
BRIGHTENING AFRICA'S PROSPECTS

STRIVING TOWARD UNIVERSAL ENERGY
ACCESS ACROSS THE CONTINENT



IN AFRICA
ON

IOA

Connecting Africa's Potential

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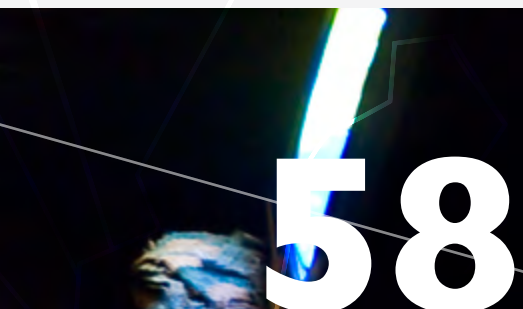
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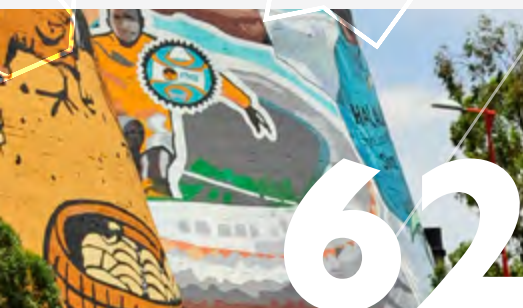
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CONTINENTAL OVERVIEW

The progression of Africa's energy development

Current status of energy in Africa

Despite rapid economic growth on the continent since 2000, Sub-Saharan Africa (SSA) is still the most energy-poor region in the world – with an estimated 620 million people without electricity, there is still a lot that needs to be done. Despite accounting for 13% of the global population, SSA only produces 4% of the global energy supply. To provide some context, in 2012 power generation on the continent stood at 90GW, with roughly half coming from one country – South Africa. By comparison, Germany, alone, has installed a generation capacity close to 200GW as of 2016 – double 2002 levels of 100GW.

Key reasons for the lack of electrification around the continent stem from unreliable and, to a certain extent, inaccessible grids. In 2012 just over 35% of SSA had access to electricity.

This figure is considerably distorted between urban and rural settings; though about 70% of urban SSA has access to electricity, only 15% of its rural counterparts enjoy the same luxury.

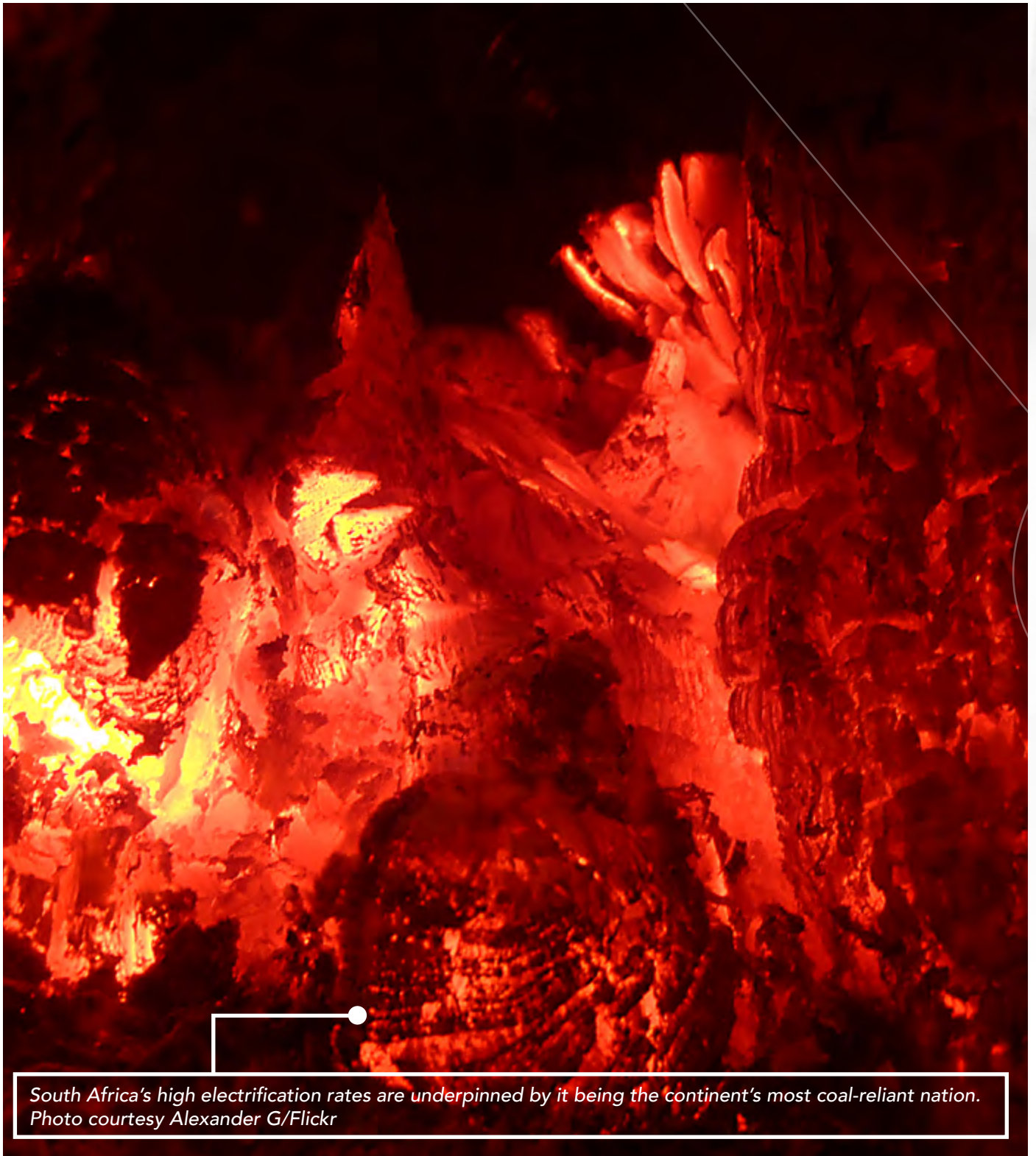


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*A composite night time view of earth from space shows a vast disparity in electrification by region.
Photo courtesy NASA Goddard Space Flight Centre (GSFC)/
Flickr*

For the, generally, electrified urban centres as well as peripheries, fossil fuels are a core energy derivative. Oil, gas and coal accounted for nearly two-thirds (65%) of electricity production in 2013. Countries such as South Africa and Nigeria are the largest consumers of fossil fuels with coal being the primary contributor in South Africa and gas in Nigeria. In both cases, electricity generated from fossil fuels accounted for 94% and 81% of total energy generation, respectively. Countries in North Africa are also heavily dependent on fossil fuels with Algeria, Tunisia, Egypt and Libya being almost entirely dependent on such fuels for energy generation.

“Despite accounting for 13% of the global population, Sub-Saharan Africa only produces 4% of the global energy supply.”

