction can be clearly seen, showing some lineaments in that direction. The very high resistive body is seen to spread northwesterly towards Chebiwon.

2-D Resistivity Cross-Sections

To better examine the resistivity variations at depth, a number of cross sections were taken across the geological structures in the area; two of them are presented here.

Resistivity cross-section WE1

The resistivity cross-section shown in Figure 6 below is along West-East direction and cuts the Northern part of the prospect. It reveals a typical resistivity structure for a geothermal system on the western part. On the eastern part the deep resistive body could be an intrusion on that part of the prospect.

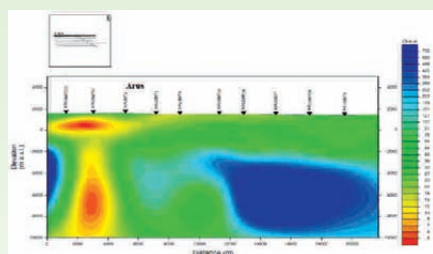


Figure 6: Resistivity cross-section WE1

Resistivity cross-section WE5

This section on Figure 7 is taken almost in the middle of the prospect and a fairly high resistivity is distinct from the system seen on the western part showing some structural controls. The high resistivity anomaly is beneath the area with numerous gas holes on the surface indicative of carbon dioxide reservoirs around the area. The presence of carbon dioxide gas is a further proof of the presence of a hot body beneath.

The interpretation of the integrated MT and TEM data and the consequent resistivity distribution maps and cross-sections from Arus geothermal prospect reveals that:

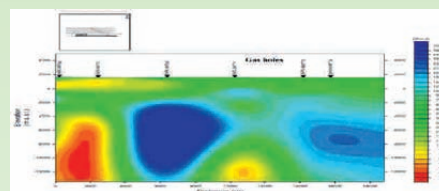


Figure 7: Resistivity cross-section WE5

A geothermal system exists to the west of the prospect area. The hotter reservoir conditions can be clearly discerned in this area, around Molo Sirwe. This area is potentially a good high-temperature area. It may also be the upflow of the geothermal system. The resistivity distribution confirms a possible geothermal system up-flowing to the northwest and is structurally controlled. The potential area determined using resistivity anomaly is about 36 Km² to the west of the study area. **AEA**

About the Author

Daniel Wamrui is completing a Master of Science in Oil and Gas Engineering at the Russia State Geological Prospecting University in Moscow. His research focuses on geophysical support in drilling horizontal wells, specifically in difficult geological settings. He has a Master of Science in Geophysics from Kenyatta University in Nairobi where his research focused on Magnetotelluric and Transient Electromagnetic imaging for geothermal resources in Arus-Bogoria area in Kenya. He has worked as an intern Geophysicist at Geothermal Development Company in Nakuru, Kenya.



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ZAMBIA

President: Edgar Lungu (January 2015)
Independence: October 1964 (UK)
Population: 15.972 million (2017)
GDP (purchasing power parity): \$65.13 billion (2016 est.)
Real GDP Growth Rate: 3.4% (2016 est.)
Per Capita GDP: \$3,900 (2016 est.)
Debt – external: \$9.562 billion (December 2016 est.)
Industrial Production Growth Rate: 6.4% (2016 est.)
Electrification rate: 45% urban and 14% rural, combined 26%
Electricity – installed generation capacity: 2.347 GW (2016 est.)

Source: CIA Factbook July 2017 and Zambia Invest

Despite the challenges developing countries face economically, Zambia held the title of one of the world's fastest growing economies for a decade. When its economy did begin to slow, its average GDP up until 2014 of 6.7%, went down to just around 3.4% for 2015 and 2016. Although the next 12 months look more promising, Zambia still faces economic challenges due to falling copper prices, reduced power generation, and depreciation of the domestic currency, the kwacha.

Despite recent strong economic growth and its status as a lower middle-income country, widespread and extreme rural poverty and high unemployment levels remain significant problems, made worse by a high birth rate, a relatively high HIV/AIDS burden, and by market-distorting agricultural and energy policies. The new government took office in September 2016 and has started implementing its economic reform program that aspires to expand growth and restore budget credibility while reducing the fiscal deficit. The first major task by the government was to launch the five-point economic recovery program termed "Zambia Plus" which is aimed at balancing the budget to sustainable levels following the increase in fiscal deficits to about 10% of GDP in 2016. A substantial part of the budget is used for paying non-discretionary expenditures such as salaries and interest payments on domestic and foreign loans, and subsidies. Key policies focus on enhancing domestic resource mobilization, improving fiscal governance, accountability and transparency, restoring budget credibility and raising the confidence of the private sector.

The government launched its Jobs and Industrialization Strategy in 2013 as an important initiative to diversify the economy and reduce vulnerability to mining. It is noteworthy that foreign direct investment in manufacturing surpassed mining for the first time in the past decade in 2015. This could be an indication that non-mining investors are looking to Zambia that offers, by regional

standards, a stable investor environment, according to African Economic Outlook.

Renewable Overview

As Zambia is not a producer of hydrocarbons, importing all of its crude oil needs, hydropower plays a significant role in powering the country with several hydropower facilities already contributing to the grid. There are plans for further development however which are highlighted in the Projects section. Solar, small scale and large scale, on- and off-grid, is expected to play a major role in helping the country reach its power generation goals. Studies for the potential to add wind power developments are also being undertaken, and nuclear energy is also being touted by the government as a potential solution to its power woes.

Development Partnerships

Like the majority of African nations, Zambia is under electrified with only 14% of rural citizens having access to power, and around 45% in the major cities, landing it at 26% countrywide, according to Zambia Invest, although Scaling Solar has those numbers at 3%, 25% and 22.1% respectively. In either case, a significant percentage of its 15.9 million citizens do not have access to modern power sources. To address this, the government has shown its commitment to developing a clean energy stream to power the nation. Zambia is receiving help from a number of development agencies and organizations to help it reach its goal of 100% energy access by 2030.

One of the partners it has teamed up with is the World Bank's financial arm the International Finance Corp. (IFC). In July 2015, Zambia's Industrial Development Corp. (IDC) entered into an agreement with IFC to explore the development of two large-scale solar projects under the IFC's Scaling Solar initiative, making the country the first ever to enter the program.

Its first tender under the program was a success. According to Scaling Solar, the competitive auction organized through the program attracted 48 solar power developers, seven of whom submitted final proposals, and the bids “yielded the lowest solar power tariffs in Africa to date.” In May of 2016 the government commissioned \$1.2 billion in renewable power plants to supply the country’s planned PC assembly plant and data center. The two solar power plants will add an estimated 100 MW to the country’s power generating capacity. The plants will be located in the Lusaka Multi-facility Economic Zone. An agreement for the second mandate under Scaling Solar was executed in February of this year. The new mandate will begin with an initial procurement round of up to 200 MW of utility-scale clean energy, with subsequent rounds to follow with a goal of developing 500 MW of renewable power.