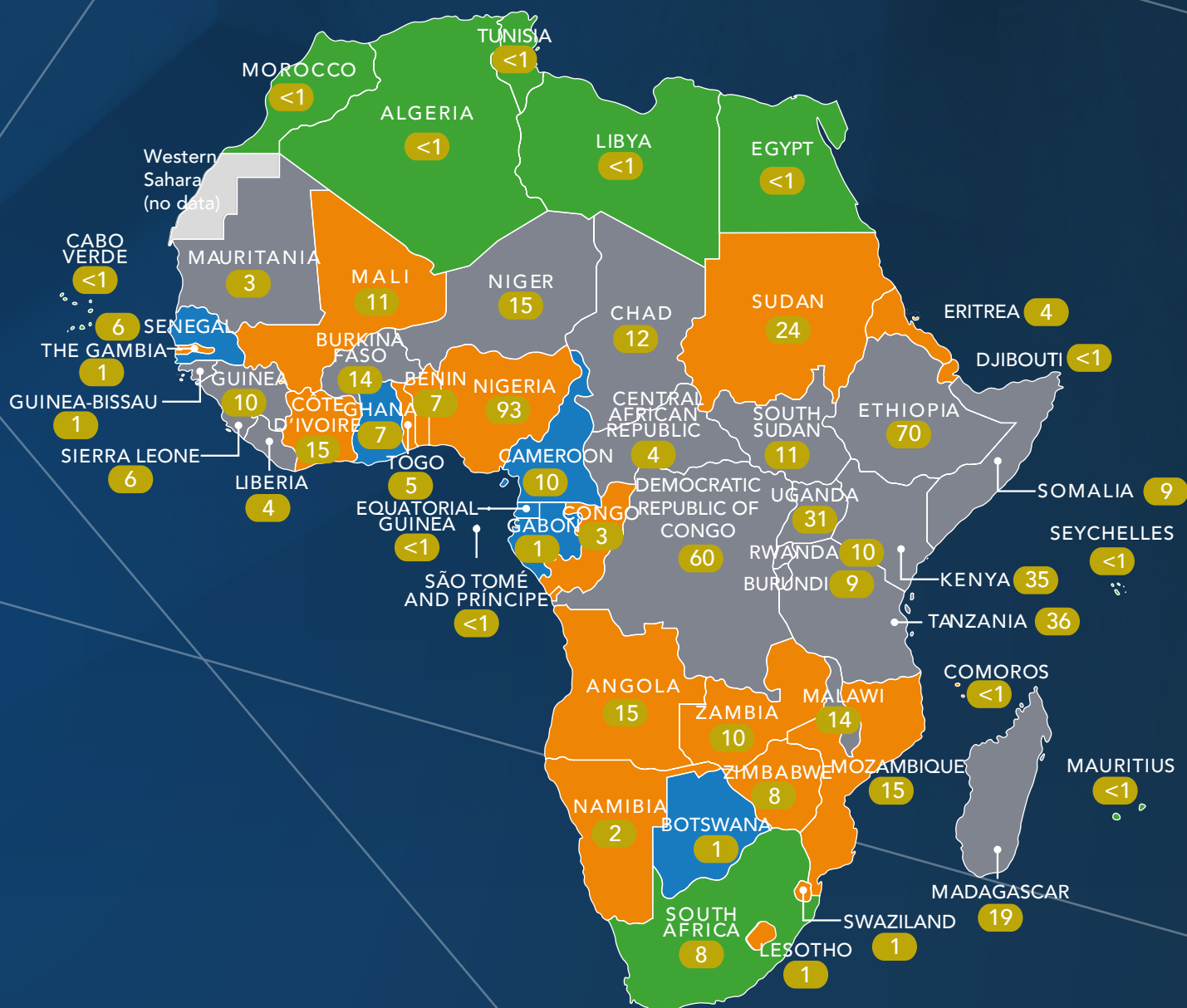


South Africa's high electrification rates are underpinned by it being the continent's most coal-reliant nation. Photo courtesy Alexander G/Flickr

Hydroelectric power is on the rise however with many countries such as Angola, Cameroon, Ethiopia, Kenya, Mozambique, Namibia and Zambia looking to this power source for electricity generation – hydroelectric accounts for between 70%-97% of power production in some of these countries. World Bank data for 2013 indicates that roughly 20% of electricity across SSA is accounted for by hydroelectric power.

It goes without saying that in times of intensified drought, such as that experienced over the period 2014-2016, this energy source becomes vulnerable. Resultantly, many across Africa resort to more costly diesel-powered generators for electricity, while others are still heavily dependent on biomass for energy generation.

CURRENT ENERGY ACCESS ACROSS AFRICA



Share of population without access to electricity

- >75%
- 50% to 74%
- 25% to 49%
- <25%

X Population without access to electricity (millions)

Nuclear energy accounts for a very small portion of energy generation and stood at a meagre 3% in 2013, with South Africa being the only contributor in this regard. Notably, South Africa has looked to expand on this share with a proposed additional 9.6GW of power coming from nuclear sources by 2030. Similarly, renewable energy accounts for less than 1% of total energy production in SSA. Kenya is the leader in this regard with a quarter of energy production coming from renewables.

This last trend is likely to shift in the coming years as more countries across Africa are looking to tap into energy sources that are not connected to central power grids.

These are likely to come in the form of more renewable access through microgrids around the continent since these grids can be implemented quickly and at a considerably lower cost than major projects.

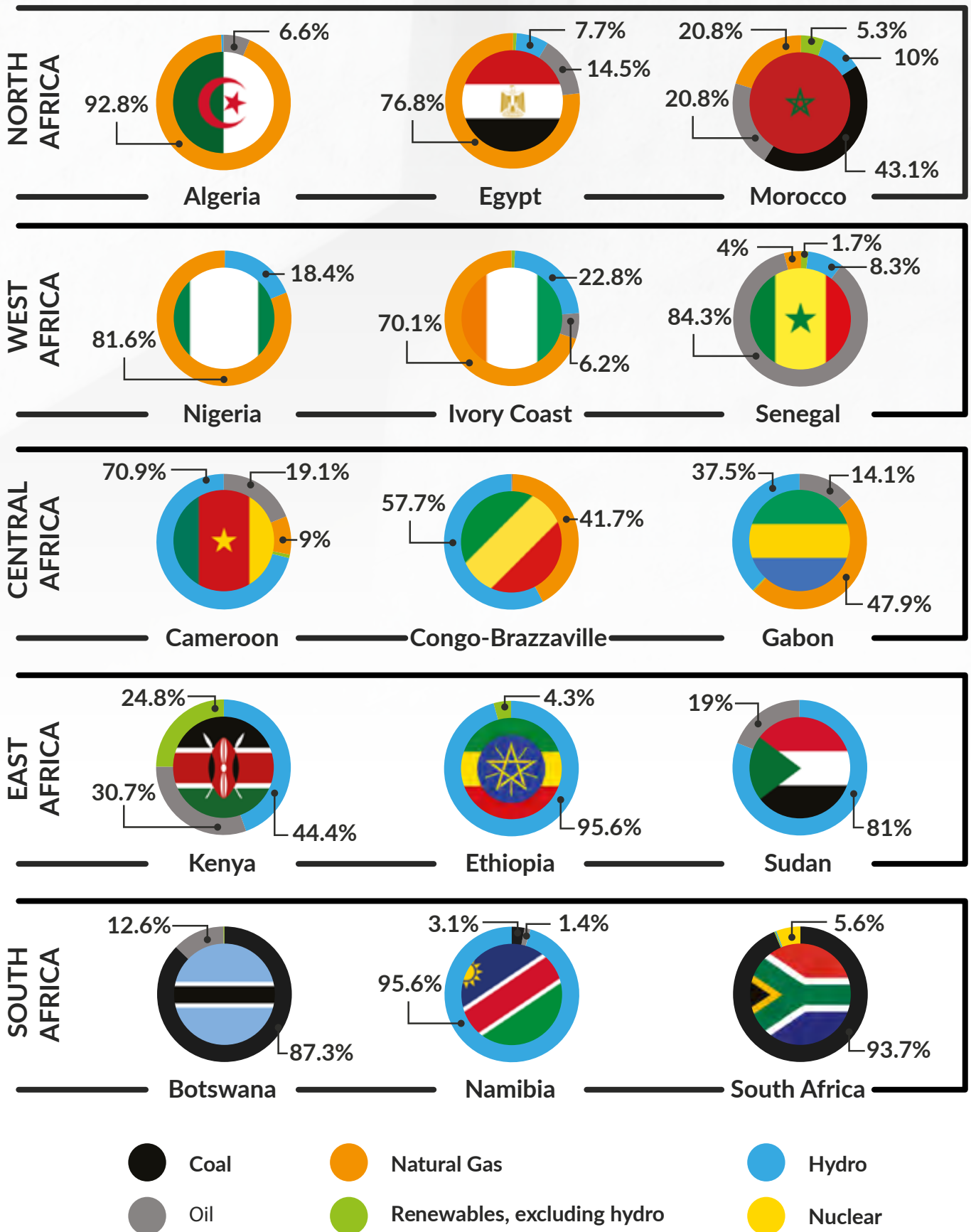
Currently, only around 1% of total electricity production is derived through renewable sources across the continent. Some countries have made greater strides to institute renewable energy generation, these include Mauritius and Kenya. South Africa and Morocco have also moved forward in this regard and boast some of the continent's most developed solar plants.

*A solar equipment shop in Accra, Ghana.
Photo courtesy Jason Tester Guerrilla Future/Flickr*



Top Economies by Region

Composition of Primary Energy Supplies



Continent-wide implementation of internal policies and initiatives as well as various vulnerabilities

Leading into 2050, Africa needs to prioritise the provision of long-term solutions to energy access as its population keeps growing. By 2040, Africa's population is projected to reach 1.8 billion, with over half of people located in urban centres. Over this period, power demand is expected to increase six times at an average growth rate of 6% per annum. Notably, energy production is moving ahead gradually with various programmes being put in place across the continent to stimulate more access.



Power lines overhang a community in Ethiopia. Keeping energy production apace with population growth and urbanisation will be paramount for Africa's future.

Photo courtesy SarahTz/Flickr

“By 2040, Africa's population is projected to reach 1.8 billion, with over half of people located in urban centres.”

External threats that may influence energy infrastructure development



Population growth

Estimates indicate that by the year 2050, the global population will increase by 2.4 billion – Africa is projected to contribute just over half of this total.

Life expectancy in Africa has also risen considerably with most Africans now living to the age of 60 – a substantial increase from 37 in 1955.

Slowly declining fertility rates will produce a bulge of youth populations across Africa.



Increased demand

Consumption in Africa is expected to increase to nearly 1,600 terawatt hours – four times the demand in 2010. Electrification will, however, only reach 70-80% of the population over this period.

Ongoing urbanisation will push power generation considerably; leading up to 2035 – oil giant BP puts estimates at 116%.

Home appliances such as fridges and air-conditioning are expected to double by 2030, pushing energy demand even higher.



Lack of investment and depressed government revenue

Fossil fuels still attract the bulk of investment while over 90% of the continent's economically viable hydropower potential remains untapped.

The UN estimates that \$US55 billion will be needed by 2030 to meet increasing demand and achieve universal access.

Tax collection systems are weak and negate the ability of government to collect taxes accordingly.



Political bureaucracy and corruption

Projects aimed at stimulating energy development in Africa are susceptible to political influence and face a high risk of corruption.

Large projects are also generally marred by poor project appraisal systems, absence of effective management and a high degree of informality.

Renewable developments face considerable obstacles in the form of state utility-provider monopolies.

Programmes to address the various issues have come in the form of continent-wide initiatives such as the Programme for Infrastructure Development in Africa (PIDA). PIDA was established in 2010 through a joint collaboration between the African Union Commission (AUC), NEPAD's (New Partnership for Africa's Development) Planning and Coordination Agency (NPCA) and the African Development Bank (AfDB). The programme has a wide-reaching scope and looks to integrate, among other things, Africa's energy, telecommunications and transport infrastructure.

Some of the larger aims of the programme include over 16,000 kms of power lines and over 54,000MW of hydroelectric power. The overarching goal is to increase power access to 70% of Africa's population by 2040. PIDA has also formulated a Priority Action Plan (PAP) aimed at developing project initiatives that are likely to have the highest potential return in terms of providing power across the continent. The PIDA PAP has earmarked 15 energy sector projects across Africa at a total cost of just over US\$40 billion.

“Hydropower has made the most progress with regard to new energy projects with over 25GW of capacity expected by 2021.”

Another key initiative instigated by the AU and supported by various heads of state is the Africa Renewable Energy Initiative (AREI). The initiative aims to achieve a minimum of 10GW of additional renewable energy generation capacity by the year 2020, and a more ambitious 300GW by 2030.

AREI seeks to encompass the whole continent with a long-term view to strengthen renewable energy initiatives by outlining various policies and programmes which can serve all of Africa. The initiative also seeks to provide support for future renewable energy projects that conform to AREI guiding principles, while also working with, among others, PIDA, Power Africa and the Africa-EU Energy Partnership. It has further aligned itself with the objectives of the NEPAD African Regional Flagship Programme (ARFP) on sustainable energy.

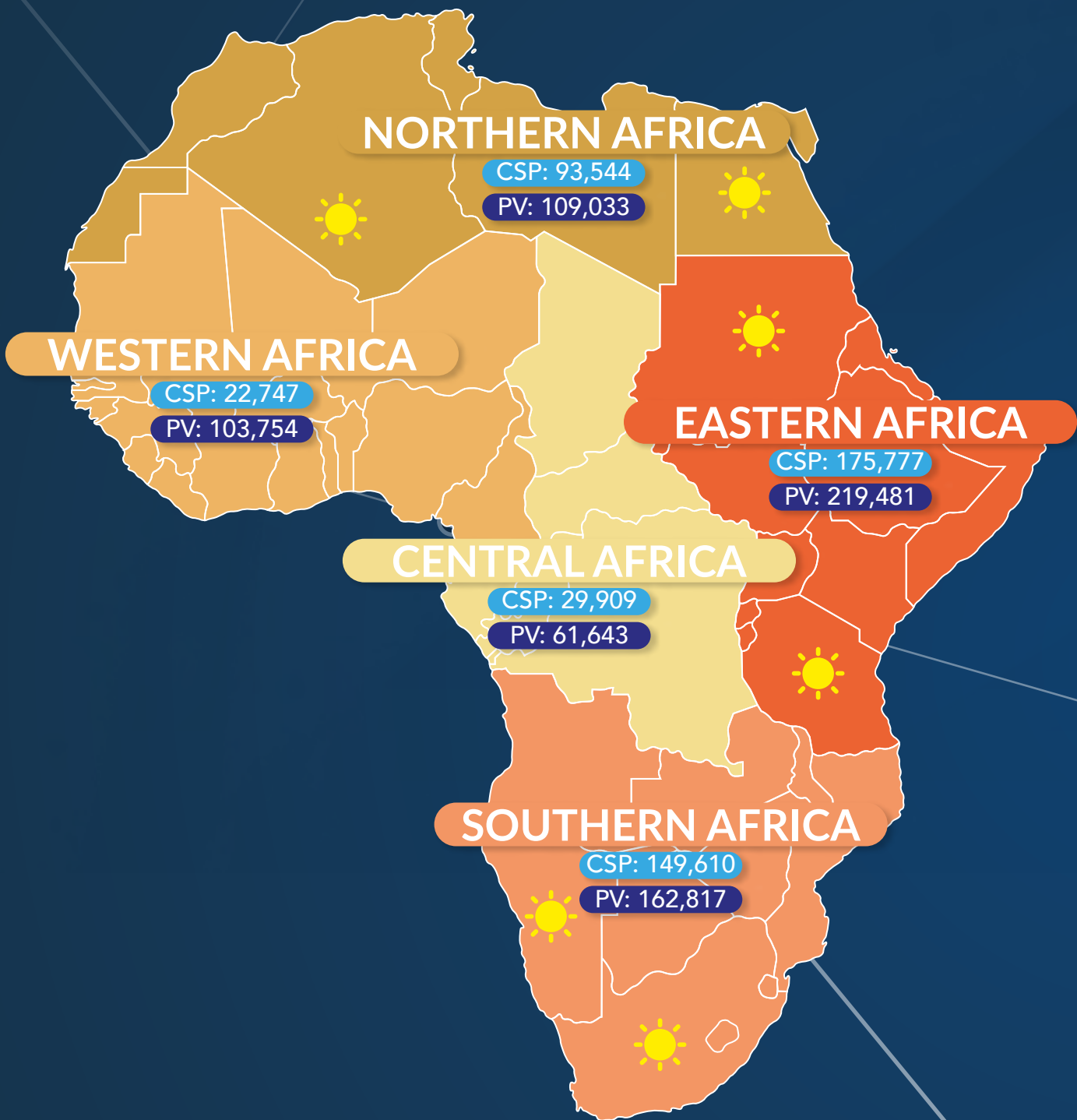
Though AREI notes the need to increase the utility of hydropower in Africa, this energy source has already made the most progress with regard to new energy projects with over 25GW of capacity expected by 2021. There is also a considerable concentration of projects in Southern Africa with Central Africa showing strong signs of initiating further energy projects in the coming years. Some of these larger projects have been somewhat successful, while others are still scrutinised for their utility and feasibility.



Solar power panels at Ain-Beni-Mathar, Morocco.
Photo courtesy Philippe Roos/Flickr

POTENTIAL FOR RENEWABLE ENERGY

Solar, Wind and Hydro



*CSP solar energy potentials in different African regions - Terra-watt hours per year (TWh/yr)

*PV solar energy potentials in different African regions - Terra-watt hours per year (TWh/yr)