One of the partners supporting Scaling Solar is the US AID Power Africa initiative, providing \$2 million in funding for the program in March 2016. Power Africa is also working on several initiatives of its own. These include providing technical assistance to the Ministry of Energy and the regulator to develop a renewable energy feed-in tariff (REFIT) and a standardized power purchase agreement (PPA) template. The first phase of the REFIT project focused on policy development, and has been completed. The policy is intended to guide and expand the role of the private sector in developing the country’s renewable energy resources and diversify the supply and nature of energy production. The second phase of the project focuses on determining the cost to the offtaker for the various renewable technologies. USAID also funded a project that assists the Zambians in addressing utility loss reduction and competitive independent power producer (IPP) procurement assessments.

Another development partner, the UK Department for International Development (DFID), signed a pact with Zambia’s Ministry of Energy in March under its Energy Africa Partnership. Under the Energy Africa Partnership Agreement, the two committed to expanding the household solar market across Zambia. Bruce Lawson-McDowall, head of the UK DFID Zambia, said that the UK is also supporting access to affordable clean energy through hydroelectric power projects such as the Western Power Ngonye Falls project in Western Province. He also stressed the need to create the right environment for effective private sector participation in the energy sector.

Hydropower

Hydropower is currently king in Zambia with just over 2,300 MW already installed according to national utility Zesco, and plenty of expansion capacity planned. Zambia and its neighbor Zimbabwe have agreed to jointly launch a mega hydropower project, the Batoka Gorge hydropower dam. The dam will have a capacity of 2,400 MW, consisting of two separate power plants, each controlled by one of the countries, with an installation cost of \$732 million per plant. The project will have an overall cost of \$6 billion, according to AfDB. These funds will be mobilized largely through debts and grants. Construction is expected to begin in early 2018, after the funds are secured, and the infrastructure is scheduled to



Zambezi River

Source: Zesco

be completed in 2023. The project will provide 6,000 indirect jobs and 1,200 permanent jobs for the infrastructure’s operation.

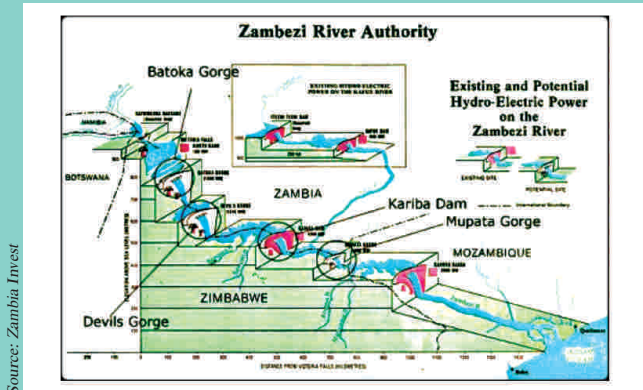
In October Zambia announced plans to start building two power generation plants that will add 550 MW to the national electricity grid once completed. One of the plants will be a 300-MW thermal power station and the other a 250-MW hydropower station, located in southern and northern Zambia respectively. Making the announcement, Zambia’s Finance Minister Felix Mutati, said that the projects would start in 2018.

Muchinga Power Company Ltd. (MPCL) said it will spend \$900 million on the development of a 330-MW hydroelectric generating station. The project, which aims to strengthen the country’s renewable energy portfolio, also includes the construction of 66 km of a 330 kV transmission line. This transport infrastructure will serve to connect the power plant to the national electricity grid. The projected power plant will have a lifetime of 20 years and could be rehabilitated at the end of this period. MPCL is a company established and owned by Lunsemfwa Hydro Power Company, Zambia’s largest independent energy producer.

“MPCL aims to develop a hydroelectric project with a capacity of between 204 MW and 330 MW on the Lunsemfwa and Mkushi rivers. The total investment will be between \$700 million and \$900 million. Energy investment is a prerequisite for industrial and commercial development in Zambia. Hydroelectric power production proves that this technology is sustainable and is being actively promoted throughout the country,” the company said in a statement. The company currently has two hydroelectric dams with a total capacity of 56 MW and plans to increase its portfolio capacity to 500 MW by 2020.

New Generation Projects – Potential Sites

- Mpata Gorge – 540 MW
- Devil’s Gorge – 500 MW
- Batoka Gorge – 1,200 MW
- Mumbotuta Falls - 300 MW
- Mambilima Falls Site I – 202 MW
- Mambilima Falls Site I – 124 MW
- Kabwelume Falls - 62 MW
- Kundabwika Falls – 101 MW
- Mutinondo - 40 MW
- Luchenene – 30 MW
- Mkushi – 65 MW



New Africa Power recently made known its plans to develop mini-hydropower plants in Zambia with a total capacity of 65 MW. A sum of \$4.6 million has already been released for infrastructure feasibility studies. These studies are expected to be completed in Q1 2018. Construction of the dams will begin in 2020. The newly formed New Africa Power is the result of cooperation between Norfund, Vineyard and Respons Ability Renewable Energy Holdings. The setting up of these infrastructures is part of the Get Fit program, which aims to enable private energy companies to set up renewable energy plants in the country. Several mini-renewable energy plants with capacities ranging from 1 MW to 20 MW will be set up as part of the program, which plans to set up 200 MW of power plants in three years.

It is also expected that in 2018, the process of selecting companies for the construction of 100 MW of mini-solar power plants in the country will be launched.

Solar Projects

In June, InfraCo Africa and Standard Microgrid signed a loan agreement for the phased disbursement of up to \$3.5 million. In parallel, the USTDA also awarded Standard Microgrid a \$750,000 grant to support project preparation services. Together, these commitments will fund the deployment of distributed solar power across Zambia. Using the loan committed by InfraCo Africa, Standard Microgrid will initially build six solar PV micro-grids in rural and peri-urban areas. Later the company will expand its distributed power service by further deploying more than 100 units. Each 10kW PV micro-grid is backed up by batteries and managed by smart metering technology which matches customer demand to available supply.

African telecoms company, MTN, is extending its partnership with energy and financial services firm Fenix International to launch pay-to-own solar home systems in the country. The Swedish Embassy in Zambia is committing nearly \$3 million to Fenix in Zambia through 2020, with USAID contributing an additional \$750,000. Fenix expects to reach 850,000 rural Zambians by 2020.

The launch in Zambia represents the first step in Fenix's expansion across Africa with their flagship product, Ready Pay Power, which provides off-grid customers access to ultra-affordable solar power. Ready Pay Power is an expandable solar home system designed to provide power to households and small businesses that the grid has failed to reach. Customers make installments of as little as \$0.20 per day via MTN Mobile Money until they have paid in full. Fenix uses these continuous micro-payments to generate a credit score, enabling customers to access additional system upgrades or financial services.

Funding from the Embassy of Sweden in Lusaka is provided as part of the Power Africa: Beyond the Grid Fund Zambia (BGFZ) initiative. This is managed by REEEP (the Renewable Energy and Energy Efficiency Partnership). BGFZ aims to bring basic clean energy access to one million Zambians and accelerate private sector growth in clean energy generation and distribution in the country. USAID's additional \$750,000 support is provided as part of its Scaling Off-Grid Energy: Grand Challenge for Development, which aims to create up to 20 million new connections in off-grid communities across Africa.

Sterling and Wilson, an engineering firm out of India, began work in August on a project to build a 54-MW solar power plant in the Kafue province of Lusaka. The solar plant's infrastructure extends over 52 hectares and is expected to be completed by the end of Q1 2018 at a cost of \$60 million.

Nuclear

December 2016 brought the announcement that Zambia plans to go nuclear, having signed a MoU with Russia to meet its ambitions. The government is planning to develop nuclear energy to power its country and the MoU is geared for Russia to help Zambia with gaining access to the technology to do so. The cooperation between the two will allow for a strategy for the development of a nuclear power plant within the next 10 to 15 years. If Zambia's plans bear fruit it could produce as much as 2 GW of electricity from the plant. Russia will assist Zambia to train young nuclear energy engineers, plan for nuclear power plant personnel, develop a nuclear energy regulator, as well as building the nuclear plant.

Outlook

The previous discussion provides highlights of the initiatives and projects underway in Zambia. While not comprehensive, it provides a clear indication that the Zambian government is serious about its renewable energy sector and is well on its way to meeting its 2030 power generation goals. Continued investment into both small- and large-scale solar and hydropower seem likely given the relatively stable and attractive investment climate the country offers. Wind power offers possibilities, but is not a concrete target at this stage. Regional initiatives are also being discussed and could see Zambia climb on board further down the road. **AEA**

NIGERIA

President: Muhammadu Buhari (since May 2015)
Independence: October 1964 (UK)
Population: 190,632,261 (2017)
GDP (purchasing power parity):
\$1.09 trillion (2016 est.)
Real GDP Growth Rate: -1.6% (2016 est.)
Per Capita GDP: \$5,900 (2016 est.)
Debt – external: \$31.41 billion (December 2016 est.)
Industrial Production Growth Rate:
-8.9% (2016 est.)
Electrification rate: 55% urban and 37% rural,
combined 45%
Electricity – installed generation capacity:
13.34 GW (2017 est.)

Source: CIA Factbook December 2017, Climatescope

Supporting one of the largest economies in Africa, the Nigerian economy still has a number of issues. In 2016, Nigeria's economy slipped into recession for the first time in more than two decades reflecting adverse economic shocks, inconsistent economic policies, and deepening security problems in the northeast and Delta regions, which played havoc with its main revenue generator – the oil sector. The country saw a moderate recovery in 2017 with real GDP projected to come in at 2.2% when official numbers are posted, backed on increased infrastructure spending and restoration of oil production to previous levels.

The government has initiated a plan for an integrated framework for development programs in the northeast through implementation of targeted social initiatives. Private investments are a key policy priority, aimed at driving economic diversification through entrepreneurship and industrialization in the lead sectors of agribusiness, manufacturing and mining.

A host of issues hinder Nigeria's economic growth including inadequate power supply, lack of infrastructure, delays in the passage of legislative reforms, an inefficient property registration system, restrictive trade policies, an inconsistent regulatory environment, a slow and ineffective judicial system, unreliable dispute resolution mechanisms, insecurity, and pervasive corruption. While President Buhari has put together a cabinet of ministers that is aimed at aiding in the move away from an oil economy, this has yet to see any economic dividends. The government is working on stronger public-private partnerships for roads, agriculture, and power. Despite the negatives, economists predict that over the medium-term Nigeria's outlook is positive, assuming oil output remains stable and oil prices keep recovering.

Renewable Sector

While Nigeria may have come to the Renewables table in earnest a bit later than its sub-Saharan African counterparts, it has made

great strides to catch up over the past few years. Nigeria is hoping to generate 40% of its power from renewable sources by 2030. Toward that goal, in November 2015 the Nigerian Electricity Regulatory Commission (NERC) approved new regulations aimed at promoting investment in renewable energy sources. The government is targeting a minimum of 2,000 MW of power generation capacity by 2020, with at least 1,000 MW coming from renewables by 2018 per the new regulations. The regulation stipulates that the capacity for a renewable plant should be between 1 MW and 30 MW and any plant above this level is likely to require additional conditions other than those already specified in the regulation. For large renewable projects, those above 30 MW, integrated resource planning will be carried out before the NERC will initiate a competitive bid process.

Taking another step to solidify its commitment, Nigeria launched its renewable energy organization in November 2016. The Renewable Energy Association of Nigeria (REAN) was launched as an umbrella association for organizations working within the country's renewable sector. The association includes members that manufacture, install, maintain, sell and finance an array of renewable energy solutions. In April REAN called on the government to abolish the VAT on all Distributed Renewable Energy Products (DREP) in the country. Segun Adaju, president of REAN, in a statement said zero VAT would help accelerate growth of Nigeria's renewable market. While the government has approved a reduction on import duties on items in various sectors and a zero import duty for machinery and equipment used in some sectors like the power sector, items used in the renewable energy sector are still subject to import duties. Adaju said zero VAT for DREP like batteries, charge controllers, inverters and the implementation of the approved low tariff on other renewable components would promote in-country assembly of DREP in Nigeria.

Africa Spotlight

Project Overview

Solar

Since the new regulations were published and REAN established, a plethora of renewable energy projects have spread across the country. Like most African countries, solar is the star of new developments while hydropower still has a large role to play and is seeing a steady stream of investment. In November, Nigeria's first Building Energy Efficiency Code (BEEC) was officially launched by the Federal Ministry for Power, Works and Housing. The BEEC is a set of minimum standards for energy efficient building in the country and should serve as another sub-sector for growth in the renewables space.

Pay-as-You-Go solar programs have spread rapidly across Africa's most populous nation where about 100 million people lack access to basic modern electricity. One such project is the Lumos Mobile Electricity Service. In November it was announced that it had



Source: Lumos

deployed its 60,000th Y'ello Box in the country. The Y'ello Box is an at-home solar electricity device that lets users gain access to reliable electricity at an affordable price. The Lumos service is combining the power of the sun and an MTN mobile phone to bring a new type of power to Nigeria. This significant milestone means more than 300,000 people right across Nigeria are now benefitting from affordable, reliable, clean electricity. Lumos Mobile Electricity Service operates in partnership with MTN. Once MTN customers have joined the service, they pay their monthly subscription fee for power from their MTN's mobile phones air account by texting a simple code. There's no need for mobile money, bank accounts or expensive machines.

Another service is offered by Azuri and Niger Delta Power Holding Company (NDPHC) who teamed up to bring power and jobs to rural households in Nigeria's Niger Delta. The partnership announced its initial launch of its PayGo Solar Home Systems in Nigeria, to deliver affordable, clean energy to 20,000 rural households in February. Azuri's PayGo Solar Home systems have the capacity to power four LED bulbs providing up to eight hours of lighting, a radio, and a USB port with charging cables for mobile phones. Customers pay the monthly top-up rate via mobile money for 36 months after which time the unit can be unlocked and the customer owns the unit. Customers will also be provided with options to upgrade to a larger system in what Azuri describes as its energy escalator pathway.