Countries with the highest technical potential for solar power

IMPLEMENTATION ACROSS AFRICA

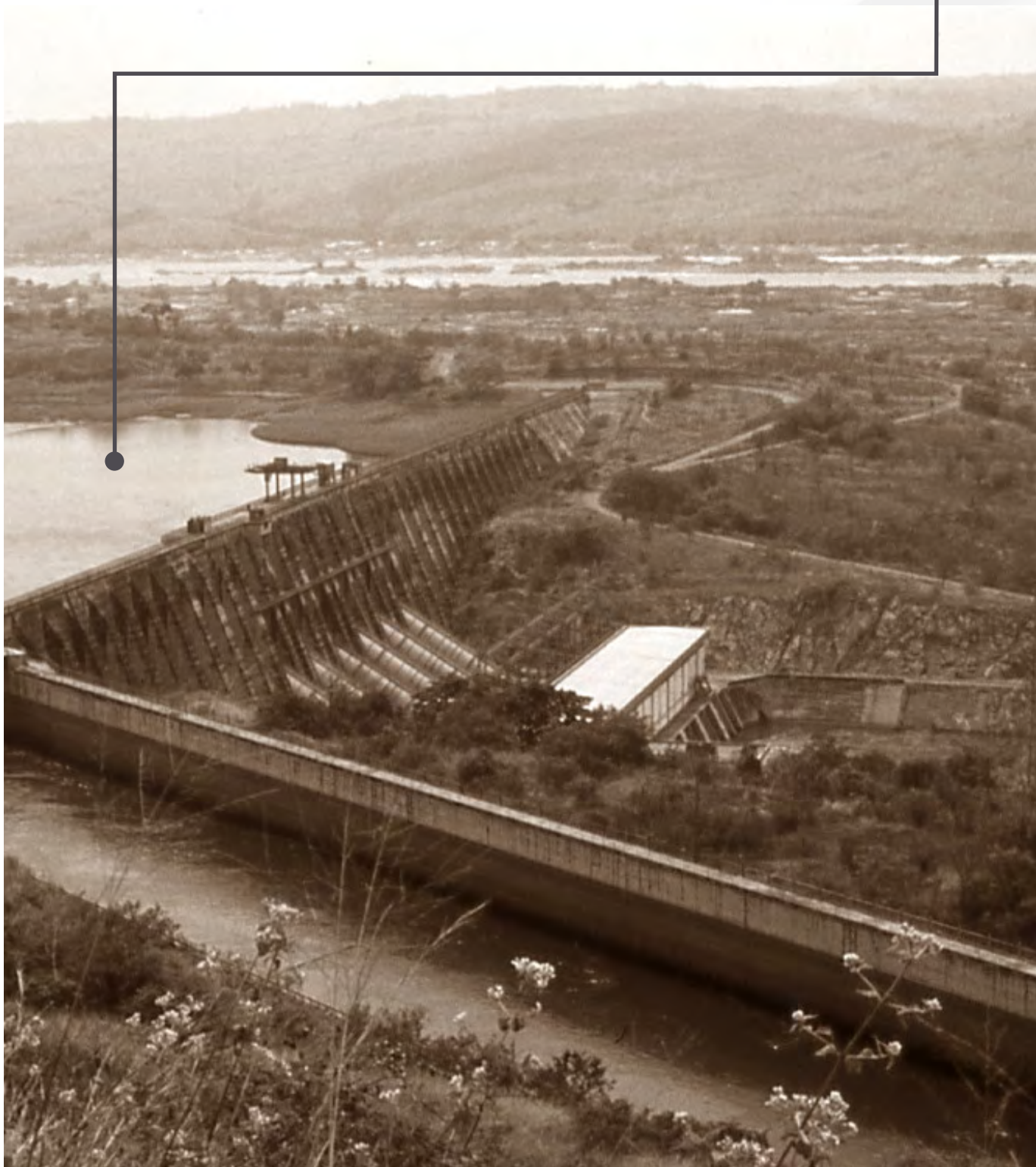


Democratic Republic of Congo (DRC): Grand Inga Dam

The Grand Inga Dam has been one of Africa's flagship hydropower projects. Since its inception in the late 1960s, Inga I and II have been able to deliver power to the DRC, though the project did not escape many cost-overruns and corruption issues of the ruling government.

The Inga III project is the latest addition to the Inga Dam at a total projected cost of US\$14 billion which could see 4,500MW power being delivered across Southern Africa – this addition would make it larger than the current biggest hydropower installation in the world, the Three Gorges Dam in China at a total capacity of 42,000MW.

*Aerial view of the DRC's Inga I dam, with the canal for Inga II flowing past in the background.
Photo courtesy Alaindg/Wikimedia Commons*



“Smaller hydropower projects hold greater feasibility and potential benefits for citizens of the DRC, but are generally side-lined in favour of the Inga project by both the DRC government and the World Bank.”

The project has, however, been marred by issues including political instability in the DRC as well as the July 2016 announcement by the World Bank that it was suspending the disbursement of some US\$12 billion toward the construction of the dam due to failure by the Congolese government to uphold the agreement on how the project would evolve. Concerns have also been raised by environmental groups with regard to the impact that reduced water flow would have on the marine ecosystem. Additional concerns revolve around adequate compensation for villagers living in proximity to the dam, and whose homes are susceptible to risk of being flooded.

Despite existing power coming from Inga I and II, few new homes have been connected to the power system, and over 4,000 km of transmission lines have not been rehabilitated since the inception of the dam. Smaller hydropower projects hold greater feasibility and potential benefits for citizens of the DRC, but are generally side-lined in favour of the Inga project by both the DRC government and the World Bank.



Poor governance and chronic instability in the DRC's resource-rich eastern provinces is both a symptom of and a cause for the nation's lack of development. Above: A Congolese soldier in the restive Beni region of North-Kivu province.

Below: A child refugee at a UN base after deadly clashes between rebels and the DRC military in North-Kivu. Photos courtesy MONUSCO/Abel Kavanagh/Sylvain Liechti/Flickr



Initiated in late 2015, the Turkana Wind Farm is expected to be completed by mid-2017 and will become the largest wind farm in Africa. The total power output of the project will stand at some 310MW and will hold the ability to supply 15-18% of Kenya's national demand. The World Bank withdrew from funding the project in 2012 as it felt that the power generated would be far too much in relation to actual demand. Since then the African Development Bank has undertaken the task of funding the US\$700 million development with the European Investment Bank and various other participating European development agencies – Google has also taken a 12,5% interest in the project upon completion which could trigger further involvement by the tech giant in Africa's energy sphere. The project will aid in boosting Kenya's current installed capacity of 2.3GW which is comprised mostly of hydropower, oil and geothermal energy.

“In some areas adjacent to the projects, villagers have filled the streets and created roadblocks, demanding that their people be given job opportunities considering that the project is located on indigenous land.”



Similar to other large scale projects, the Turkana Wind Farm has faced hurdles along the way to implementation and completion. Concerns around indigenous beneficiation have been a focal point with tribes clashing over resources in recent periods. In some areas adjacent to the projects, villagers have filled the streets and created roadblocks, demanding that their people be given job opportunities considering that the project is located on indigenous land. Local tribes' people have also indicated that various cultural activities have been made impossible due to the scope and size of the project across the area that it occupies – some 150,000 acres. The land dispute in the region has, in effect, stalled the development of the project since 20 December 2016, and can only continue once the land rights issue has been resolved.

A geothermal plant in Kenya. Sitting atop a continental fault line, East Africa's Great Rift Valley holds massive wind and geothermal potential. Photo courtesy Lydur Skulason/Flickr

South Africa: Nuclear Build Programme

One of Africa's largest energy producers, South Africa, has in recent years undertaken the task of expanding on its nuclear energy-generation capabilities. The country is currently the only producer of nuclear energy in Africa, with an installed capacity of close the 1,900MW.

The new nuclear build programme seeks to expand on this capacity by introducing a fleet of six new nuclear plants over the course of the next 20 years, at a total installed generation capacity of 9,600MW.

The argument put forth by the South African government is one of weaning the country off its overwhelming coal dependence –

responsible for generating more than 90% of power at present – while also catering for the aging infrastructure of its coal-fired power plants, rising population growth, and to aid in the energy-intensive socio-economic development that it seeks to achieve over the next two decades.

The introduction of more nuclear energy will also see the country adhere to its global greenhouse gas emission targets.

A man paddle-surfs within sight of Koeberg nuclear power station – Africa's only nuclear plant – north of Cape Town. South Africa's government is in the process of trying to push through a controversial series of nuclear builds.

Photo courtesy Derek Keats/Flickr



“Though the aim of the government has some merit, the possibility of the nuclear fleet in a time of economic malaise has raised questions by civil society organisation regarding the financial feasibility of the project, which is estimated to cost US\$50 billion.”

Though the aim of the government has some merit, the possibility of the nuclear fleet in a time of economic malaise has raised questions by civil society organisation regarding the financial feasibility of the project, which is estimated to cost US\$50 billion. The undertaking of such a large scale project will have considerable financial impact and is far less feasible than implementing less costly renewable energy alternatives.

Given the lengthy project time and cost overruns with the Medupi and Kusile coal-fired power plants that the national power provider, Eskom, has been building over the last number of years, the fears over the same happening with the nuclear build programme are strong.

Political meddling by the ruling African National Congress (ANC) party's upper echelon may also result in corruption and tender favouritism toward an elite few. In 2014, news emerged that the government has preliminarily allocated the contract to Russia's Rosatom, with further evidence being uncovered that individuals close to the president would stand to benefit financially. Speculation also exists that the fractures within the ruling party on the nuclear build programme led to the abrupt dismissal of former finance minister, Nhlanhla Nene, in December 2015.



An artist's rendition of Japanese workers at Fukushima Daiichi power station during the Tsunami-induced meltdown in 2011. Critics point to the incident as proof that nuclear power is inherently unsafe.

Image courtesy Surian Soosay/Flickr

Comparison of external initiatives to strengthen energy development and access across Africa

Aside from the internally driven AREI and PIDA initiatives, outside parties have also looked to become more involved in strengthening Africa's energy future. The US Power Africa Initiative, the Africa-EU Energy Partnership and the UK's Energy Africa Campaign are some of the larger initiatives and partnerships that are working toward this overall energy access goal. Not to be left

behind, eastern nations such as China and Japan have also sought to become involved in this drive to electrify Africa.

US Power Africa

The US Power Africa initiative was launched by President Obama during his visit to the continent in June 2013, and seeks to double access to power in sub-Saharan Africa. The programme targeted certain countries on the East and West coasts of Africa including Ethiopia, Ghana, Kenya, Liberia and Nigeria, with an aim to add an additional 10,000MW of efficient energy generation capacity across these countries, and electrify some 20 million new homes. Various energy initiatives would be added including on-grid, mini-grid and off-grid solutions. With an initial commitment of US\$7 billion by the US government, the Power Africa programme has attracted an additional US\$43 billion from private and public sector partners.

“With an initial commitment of US\$7 billion by the US government, the Power Africa programme has attracted an additional US\$43 billion from private and public sector partners.”



A man cycles past a store for Mobisol, a Power Africa partner in Rwanda. Based in Berlin, Mobisol provides solar power solutions for homes and small businesses in East Africa.

Photo courtesy Rachel Couch/Power Africa/Flickr

As with all large projects, things are slow to materialise. By 2016 there has been little progress and the initiative has been stagnant with little actual development taking place. In Ghana, it has taken nearly a year and a half to approve an emergency power scheme for the country, while only 374MW from six large projects has been brought online. Though many of the projects are driven by renewable energy, some, such as in Senegal, use fossil fuels to achieve electrification. Corruption and slow progress on the part of governments also plays a role, with the average time for completion of large projects being around 10 years.

Africa-EU Energy Partnership

The European Union has launched a similar initiative to partner with African countries in achieving greater access to energy. In late 2007, African and European Heads of State, along with their governments, came to a consensus to launch the Africa-EU Energy Partnership where knowledge and resources would be shared.

The aim of the Africa-EU partnership is to generate an additional 10,000MW of hydropower, 5,000MW of wind power and 500MW of solar and geothermal power by 2020. The EU is looking to generate around US\$106 billion for the initiative and to support over 500 small and medium enterprises to construct various power initiatives. Some 20% of this total is aimed at assisting Africa to meet its climate change objectives. The Lake Turkana Wind farm is one project financed by this initiative.

As with the US Power Africa initiative, moves toward constructing new power plants has been slow. One major issue has been the inability to track progress or monitor what investment is coming into various projects. Record-keeping is poor across Africa and corruption still plagues many of the countries where large energy projects are looking to materialise. Going forward, it will become imperative that investment is tracked in order to ensure that they are able to deliver on requirements within budget.

“The aim of the Africa-EU partnership is to generate an additional 10,000MW of hydropower, 5,000MW of wind power and 500MW of solar and geothermal power by 2020.”

UK's Energy Africa Campaign

Along with the US and the EU, the UK has launched its own rival campaign in October 2015 to assist Africa achieve universal energy access by 2030. Forming the backbone of this campaign is the aim to overcome financial hurdles, policy and regulatory barriers, raise awareness and position the campaign within broader global efforts. Focus is given to off-grid solar energy, with this energy type being at the backbone of the campaign, but overall the objectives have a far smaller focus on large-scale power infrastructure.

Leading up to the launch of the campaign, the UK has invested just over US\$1 billion toward power infrastructure development. Memoranda of Understanding have been signed between the UK government and Ethiopia, Nigeria, Sierra Leone, Somalia, Ghana, Malawi and, most recently, in 2015, Rwanda.



*Anti-graft billboard in Zambia. Corruption is regularly cited by experts as one of the largest obstacles to improving Africa's infrastructures because of added costs and inefficiencies.
Photo courtesy Lars Plougmann/Flickr*



A woman in Tanzania showcases her off-grid prepaid M-Power solar lighting inside her home, installed as part of scheme funded by the UK's Department for International Development (DfID).
Photo courtesy DfID/Flickr

Though the program is still in its infancy, criticism has come from the strong drive to increase investment in solar grids, which will only reach 40% of Africa's population, leaving around half a billion people without power by 2030. The UK campaign faces strong challenges from large-scale infrastructure development over its preference to support smaller off-grid projects. The lack of legal and tax structures is also a problem that the campaign will face in its drive to direct investment toward where it's most needed.

“The UK campaign faces strong challenges from large-scale infrastructure development over its preference to support smaller off-grid projects.”

China

China has undoubtedly been one of the largest investors in African infrastructure over the last 10-15 years, and as of 2014, the world's largest. Over the period 2005-2011 over US\$10 billion worth of investment from China has gone into sub-Saharan Africa's energy infrastructure. Though a lot of this investment has gone into developing hydrocarbon resources, there has also been considerable investment in energy generation. One of the largest projects, that has received investment from the Exim Bank of China, is the US\$500 million loan to Nigeria for transmission lines, and the provision of financing to Ethiopia for the construction of the Gilgel Gibe III hydropower project.

The main criticism of China's involvement in Africa is the way that it conducts relations, and especially its business practices, which fail to promote good governance and human rights. China has, similarly, been accused of developing Africa's oil and gas infrastructure only to reinforce its own growth without providing any real benefit to host countries.

Compliance with safety and environmental standards are also core issues, along with bypassing local law through political connections.

Many of the projects that China has completed have also been done on the back of imported Chinese labour with little local involvement or knowledge transfer, further exemplifying the imbalance in the Chinese infrastructure-growth relationship with Africa.

“The main criticism of China's involvement in Africa is the way that it conducts relations, and especially its business practices, which fail to promote good governance and human rights.”



*A Chinese construction site in Amhara, Ethiopia. Critics of large-scale energy projects say they are predominantly set up to benefit big industry over local communities.
Photo courtesy SarahTz/Flickr*

Japan

Not to be outdone by China, Japan has also become considerably more involved in Africa's energy sector in recent years. As a first step it has sought to bolster investments in Kenya's healthcare and energy sectors since 2013. The Asian country has already financed the Olkaria 1, 140MW geothermal power project. Large Japanese trading companies, such as Marubeni, have also pledged their support elsewhere and sought to build Nigeria's largest power plant in Lagos at a total cost of US\$1.9 billion, while Mitsubishi Hitachi Power Systems provides key components for the facility. Sumitomo Corp. has inked a similar agreement in Mozambique; they plan to construct a \$US2 billion fossil-fuel powered plant capable of doubling the country's energy supply.

On the entrepreneurial end, one of Japan's start-ups, Digital Grid, has established the WASSHA service in Tanzania which rents out LED lights, radios and tablets to consumers who are able to use the devices but need to bring them back to the rental kiosk for charging. By June 2016, the company already had over 650 kiosks throughout the country.

Smart meter systems are another avenue that the Japanese government and private sector companies have been exploring in boosting energy access throughout Africa. These will have a strong focus on providing electricity access to off-grid energy solutions and rural areas.

Despite the current focus on carbon energy, the outlook for renewable growth through investment, is positive

Throughout Africa there is still a large emphasis on using carbon fuels for energy generation, especially in large economies such as Nigeria and South Africa. Promulgation of hydroelectric power is considerable especially in countries like Kenya, but also in others including Ethiopia, Cameroon and Zambia.

Nuclear power is still far off for many countries, though South Africa is looking to expand on its own fleet over the next two decades and bring an additional 9,600MW online through nuclear power.

Increased electrification in rural areas would significantly aid in the administration of health services.

Left: A child receives a vaccine at Kibati camp in Western Rwanda.

Below: Family planning supplies await distribution at a humanitarian site in Cote d'Ivoire.

Photos courtesy Julien Harneis/Flickr; European Commission DG ECHO/Anouk Delafortrie/Flickr



The largest potential, however, rests with off-grid solar power plants which are increasingly taking greater shape across Africa in both Northern and Southern Africa.

Greenpeace activists in Johannesburg demonstrate outside the headquarters of South Africa's state-owned utility, Eskom, to demand the energy monopoly deliver clean, affordable energy. Photo courtesy #TourDeJozi/Flickr

Initiatives such as PIDA and AREI will likely drive the development of internal policies and look to boost energy projects across the continent. External players, such as the US, UK, EU and eastern countries such as China and Japan, will also have a considerable role as all are investing in power development within Africa in various capacities including power projects, transmission line rehabilitation, off-grid power solutions and metered power management.



IN ON AFRICA

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- Brand equity studies
- Competitor intelligence
- Due diligence
- Feasibility studies
- Geopolitical research/analysis
- Market/consumer research
- Opportunity assessments
- Risk assessments
- Social research
- Security analyses

“Tackling the lack of data keeping and endemic corruption across Africa is a further challenge that power projects face. This is highlighted by the Inga III in the DRC and the nuclear fleet that South Africa seeks to build.”

Considerable challenges will emerge in the appropriation of funds and investment, and ensuring that projects are completed within given timeframes and are not overtly over-budget will also be difficult. Tackling the lack of data keeping and endemic corruption across Africa is a further challenge that power projects face.

This is highlighted by the Inga III in the DRC and the nuclear fleet that South Africa seeks to build. Large power projects also need to take into account what impacts may be incurred by indigenous populations as these may be far-reaching and, in cases such as the Turkana Wind Farm, may bring projects to a halt.