NDPHC is a government-funded initiative formed to add new capacity to Nigeria's electricity supply system. Azuri's partnership with NDPHC also highlights the Nigerian government's efforts to support the roll out of off-grid solar systems and its commitment to renewable technologies as a sustainable way to generate electricity for rural communities. Following this launch, NDPHC, through

the project, plans to start a phased rollout in northern Nigeria, followed by a nationwide deployment, targeting the 70 million Nigerians living in off-grid communities. The deployment of 20,000 Azuri solar home systems is expected to create 500 direct jobs, including solar installer and agents (for a minimum of 24 months) and 5,000 indirect jobs.

Small- to large-scale solar programs are being deployed or under consideration as well. Wärtsilä received a letter of award for a 95.3MWp (75MWac) solar PV power plant. The award comes from Pan Africa Solar Ltd. and will be Wärtsilä's first utility-scale solar PV project exclusively for an on-grid application. When operational, the plant will be the largest in Nigeria; and one of the largest on the continent. The 75-MWac output to the grid is expected to serve approximately 1.1 million households with electricity. It will be a major contributor of economic benefits to the local communities in Katsina State, in northern Nigeria. The technology includes photovoltaic modules with single-axis trackers, optimizing the energy yield produced by the plant.

It was announced in March that three Nigerian states will see new solar plants built through an investment by GreenWish Partners. The three states are Kaduna and Jigawa in the north and Enugu in the southeastern part of the country. GreenWish Partners will invest \$280 million toward the construction of the three plants. The plants are expected to produce electricity starting in Q1 2018. The deal falls under a framework to accommodate solar power producers that was introduced last year aimed at attracting more alternative energy investment into the country. Under the new framework GreenWish signed a power purchase agreement with Nigerian Bulk Electricity Trading Plc (NBET), which allows for GreenWish to sell to the national grid.

In April five Nigerian states signed a partnership agreement with GreenElec for the installation of mini-solar power plants. The five states are Kaduna, Imo, Rivers, Delta, and Ogun. The initiative will make the populations of these states less dependent on the national network, in addition to boosting the country's energy mix. GreenElec President Marvel Hochet said, "Surveys conducted by GreenElec show that an average community has 5,000 inhabitants and requires two mini-solar power plants. In addition, an average household has five people, and when we divide by 5,000 people we have 1,000 households. So a mini-plant will serve 500 homes, two of which will serve 1,000."

Meanwhile, rooftop solar is set to take hold in Nigeria as well. Soventix out of Germany and Gentec EPC, formed a JV dubbed Soventix Hybrid Ltd.. The JV will at first focus on industrial rooftop solar applications that will synchronize with existing generators or grid power systems. This will allow industries to have additional sources of power generation at a lower price and at the same time reduce emissions significantly. Phase 2 would also aim to develop national solar parks.

Hydropower

If plans come to fruition, Nigeria will see a massive hydropower plant constructed. The China Civil Engineering Construction Corp. (CCECC) recently said it will build a 3,050-MW hydroelectric plant in the Mambila region of eastern Nigeria. With a total cost

Source: Unsplash



Mabdila region set to host mega hydro dam

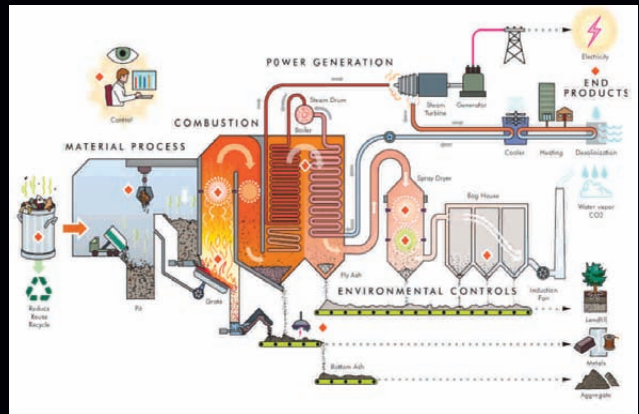
of \$5.8-billion, the project will last six years and will be 85% financed by the Export-Import Bank of China (Eximbank China) and the Nigerian government will contribute the remaining funds. Babatunde Fashola, Minister of Energy, Works and Housing said, “The scope of the work is very broad. The project will require the construction of 700 km of electric transmission lines. It also includes the construction of four dams of which one is 150 meters high, two 70 meters and one 50 meters.”

A couple of the country’s existing hydropower facilities were set to see some refurbishment over 2017 and into 2018. The AfDB in December 2016 issued \$100 million in funds to support the country’s expansion of its power sector. The facility consists of \$80 million in loans and \$20 million of the bank’s own funds. The funds will be used to rehabilitate two of Nigeria’s hydropower dams, the Kainji and the Jebba. Rehabilitation of the dams will increase power output, which is currently 917 MW. According to reports, once the project is complete the dams will add 1,338.4 MW of power to the national grid.

Another hydropower ambition was announced by GE in May. GE is looking to expand its participation in Africa’s hydroelectric power generation sector. The company aims to increase the hydroelectric capacity of the continent of 29 GW. Nigeria’s share is tagged at 2 GW. The company plans to implement the newly developed digital hydroelectric power plant technology in these new projects.

Other Alternatives

Solar and hydro are not the only renewable projects Nigeria has on its books. NNPC, Nigeria’s state-run oil firm, signed a MoU with the Kebbi state government (KBSG) to build a bioethanol plant. The plant is expected to use cassava and sugarcane as its feedstock. According to a statement from NNPC, the plant will have a capacity to produce 84 million liters of bioethanol per year. The Nigerian government is investing in biofuels as it reduces its dependence on oil and diversifies its economy.



Waste to energy process

Source: Delatway Energy

Several waste-to-energy (W2E) projects are being implemented or under consideration throughout the country. Green Rhino Energy says it is developing a W2E project in Nigeria. When implemented, it will consume 600 tons of waste per day and convert it into around 1 GWh per day of electricity. The municipality is both the guarantor of waste supply and the oftaker of electricity, which is being fed into the distribution network, which is owned by the municipality. The Lagos State Waste Management Authority has been undertaking various W2E projects since 2012. Currently a partnership (including academia, private and public sectors) is looking into the feasibility of processing liquid fuel (biofuel) from waste plastic materials.

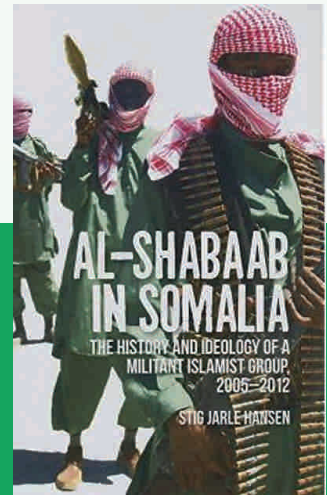
Then there are the country’s nuclear ambitions. Russia and Nigeria signed a contract for the construction and operation of nuclear power plants in November, according to a Bloomberg report. The agreement with Russia includes, among other things, conducting feasibility studies including the study of the sites of implantation, the evaluation of the capacities, the financing and the establishment of a schedule for the implementation of the project. The signing of this new agreement comes to materialize the intergovernmental agreements concluded in 2009 by the two countries in order to proceed to a peaceful use of nuclear power. In 2015, the Nigeria Atomic Energy Commission had discussed the establishment of four plants at an estimated cost of about \$20 billion.