Regardless of the challenges there is much opportunity to further develop Africa's energy infrastructure. What remains to be seen is how many of the promised investments materialise and whether they will be properly utilised in the development of the targeted countries.



IN ON AFRICA

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SIYENZA

Event Portfolio



AFRICA ENERGY INDABA

SOLUTIONS FOR AFRICA
CONFERENCE AND EXHIBITION

The event is the official Africa Regional Event of the



Furthermore, it is hosted in partnership with



The Africa Energy Indaba conference has become the foremost forum for debating and exchanging solutions to Africa's energy challenges and continues to show growth every year. The conference and its various side events focus on: African power suppliers; alternative and renewable energies; oil and gas; the legal and regulatory energy framework, and investment opportunities in African energy projects, leadership in energy, to name a few. The event is known and acknowledged as the energy decision-maker's event in Africa, attracting Energy Ministers, many leading energy CEOs and other influential energy stakeholders to the forum. The exhibition has become a significant marketplace for African and international stakeholders doing business in Africa's energy sector.

Venue: Sandton Convention Centre, Sandton, South Africa www.africaenergyindaba.com

9TH EDITION: 21 - 22 FEBRUARY 2017 . 10TH EDITION: 20 - 21 FEBRUARY 2018

manufacturing indaba



The event is hosted in partnership with a number of strategic partners, which include:



All nations require and rightly aspire to efficient industrial bases to meet changing needs in a globalised world. South Africa has developed an established and diversified manufacturing base that has shown its resilience and potential to compete in the global economy. Collaboration and investments by both the public and private sectors in manufacturing is essential for regional and continental growth. The aim of the annual Manufacturing Indaba and its provincial roadshows is to bring together business owners, industry leaders, government officials, capital providers and professional experts to explore opportunities and grow their manufacturing operations. Manufacturing Indaba is the leading manufacturing event in Sub-Saharan Africa. The two-day event has shown impressive growth year on year and has proved its value in catalyzing business connections and helping manufacturers to innovate and grow their potential.

Venue: Emperors Palace, City of Ekurhuleni, South Africa www.manufacturingindaba.co.za

4TH EDITION: 27 - 28 JUNE 2017 . 5TH EDITION: 26 - 27 JUNE 2018



The event is hosted in partnership with the



Africa, with a population exceeding 1 billion people, is well placed as an emerging market and has successfully maintained an average growth rate of 4% for the past few years as a continent. Africa is also urbanising at breakneck speeds, which means the need for infrastructure such as bypasses, bridges, new highways and new technologies need to be deployed in congested areas where traditional methods cannot work. This evolution of infrastructure and the underlying drivers of growth are highlighted at the annual Infrastructure Africa conference and exhibition. With discussions on specific project development opportunities from infrastructure players operating on the ground, the two-day business forum offers businesses the platform to set their regional strategies for long-term growth and the opportunity to unpack the enormous growth potential in Africa's infrastructure sectors.

Venue: Sandton Convention Centre, Sandton, South Africa www.infrastructure-africa.com

6TH EDITION: 21 - 22 AUGUST 2017 . 7TH EDITION: 28 - 29 AUGUST 2018



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IOA EXPERT INSIGHTS

Addressing energy deficiencies and tackling challenges in the power sector

The year 2017 is likely going to be a key development phase of African energy generation. The continent will face some considerable challenges in the coming months including the changes that the incoming Trump administration may implement with regard to the Power Africa initiative, the likely rise to oil prices on the back of the late 2016 OPEC agreement to curb production, as well as tackling various challenges on large energy infrastructure projects and initiatives that are in the process of rollout.

IOA asked some of its expert African consultants to comment on the challenges of these factors and how they can be mitigated in the coming year.

IOA renewable energy expert, Rob Short

IOA Expert Consultants

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





Local labourers at a hydroelectric construction site in Rwanda's Mukungwa River valley.
Photo by Matt Chenet for Power Africa

Udeme Akpan is an external IOA consultant and Energy Editor of National Monitor – a leading newspaper in Nigeria – and is also based in Nigeria. He has over 20 years of experience examining the dynamics of Nigeria's energy sector, while his writing abilities have provided him with numerous awards and membership in a number of professional organisations including the National Association of Energy Correspondents.



Q: The landmark oil production cut deal driven by the Organisation of Oil Producing Countries (OPEC), is the first time, since 2008, that the organisation aims to cut production and the largest in scope since the late 1990s. Considering how many African countries are reliant on such fuels for energy generation, government revenue and economic development, what impacts do you foresee in terms of rising oil prices?

Udeme Akpan: It should be noted that cuts based on what has come to be known as the 'Algiers Accord', are targeted at achieving the production target of 32.5mb/d. It is also aimed at accelerating the ongoing drawdown of the stock overhang and bring the oil market rebalancing forward. The execution of the Accord which was put in force on January 1, 2017 is to be properly monitored to ensure that desired objectives are achieved.

IOA energy expert, Udeme Akpan

There is no doubt that the cut will impact negatively on nations with the capacity to supply more oil to the market, including producers in North Africa. Countries in East and West Africa will not suffer much as they are not very large producers. It will not affect Nigeria which has the capacity to produce commercial oil as OPEC did not slash its output due to the prolonged militancy in the Niger Delta which has already affected production and export to the global market. However, it is in the collective interest of all members to earn more from the little they supply to the market rather than to supply excess oil in order to earn more.

Q: In its 2015 annual report, the Africa Progress Panel states that "Africa is losing an estimated US\$8.2 billion annually through power sector inefficiencies associated with poor cost-recovery, distribution losses and other factors". Before spending money on new projects, what are some of the ways in which African governments could target 'low hanging fruit' to immediately improve the efficiency of present energy systems?

Udeme Akpan: The governments of African nations have not completely succeeded in providing adequate and stable power to consumers despite many years of attempting to do so. This is very instructive. It clearly shows that it is not the business of the government to be in business, including power generation, transmission and distribution.

It was this realisation that compelled Nigeria to sell its power investments to private investors. Although losses and other factors are still there, they have been reduced through improved monitoring, maintenance and discipline associated with private sector operations.

So, it is better for the governments of African nations to emerge with good policies, guideline and incentives among other aspects, while also allowing private investors to drive activities.

Q: At the UN climate summit in Paris in December 2015, the African Union (AU) announced its US\$20 billion African Renewable Energy Initiative (AREI), aimed at ensuring universal energy access in Africa by 2030. The period up to mid-2016 was planned to focus on resource mobilisation, establishing governance and management structures as well as identifying Phase I projects to be completed by 2020. What progress has the AREI made thus far? Are there any notable achievements made, and are there any potential pitfalls to be aware of?

Rob Short: AREI is an ambitious African led initiative to drive energy access and promote renewable energy on the continent. It is currently designed as a two-phase programme that will run until 2030. The key objective for phase one, running from 2016 – 2020, is to achieve a minimum of 20GW of additional renewable energy generation capacity installed on the continent. Phase two will run from 2020 until 2030 and during that period as additional 300GW will be added through its activities.

The targets, especially in the second phase, are ambitious but recognise the urgency to promote economic development through increasing access to energy services, while also reducing greenhouse gas emissions.

The initiative is in its early stages, undertaking research and political work that will lay the foundations for future activities and impact. As with all those types of initiatives there are always teething problems and tight, perhaps unrealistic, deadlines (the Green Climate Fund for example has not been without its problems and issues), but this is to be expected with such complex initiatives that are intended to be truly transformative.

A comprehensive update on AREI was given at COP22 in Marrakesh by the interim independent delivery unit, which clearly described the progress made.

This included the development of the criteria to fund projects and programmes, and the start of a mapping exercise to identify and detail what similar initiatives are happening on the continent to support co-operation, especially amongst development partners. This mapping exercise will be used to develop a database of all the initiatives for ease of use by stakeholders as the initiative moves forward. .

2017 is clearly a crucial year to get the key internal resources and information in place that will provide the basis for AREI achieving its objectives in the long-term. To do this it obviously needs to be up and running on its action plan as soon as possible. The next opportunity for a formal report back appears to be the planned multi-stakeholder meeting early in 2017 (no date has been set as yet). This will provide a clear sense of what progress has been made.



Q: Western, Chinese and private investors alike are increasingly placing a stake in the development of African energy systems and markets. Could you briefly compare the different reasons that motivate external actors to strengthen energy production and access in Africa? Would you consider this deal-making or development?

Udeme Akpan: The problem of inadequate and unstable power supply in Africa has attracted global attention. The governments of many developed economies, including the USA and China have expressed commitment or determination to participate. Investors in such nations have also made Africa their preferred destination. Expectedly, some of the deals have the promise to culminate in great projects of great impact on the economies of these nations. But some may not make much impact, considering some factors, especially their sizes, ownerships and management.