Outlook

With Nigeria’s severe power deficits, any and all alternative forms of energy are welcome and are already showing tangible results. The current administration appears committed to bringing power to the country at an accelerated rate and renewable energy is set to play a starring role alongside natural gas. As long as the country can maintain stability and keep the Niger Delta calm, and the Boko Haram contingent in the north under relative wraps, investment should flow from all of the agencies that are focused on developing the renewable energy sectors in sub-Saharan Africa. **AEA**

The Past, Present, and Future of Somalia

Al-Shabaab in Somalia: The History and Ideology of a Militant Islamist Group
Stig Jarle Hansen
Oxford University Press
2016



Just when it begins to look like Somalia has turned the corner, something terrible inevitably happens. Over the last decade, many of the terrible things that happen in Somalia can be directly linked to home-grown armed Islamist group Al-Shabaab.

The self-proclaimed East African branch of Al Qaida has been in the headlines since 2007, when it emerged following the collapse of the Islamic Courts Union. The Union was an affiliation of Islamists who tried to bring order to Somalia by implementing sharia law. It worked, at least for a while.

When the Islamic Courts fell apart in the face of pressure from regional powers, it not only created a power vacuum, but it also meant that enterprising jihadists were forced to find another outlet for their activities. Al-Shabaab fit the bill, and a decade later the group remains a major player in Somali politics.

How major? In November, the United States’ military announced that there are now more than 500 US troops on the ground in Somalia. The US Africa Command claims they have launched 28 airstrikes in Somalia this year, mostly from drones. Al-Shabaab is the reason for both the soldiers and the airstrikes.

While the United States, and indeed most of the world, has long considered Al-Shabaab the most significant terrorist threat in East Africa, the ramping up of drone strikes and the boost in the troop deployment indicates Washington is increasingly worried about the

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In October, a truck bombing in Mogadishu killed over 300 people, and according to a UN report the group has recently mastered new bomb-making technology that allows it to make even more devastating vehicle-borne explosives.

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Source: Nathaniel Feitch

Al-Shabaab must be stopped to protect the innocent Somali children

group. At least some of that concern stems from a series of dramatic attacks staged by Al-Shabaab recently. In October, a truck bombing in Mogadishu killed over 300 people, and according to a UN report the group has recently mastered new bomb-making technology that allows it to make even more devastating vehicle-borne explosives.

All of this has some wondering if the fighting in Somalia may be set to escalate, and whether an escalation is the best way to put the country on the track to stability. After all, while Somalia is not a rich country by any measurement, peace and stability will undoubtedly promote prosperity. Even before Somalia descended into chaos in the early 1990s there were oil companies interested in exploring the country’s coastal littoral, and the emergence of East Africa as an important frontier for oil and gas has done little to diminish interest in the country. Still, Al-Shabaab remains a major hurdle to doing serious business in Somalia. Does the increasing U.S. involvement bode well or ill?

Short of looking into a crystal ball, the next best place to find an answer to this question might be in Stig Jarle Hansen’s book “Al-Shabaab in Somalia: The History and Ideology of a Militant Islamist Group.” First

published in 2013 and then updated in 2016, “Al-Shabaab in Somalia” was the first book-length look at the foundation and structure of the militant group, and it remains the best.

Hansen is uniquely positioned to discuss Al-Shabaab. An associate professor at the University of Life Sciences in Oslo, he speaks Somali, Swahili and Arabic. More importantly, he is a keen observer and researcher who eschews easy answers and expertly describes the group in all its complexity. Often Al-Shabaab is discussed in the international press as either a purely local Somali group or a cog in the increasingly internationalized business of armed jihad. However, Hansen does an excellent job of showing how the movement is a complicated combination of the two, revealing how the group uses a combination of local and international grievances to mobilize its membership.

While the author extensively uses sources from popular media as part of his research, he manages to go well beyond the headlines by including information and interviews with Al-Shabaab leaders. His willingness to put his own boots on the ground in Somalia and meet with movers and shakers within the organization means that he is able to cut through many of the usual biases that color coverage of the Al-Shabaab. He also relies heavily on material produced by Al-Shabaab itself, including news from its propaganda arm, websites sympathetic to the group, and even YouTube clips posted by the militants.

What emerges is a portrait of an Islamist militant group that often employs rhetoric common to international jihadist organizations but still has a firm grounding in Somali culture and politics. In fact, Hansen shows again and again that an understanding of Al-Shabaab cannot be separated from an understanding of Somali clan structures. While this could make for a messy and unnecessarily complicated book in another author’s hands, Hansen avoids getting bogged down in the intricacies of Somali cultural norms. He provides readers with just enough background to forge a basic understanding.

The result is the story about what can only be described as a remarkable organization. While Al-Shabaab is generally considered East Africa’s public enemy number one, it has an admirable knack for survival. Somali warlords, the Ethiopian army, the Kenyan army, African Union troops, and American special forces have all fought against Al-Shabaab, but none of them have succeeded in eradicating the group.

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Even before Somalia descended into chaos in the early 1990s there were oil companies interested in exploring the country’s coastal littoral, and the emergence of East Africa as an important frontier for oil and gas has done little to diminish interest in the country. Still, Al-Shabaab remains a major hurdle to doing serious business in Somalia.

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The story of how Al-Shabaab has staved off complete collapse is perhaps the most interesting aspect of Hansen’s book. Although Al-Shabaab has only existed as a formal organization for a little more than a decade, it has seen dramatic ups and downs. From a membership of only 33 in 2005, it became arguably the strongest force in Somalia around 2006 during the height of the Islamic Courts’ power. By 2007 an Ethiopian invasion of the country had killed many prominent Al-Shabaab leaders and the groups’ power collapsed. Then a resurgent Al-Shabaab reemerged yet again as the strongest force in the country, gobbling up territory across southern Somalia. Ethiopian, Kenyan, and African Union forces, supported by western powers, subsequently took back the territory, but Al-Shabaab remains a prominent thorn in the side of its enemies.

But, as Hansen notes, the movement has its internal weaknesses and divisions. Disgruntled members are kept from leaving through intimidation and threats, and internal power struggles have characterized the group. In fact, the internal politics of Al-Shabaab are much more interesting than their ideology. One cannot help think that a canny exploitation of these divisions may be as effective as boots on the ground.

In short, while putting military pressure on Al-Shabaab is likely an important part of dismantling the organization, playing smart politics could be equally important. The movement’s political strengths and weaknesses are well described in “Al-Shabaab in Somalia,” making Hansen’s book required reading for anyone with an interest in seeing how the latest escalation in fighting in Somalia plays out. [AEA](#)

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ITFC Signs Financing Agreement with Senelec

The International Islamic Trade Finance Corporation (ITFC) signed a €110.5-million Murabaha Financing Agreement (CFA Franc 72.5 billion) with Senegal's state-run utility, Senelec. The financing agreement will aid Senelec in meeting its country's energy needs through power system efficiency.



Hani Salem Sonbol

The agreement was signed by Hani Salem Sonbol, CEO, ITFC, and Mr. Mouhamadou Makhtar Cissé, CEO, Senelec. Sonbol said after signing the agreement, "The operation will contribute to secure the supply of petroleum products for electricity generation and power plants in the country, and therefore support its economic development. Moreover, the financing is expected to help improve people's living conditions in Senegal."

FMO and Access Power Launch Shark Tank Competition

FMO and Access Power launched the 2018 FMO Access Power Solar 'Shark Tank' competition following the competition's successful first installment in 2016 at the 'Making Solar Bankable' conference. The initiative is aimed at helping local solar power developers that require development support to make their innovative solar projects more impactful.

In order to be considered for the grant, the proposed projects must be located in Asia, Africa or Latin America and be based on solar PV technology. They should also meet the capacity criterion of 10 MW or more, and be at an advanced stage of development (preliminary feasibility studies should have been completed). Furthermore, eligible projects should have an innovative or impactful angle to the project that can be developed with support of the grant.

Proposals will be screened and scored by a pre-selection committee assembled by FMO and Access Power. Four shortlisted finalists will be invited to present their projects and answer questions from a panel of judges in front of a live audience on February 15, 2018 during the second edition of the 'Making Solar Bankable' conference, co-organized by FMO

and Solarplaza in Amsterdam, Holland on February 15 and 16. The winning project will be announced at the end of the session during the event.

The winner will receive a \$100,000 grant towards the development costs of their project from FMO and Access Power. In addition to that, Access Power will pre-qualify the winning proposal of the Solar Shark Tank competition for the 2018 edition of the Access Co-Development Facility (ACF) competition, subject to meeting ACF qualification requirements. Access Power will provide the ACF winner with technical support, financial structuring and development process management.

Sparrows Group Acquires Alpha Offshore Service

Sparrows Group announced its acquisition of Danish wind energy specialist Alpha Offshore Service A/S. Already a supplier of capital equipment to the wind energy industry, the deal significantly strengthens the group's operations and maintenance capabilities in the sector. Alpha Offshore provides engineering personnel and inspection services to the energy industry, specializing in the delivery of operations and maintenance, and supervisory and commissioning services to onshore and offshore wind developments.

The company will continue to be run under the same management as a separate entity within the Sparrows Group, ensuring operational consistency while also providing them with access to a wider pool of expertise and resources.

Sparrows' engineering and design capability in structural, mechanical, electrical, hydraulic and reliability disciplines, combined with their extensive global network will enhance Alpha's existing capability and international presence. In addition to renewables, the acquisition bolsters the diversity of Sparrows' existing technical capability across the oil and gas and industrial sectors.

New Energy Minister for Mozambique

Mozambique has a new energy minister as the country's president, Filipe Nyusi, sacked the heads of four ministries. Ernesto Max Elias Tonela has been appointed to replace Leticia da Silva Klemens as minister of energy and mineral resources.

The country's new energy minister is an economist by training and previously served as commerce minister. Tonela has also worked

previously on the board of the Hidroelectrica de Cahora Bassa (HCB), the company responsible for Mozambique's 2,000 MW hydroelectric dam.

Nyusi's offices said Jose Condugua Antonio Pacheco was named the new foreign minister, replacing Oldemiro Baloi. The president also replaced the ministers of industry and trade and of agriculture and food security.

AfDB Launches Youth Advisory Group to Create 25 Million Jobs

The President of the African Development Bank Group (AfDB), Akinwumi Adesina, has launched the Presidential Youth Advisory Group (PYAG) to provide insights and innovative solutions for job creation for Africa's youth, as outlined in the Bank's Jobs for Youth in Africa Strategy (JfYA).



Akinwumi Adesina

The Jobs for Youth in Africa initiative aims to create 25 million jobs and benefit 50 million youth over the next 10 years by equipping them with the right skills to get decent and meaningful jobs. It is currently the largest effort going on for youth employment in Africa today.

The advisory group, inaugurated on the sidelines of the 6th EU-Africa Business Forum in Abidjan on November 27, will work with the Bank to create jobs for Africa's youth.

"This is a huge opportunity for Africa. If we fix the youth unemployment challenge, Africa will gain 10-20% annual growth. That means Africa's GDP will grow by \$500 billion per year for the next 30 years. Africa's per capita income will rise by 55% every year to the year 2050," Adesina said at the inauguration of the Group.

Total and EREN RE Receive Green Light

Total and EREN Renewable Energy (EREN RE) received approval from the relevant authorities to finalize their strategic agreement signed in September 2017. As of December 1, Total has become an indirect shareholder of EREN RE with an indirect interest of 23%. EREN RE has changed its name to Total Eren as of the same date.

Following the approval of the transaction by the French Competition Authority on

November 23, along with the consent of all the involved stakeholders on December 1, the administrative requirements necessary for the strategic agreement to proceed were met according to schedule.

Present on five continents, Total Eren's aim is to achieve a global installed capacity of more than 3 GW by 2022 and the capital increase subscribed by Total represents an important milestone towards the achievement of this objective. Following this five-year period, the agreement will provide Total with the opportunity to take control of Total Eren.

Total's stake in Total Eren complements the Total Group's portfolio of renewable energy businesses. In particular, Total Eren allows Total to enter the wind power generation segment. Regarding the development of its solar farm business, Total Eren's strategic priority is to focus on emerging countries where the demand for electricity is growing.

Engie Acquires South African Companies

Engie reached an agreement with two South African energy services companies, Thermaire Investments (Pty) Ltd. and Ampair, to acquire 100% of their respective shares. Together, both companies employ more than 500 people across South Africa, Botswana and Mozambique, and are major players in the HVAC installation and service segment in their respective markets.

Jointly, the acquired companies will form the largest South African HVAC contractor with a strong capacity to export its skills cross-border and into the greater Southern African region.

"We are proud of this first step in the business to business market and excited about jointly exploring further opportunities in the region," says Mohamed Hoosen, CEO of Engie Southern Africa.

As a global energy company and expert operator in Renewables and Energy Storage, Lighting, Heating and Cooling

Systems, and Energy Management and Controls, Engie is embarking on an acquisition strategy to grow its presence in the African market.

Egypt to Set up Nuclear Regulatory Body

Egypt is set to establish a nuclear power industry regulatory agency in early 2018, according to reports out of the Ministry of Electricity and Renewable Energy. According to an *Al Mal News* report the nuclear power regulator would be responsible for supervising the construction of Al Dabaa nuclear power plant, until it is handed over to the nuclear power plants authority.

Laws required establishing the nuclear plant have already been finalized by the ministry. Egyptian Parliament approved three laws governing nuclear regulation and usage in late November, an *Ahram Online* report said.

The regulation laws, if approved by the president, will establish two authorities to regulate the usage of nuclear power, according to the report.