A market lit up at night in Marrakesh's famed Jemaa el-Fnaa square. North African nations already have near universal access to electricity, but must wean themselves off fossil fuels.

Photo courtesy Martin Fisch/Flickr

Q: What are your thoughts on how the presidency of Donald Trump will change the dynamics of US involvement in African energy development – will this create opportunities for other state and non-state investors to take advantage of?

Udeme Akpan: There is no doubt that the advent of Donald Trump will witness some changes in international relations as well as investment in different parts of the world, depending on his interests and energy policy. The vacuum will be felt if there is total withdrawal on the part of the US, but it will not be very obvious and impacting if it is only partial. However, US representative that I liaise with will not completely ignore Africa.

The US will likely seek to have a place in Africa's energy sphere so as not to completely leave the space for China and others.

Q: A frequent flashpoint for mega-projects – including renewables – is obtaining licenses from local communities to build on their land. Beyond vaguely defined offers of jobs, what are some of the most effective incentives that government and investors can extend to local communities to ensure a mutually beneficial energy development process?

Rob Short: "Social License" related concerns have been a key feature of mega-project implementation, specifically those that are located in rural areas and/or areas that have high unemployment and limited development opportunities. This is not however just a problem of large scale projects. Even smaller projects such as solar PV or small-scale hydro generation developments have experienced problems with social issues, and specifically in managing local interest groups that want benefit unfairly from the projects.

The government and investor approach has generally not been to incentivise such activities but to make them requirements linked to approvals. This also applies in the case of government, for example, project licensing and/or offtake agreements (such as power purchase agreements). In the case of investors, reflecting the move towards the effective use of social and environmental safeguard requirements, actually requiring that community development plans are developed, implemented and reported on.

This probably makes more sense as an approach as incentive programmes are notoriously difficult to design, implement and monitor, and would tend to be over the short and medium term. This is in comparison to a plan that would be required over the lifetime of the project.

The difficulty is in designing and implementing these plans. They will need to reflect the project context and have a strong element of community participation in their development to ensure they focus on activities that reflect local concerns and deliver real impact. The need for ongoing communication with communities has almost become a cliché, but it remains a key element of such an approach, particularly in identifying emerging risks to projects and showing communities how they are benefitting. There is a best practice in this area, and perhaps what government and investors could do more is to help facilitate the sharing of what works and what doesn't, and why, amongst the project developers it is involved with. This would imply that government actors would also improve their capacity in this area, which has been an issue in certain jurisdictions, for what are complex and difficult issues to deal with.

Masai tribesmen in Tanzania. Negotiation of land rights and the appropriation of ancestral land by government for large energy projects is a flashpoint for government and project developers. Photo courtesy Michal Huniewicz/M1key.me/Flickr



Q: Africa's largest hydrocarbon producers are nations that are either threatened by conflict – such as Libya, Nigeria, Algeria, South Sudan – or in the grip of authoritarian governments: Angola, Algeria, Chad, Egypt, Equatorial Guinea, Gabon and Mauritania. What are the obstacles that conflict and rigid governance present when trying to shift to more sustainable energy systems? What should investors be most wary of when looking at potential energy projects in Africa?

Udeme Akpan: Conflict and rigid governance usually lead to tension, crises and production disruption. These and other factors also breed financial and other losses. Investors should look out for many essentials, especially policies, incentives, size of the market, cost of funds, and availability of trained human capital as well as experiences of operators in such environments.

Traditionally, oil companies prefer to invest more in an environment of high oil prices. Banks that provide the funds also encourage investment during high prices. Like in other parts of the world, it will encourage more exploration and development in Kenya, Mozambique and Uganda. But they will be doing so at high cost too. Instead of waiting for high prices, wise investors have since decided to increase exploration and development during times of low prices when investment cost is also low to enable them to maximise profit.

As an example, the development of South Africa's shell reserves will not only depend on oil prices alone. It will also depend on government policy. It is the policy that would determine the action of the government in attracting investors. It will also depend on incentives provided to attract and retain serious investors and other considerations. In other words, if such investors found South Africa more attractive in terms of policy, incentives, political stability and other considerations, they will be more likely to invest. But, if they have better offerings elsewhere, they will likely go there than invest in South Africa.



The Niger Delta – the heart of Nigeria's oil industry – has grappled with resurgence in militancy in 2016 due to the domineering presence of foreign oil companies and a legacy of environmental destruction. Above: Italian oil and gas contractor Saipem constructs pipelines in Port Harcourt, Rivers state.

Below: Oil sodden marshland in the Niger Delta. Photo courtesy Sosialistisk Ungdom (SU)/Flickr; Cristiano Zingale/Flickr



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FEATURE ANALYSIS

Though power pools hold value in the long-term, maximising the presence and return
By Ogi Williams

Power pools and power trading are not new to Africa. Their origins trace back to the 1950s with the first formal bilateral agreement between the Democratic Republic of Congo and Zambia. Other similar agreements were also evident across the continent until the formation of the first official power pool in Southern Africa, aptly named the Southern Africa Power Pool (SAPP), in 1995.

The SAPP is currently the most developed of all power pools on the continent, but it also gave rise to the development of other such pools including the West Africa Power Pool

(WAPP) in 2001, the Central Africa Power Pool (CAPP) in 2003, and the East Africa Power Pool (EAPP) in 2005. North Africa also has a power pool, albeit under a slightly different cooperation arrangement, in the form of an association of power utilities under the banner of the Comité Maghrébin de l'Electricité (COMELEC) formed in 1989. The four power pools, along with COMELEC, are all recognised bodies within their regions, and work jointly to increase electrification rates across the continent.



Solar heaters atop homes in Port Elizabeth, South Africa.
Photo courtesy Vaiz Ha/Flickr

of microgrids must take priority

“The private sector has been slow to participate in power initiatives, while the public sector has often been stretched too thin to address power deficit issues, further exacerbating the problem.”

Undoubtedly, the various power pools do have some effect, but many are strapped with poor generation capacity and are over-reliant on single suppliers.

- The SAPP is, by far, the most developed power pool; it carried an installed generation capacity of 54GW in 2010 which equates to 320TWh of electricity. South Africa alone accounts for the bulk of this capacity, with coal being the main driver of power generation in the country. The SAPP is dependent on the ability of South Africa to supply power.
- In the WAPP the situation is similar, with Nigeria, Ghana and Côte d'Ivoire accounting for 90% of generation through the primary use of thermal plants powered by gas and a further 20% coming from hydropower. This power pool, however, only produces a combined 10GW of power, roughly equal to 50TWh. This is a massive margin in difference when considering that the population of WAPP is considerably larger than that of the SAPP.
- The EAPP has a higher total generation at 38GW, producing around 160TWh of electricity. Again however, one country, Egypt, accounts for the bulk of power production at 70%.
- The CAPP is the least developed power pool, accounting for a combined generation capacity of just 5.6GW which translates into roughly 20TWh of electricity. Production is slightly more distributed across members, but Angola, Cameroon and the DRC account for 80% of total generation.
- In COMELEC, the picture is very similar to that of the other power pools. The exception is that Egypt is also connected as the main supplier to this power pool, in addition to the EAPP, which places further strain on the country, leaving it susceptible to region-wide blackouts. The total generation capacity in the association is 60GW which translates into around 260TWh of electricity.

Regional power pools across Africa

Energy output capacity



- North Africa: 60,000MW
- West Africa: 10,000MW
- Central Africa: 5,600MW
- East Africa: 38,000MW
- Southern Africa: 54,000MW

Despite efforts to pool power and increase trading, there is still a considerable shortage of electricity supply across the continent. A significant reason for the lacking rise in electrification across Africa, is associated with poor planning and maintenance of existing facilities. The private sector has been slow to participate in power initiatives, while the public sector has often been stretched too thin to address power deficit issues, further exacerbating the problem. Regional cooperation has been slow with planning and integration not being taken very seriously by member states. The lack of power resources in many countries has left no other option but to import fuels, generally at high cost.

Heavy fuel and oil generators account for considerable portions of power generation in western and eastern Africa. Compounding this trend is the lack of sufficient demand for power to instigate development of scale economies to reduce overall power costs. Demand in over two-thirds of countries in Sub-Saharan Africa is lower than 500MW, while 22% of these countries have generation systems of 100MW or less. This contributes considerably to inflated costs of power generation in many countries. As already noted, the main drivers of power generation are localised in a handful of countries across the continent, with South Africa in the SAPP, Nigeria and Ghana in the WAPP, and Egypt being the main generator in both COMELEC and the EAPP. The CAPP is the only pool where power trading is a more feasible initiative given that Angola, Cameroon and the DRC generate roughly equal power individually.

*A drillship off the coast of Angola. The nation's heavy reliance on oil has had negative social and economic consequences.
Photo courtesy darksida/Flickr*

“Demand in over two-thirds of countries in Sub-Saharan Africa is lower than 500MW, while 22% of these countries have generation systems of 100MW or less.”