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Industry First for Offshore Wind

Ampelmann, a global leader in offshore access solutions, has created, in cooperation with Seaway Heavy Lifting, an industry first innovation allowing workers safe and efficient access to install the jackets for 84 wind turbines on the Beatrice Offshore Windfarm Limited project in the Outer Moray Firth.

Global offshore contractor Seaway Heavy Lifting awarded the EPCI contract to Ampelmann to design and create an Angular Boom Tip. This will allow secure connection at difficult angles for safe gangway transfer between the 5,000-tonne heavy lift vessel (HLV) *Oleg Strashnov* and the 2,500-ton HLV *Stanislav Yudin* to install 84 individual wind turbines.

Conventional gangway tips are rounded which can fit on the majority of offshore wind turbines or offshore assets. However, due to the size of the HLV, its close proximity to the jackets and the location of its access gates, Ampelmann custom-made the V-shaped tip at the end of the 25-meter gangway to give workers easy access to build and manage each new wind structure.

Friso Talsma, Ampelmann's Manager Sales and Business Development for Offshore Wind said: "Though the tip is a quite a



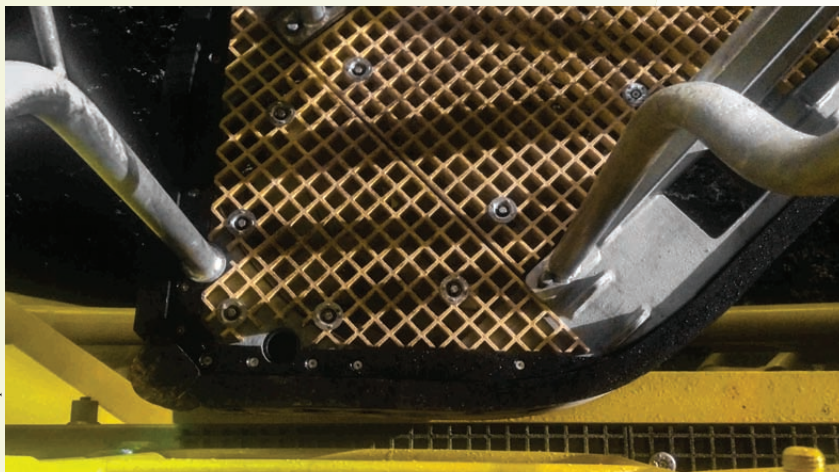
Source: Ampelmann

straightforward piece of steel, the rubber covered angular shape now allows us to land at difficult angles as small as 45 degrees, while eliminating the risk of gaps between gangway and structure. It's a new innovation, tailor-made for this particular project and overcomes a significant safety and potentially costly challenge faced by the operators to ensure safe access to the structures. It's an industry first and no other competitor has such a solution."

The design, development and installation of the detachable tip took around two months and is deployed on the Beatrice project using the company's A-type motion compensated gangway system which is able to transfer people with zero movement in significant wave heights of up to three meters.

Talsma continued: "This type of solution can also be adopted by the oil and gas industry in certain situations. For example, if the type of angles change, the tip can be adapted to suit and solve that problem or a new bespoke version created. Ampelmann is always open and flexible to finding solutions for our customers. No is never the answer. We have so much experience of Walk to Work in the offshore industry that we are fully aware of the challenges and the potential solutions."

The Beatrice Offshore Windfarm Limited Project is expected to power approximately 450,000 homes, around three times the number of homes in the Moray and Highland regions of Scotland. Offshore construction began in 2017 and is expected to become fully operational in 2019.



Source: Ampelmann

Biogas Mixing Pump Sets New Standards

The NEMO[®]B.Max[®] progressing cavity pump made by NETZSCH presents itself as the feeding technology which is perfectly tailored to biogas applications. Solids from the dosing unit are mixed with recirculated substances in

the mixing pump. The homogeneous mixture with a dry matter content of up to 25% is then conveyed to the fermenter. The NEMO[®]B.Max[®] provides twofold assurance of optimum product feed into the conveying

chamber: its pump housing is fitted with a large, rectangular feed hopper and removable, conically shaped compression chamber, as well as a coupling rod with patented, horizontally positioned conveying screw. This

conveys quantities of up to 75 m³/h at pressures of up to 48 bar. Ideal feeding and mixing of the substrates into the biomass are ensured by the spiral lobes of the mixing and screw conveyor, which have been strengthened and offset. This not only prevents bridging, but also leads to optimum mixing of the liquid phase and dry substrate in the hopper chamber. At the same time, the feed tube, installed on the hopper housing contra to the flow direction of the pump, also ensures improved substrate mixing – which means a higher gas yield as well.

NETZSCH designers have achieved compact dimensioning, low overall weight and constant shaft height, irrespective of the design and size of the drive, by flanging the drive directly to the pump's lantern. The system can be flexibly adjusted to the dosage unit in each case through



Source: NETZSCH

the various hopper lengths on offer. Numerous inspection openings in the hopper and compression chamber of the NEMO[®]B.Max[®] make it easier for operators to carry out inspection and maintenance. In the event of the pipework getting clogged up, the NETZSCH mixing pump has no problem flushing this out with a pressure of up to 12 bar, as the NEMO[®]B.Max[®], with its two-stage construction, is also designed for high back pressures. The speed can be adjusted on

the NEMO[®]B.Max[®] using a frequency inverter. This means the system can be flexibly adjusted to suit various raw materials, the mix ratio of the substrate and feed times.

The NEMO[®]B.Max[®] is particularly well suited to fermented, renewable raw materials, macerated biological waste, food waste and sugar beet, co-substrates, whole plant, maize and grass silage, solid manure, dry chicken manure and liquid manure.

WindGEMINI Turbine Tracker Debuts

DNV GL, an independent energy advisory and certification body, has launched WindGEMINI, its first online digital twin online tool giving wind farm owners and operators advanced insights into turbine condition and performance, enabling better informed wind operation decisions.

The WindGEMINI framework is based on digital twin technology, equipping users with digital copies of their wind turbines which are continuously updated in real-time, making use of the stream of information received from turbines and wind farm sensors, to reflect the real conditions experienced by the turbines on site.



Source: DNV GL

WindGEMINI gives owners and operators 24/7 access to key metrics and advanced analysis to understand the performance, condition and remaining life of a turbine and its components. This knowledge can be used to optimize servicing, inspections and plan repairs or replacements, thus minimizing downtime and lost revenue, as well as informing financial modelling and strategic decision-making processes.

WindGEMINI is built on DNV GL's 25 years of wind turbine design experience and on the analysis of more than 50 GW of global onshore and offshore wind plants. It gives owners and operators an easy, accessible way to unlock the value within their data and can be utilized across the entire portfolio, as it is compatible with any turbine model.

Operational benefits and applications of WindGEMINI include:

- A turbine life estimator uses aeroelastic modelling to estimate the effect of site conditions on the fatigue accumulation of the main structural components. It provides an estimate of the remaining life of a turbine which can be used to identify opportunities to extend life or upgrade turbines.
- Predictive analysis of the turbine drivetrain identifies patterns indicative of incipient failure modes and raises alerts with varying confidence levels. This information can be used by owners and operators to avoid failures, optimize inspections and reduce downtime.
- A power curve performance watchdog identifies shifts in the turbine power curves and sub-optimal control modes, so that they

can be corrected to regain any potential energy losses.

- Structural integrity monitoring uses high-frequency data to identify issues, such as rotor imbalance and foundation degradation, which can have adverse effects on energy capture and turbine life.

Prajeev Rasiah, Executive Vice President, for DNV GL's energy business in Northern Europe, Middle East & Africa, said, "As the wind industry matures, there is constant pressure to reduce costs and increase revenue, and grid operators no longer tolerate downtime and under performance. WindGEMINI is part of DNV GL's drive towards a more digital future and, as a leading independent advisor to the renewables industry, builds on our expertise of leveraging technology to drive down cost of energy."

6.2-MW Biogas Project Designed for Sustainable Growth

The German plant manufacturer WELTEC BIOPOWER recently signed the contract for a biogas plant extension of the milk powder producer Estancias del Lago (EDL) in Uruguay. From late 2018, the plant with its eight digesters will generate a rated thermal input of more than 6 MW from cattle manure and fodder leftovers. The company will use the biogas for drying and steam generation purposes in the production process.

Founded in 2007, the agricultural company EDL now farms an area of about 37,000 ha. On this area, the South Americans grow maize, sorghum and soya as feed for their approximately 14,000 dairy cows. The company foundation was accompanied by the establishment of a huge site in Durazno, north of the capital Montevideo. Apart from the cowsheds with milking centers and feed silos as well as the biogas plant, the premises now hosts a dairy and a grain mill. In Durazno, Estancias del Lago produces about 20,000 tons of milk powder a year for export. Most of the milk solids are sold to China, Brazil and the Middle East.

In 2013, WELTEC had set up the first 800-kW biogas plant for EDL. Back then, expansion plans were already being considered. First, however, more cattle were needed. In the meantime, the number has therefore been stocked up from 8,000 to 14,000 cows. Now, 1,365 tons of cattle manure plus 8.4 tons of feed leftovers are available for the energy generation.

In view of the dimensions of the AD plant, the structural preparations already started in September 2017. In early 2018, WELTEC BIOPOWER will begin installing the six new 5,000-m³ stainless-steel digesters and the two



Source: WELTEC BIOPOWER

1,050-m³ pre-storage tanks for the slurry. With WELTEC's custom-developed process control system CeMOS, the entire biogas plant will be fully automated from the end of 2018.

“As was the case back in 2013, the main reasons why the company opted for us were the high requirement profile and quality standard” explains Jens Albartus, Director of WELTEC BIOPOWER. For the plant expansion, the customer thus again wants to make use of stainless steel. “We wanted to work with an experienced manufacturer with industrial expertise,” explains Franz Cifuentes, Director of EDL. Equipped with experience gained in the construction of large biomethane parks such as the one in Könnern, Germany, WELTEC is in charge of the entire building site management in Durazno, including the ancillary work.

Two gas boilers use part of the 30,000 standard m³ of biogas that is produced every day to generate heat for the biogas process. Most of

the biogas is transferred to the close-by milk powder production facility via a pipeline. The biogas covers up to 35% of the heat required for the drying process and 100% of the steam needed is generated with biogas.

All operational units of the entire site are run in a very sustainable way. EDL contributes to this by growing its own fodder. The digestate from the biogas plant is used as fertilizer. Moreover, the cycle is closed by raising its own dairy cows and processing the milk on site. At the facilities located just 150 meters from the cowsheds, the milk is processed to powder within four to eight hours. Another synergy has been established between EDL's fuel production and other parts of the business: Apart from soya oil for the biodiesel plant, the oil mill yields press cake that is fed to the animals.

By means of plant extension, EDL can use its huge supply of raw material to establish a smart synergy between its agricultural and industrial operations. This is exemplary especially in view of the fact that this strategy is pursued throughout the country. Meanwhile, energy efficiency and renewable energies are the main drivers of the diversification of Uruguay's energy mix. The efforts are promoted by progressive environmental laws. In relation to the share of the primary energy, renewable energies already accounted for 57% in 2017. To further boost this share, the government in Montevideo has formulated the goal of using a growing portion of the agricultural leftovers for the generation of energy. The project Estancias del Lago is a fine example of how this can be achieved.



Source: WELTEC BIOPOWER

Conferences

View news items in their entirety at www.AE-Africa.com

December 2017

6-7	Energy from Waste 2017	London, UK	www.efw-event.com
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January 2018

24-25	Regional Energy Cooperation Summit	Abidjan, Cote d'Ivoire	www.regional-energy-cooperation-summit.com
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February 2018

14-15	Saudi Renewable Energy Conference	Riyadh, KSA	www.renewableenergyksa.com
23-25	East Africa Energy & Infrastructure Summit	Kampala, Uganda	www.energynet.co.uk
23-25	The 2nd Africa Energy Forum: Off the Grid	Kampala, Uganda	www.aef-offgrid.com
28-Mar 2	Powering Africa Summit	Washington D.C. USA	www.poweringafrica-summit.com

March 2018

7-9	West Africa Power Summit 2018	Dakar, Senegal	www.wafpower.com
13-14	SPACE – Efficient Properties. Maximizing Investments	Nairobi, Kenya	www.space-conference.com

April 2018

17-17	Green Business Summit	Abu Dhabi, UAE	www.events.economist.com
17-18	Egypt Solar Energy Forum 2018	Cairo, Egypt	www.solarforumegypt.com
25-26	Mozambique Mining, Oil & Gas and Energy Conference and Exhibition (MMEC 2018)	Maputo, Mozambique	www.ametrade.org

May 2018

2-4	ICCI Powered by POWER-GEN	Istanbul, Turkey	www.icci.com.tr
9-10	North Africa Renewable Energy Summit 2018	Casablanca, Morocco	www.moroccorenewable.org

June 2018

19-22	Africa Energy Forum	Le Morne, Mauritius	www.africa-energy-forum.com
21-22	8th Zambia International Mining and Energy Conference & Exhibition	Lusaka, Zambia	www.ametrade.org
26-27	Manufacturing Indaba	Ekurhuleni, South Africa	www.manufacturingindaba.co.za

July 2018

17-19	POWER-GEN & DistribuTECH Africa	Johannesburg, South Africa	www.powergenafrika.com
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August 2018

16-18	Asia (Guangzhou) Battery Sourcing Fair	Guangzhou, China	www.battery-expo.com
16-18	10th Guangzhou International Solar Photovoltaic Exhibition 2018	Guangzhou, China	www.pvguangzhou.com

November 2018

6-8	5th Senegal International Mining Conference & Exhibition (SIM SENEGAL 2018)	Dakar, Senegal	www.ametrade.org
30-Dec 1	Africa Renewable Energy Forum	Casablanca, Morocco	www.africa-renewable-energy-forum.com

Please check with organizers directly to confirm information as dates and venues are subject to change.



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