Necessarily, smaller contributors become more susceptible to downtimes from larger producers in their respective regions. Additionally, trade within regions is still marginal with the SAPP logging the highest amount of intra-regional power trade, which is primarily between South Africa and Mozambique. Others in the SAPP are highly dependent on power from South Africa including Botswana, Namibia and

Swaziland who all rely on power imports. This emphasis on power sharing among main grids also negates the issue of energy access and reducing energy poverty. Though the opportunity exists to bolster power generation in individual countries such as in the EAPP, where Ethiopia and Kenya are looking to expand production, projects are costly and face challenges with the terrain. Nonetheless, if more countries are producing more power it would lower power costs, over time, which would make it more affordable to consumers and may stimulate demand.

Microgrids are becoming more viable alternatives

As noted before, the cost of producing power in various countries is still too high and makes it unaffordable to increase power generation. Similarly, the lack of existing infrastructure for transmission means that rural areas will still find it very difficult to access power supplies.

In a scenario where power pools are increasing overall country access to electricity supplies, they will still need to provide adequate transmission lines for access in more remote areas. This can, again, prove too costly due to the lack of consumption demand along with high incurred costs of production. Necessarily, it becomes more important that cheaper and more effective methods for electrifying rural areas are employed. At present, the introduction of microgrids across Africa is proving to be a more viable alternative to increasing participation of power sharing as they allow for remote communities to access electricity at affordable costs without the need to boost the central grid through large-scale projects.

The implementation of microgrids has a number of positive outtakes that make it more feasible for rollout. For one, due to the smaller size and scale, less investment is needed per project. Turnaround times for project completion are quicker, while keeping the impact on the environment generally low and providing easier maintenance of units. The use of wind and solar power are the preferred mode of microgrid implementation so this method also promotes renewable

energy. Kenya's Powerhive has looked to build a solar power system with a 1-2MW capacity through investor financing. A similar initiative is taking place in Tanzania with the involvement of European investors and technology firms in conjunction with a Tanzanian university – the project involves the construction of a 5MW solar-powered microgrid and will be funded by the European Commission and the Sustainable Energy Fund for Africa at a cost of US\$18.3 million. As part of faster solar power rollout, various initiatives have also allowed for consumers to buy power on the go, instead of commissioning expensive solar units, making it affordable to developing countries to utilise renewable microgrid power.

“At present, the introduction of microgrids across Africa is proving to be a more viable alternative to increasing participation of power sharing as they allow for remote communities to access electricity at affordable costs without the need to boost the central grid through large-scale projects.”



*A young girl in Malawi reads at night using a micro-solar light. Increased access to energy greatly improves education outcomes.
Photo by Jerry Barnett/SolarAid photos/Flickr*

The EDA looks to cap daily use of energy per household to ensure that users do not place any additional strain on the grid, thereby prolonging the life of components and the grid in general. Tariff collection systems have been put in place at fixed rates based on affordability, and they are able to pay for repair and maintenance costs as well as repay portions of capital costs.

Solar PV microgrids and SPDs – PowerGen, Kenya

Kenya's PowerGen has been one of the main advocates of implementing microgrids across the country, especially in more remote regions in the north that are far from the central grid. They have looked to implement two different microgrid models; firstly, a completely standalone microgrid, and secondly, an Surge Protection Device (SPD) model which is also a microgrid but is connected to the main supply grid.

The microgrid is completely standalone and has its own power generation and distribution capacity. The SPD model, on the other hand, looks to provide the "last mile" connection where central grids are not able to reach areas that are too far away from distribution lines. Both models employ the same distribution network, smart metering, a financed connection fee and the ability to improve service quality with battery storage. They also look to improve the quality of the overall grid, at the periphery, by using storage and back-up generation.

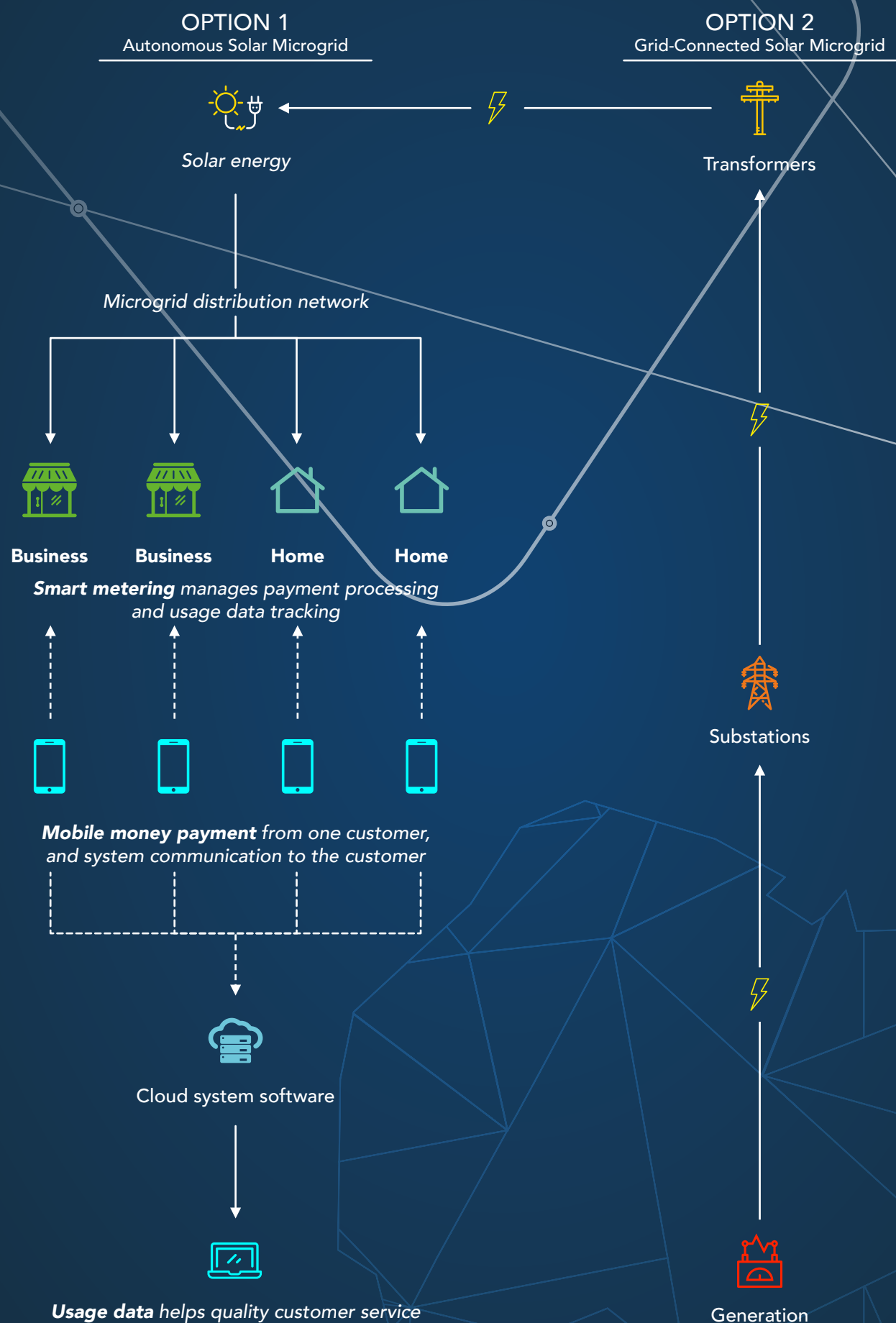
Solar PV microgrids – Trama TecnoAmbiental / Aguas de Porta Preta, Cape Verde

In 2012 a consortium of companies came together to electrify the island of Santo Antão in Cape Verde through the introduction of a multi-user solar-grid (MSG) which is inclusive of a photovoltaic generator, a storage battery, electricity monitoring, control and power conversion equipment as well as an LV distribution grid.

To ensure sustainability in the implementation of the grid, an Energy Daily Allowance (EDA) system was put in place.

PowerGen Kenya

Solar power grid connections



The use of microgrids adds to sustainable development

An additional factor to consider in implementing microgrids over centralised grids and power pools is the ability of microgrids to stimulate faster economic growth and development. Microgrids can also reduce the existing costs of industries that are dependent on central grid utility companies to supply them with power at higher tariffs, in comparison to utilising their own microgrids with decentralised power. In South Africa for example, private hospital group Netcare, is looking to roll out solar-powered heating and electricity in the coming years due to consistently increasing power costs.



A Somali woman cooks samosas for Ramadan on a kerosene stove in Mogadishu. The noxious fumes created by indoor cooking with kerosene and other cheap fuels causes over 600,000 deaths per year across Africa.

Photo courtesy AMISOM/Ilyas A. Abukar/Flickr

Introducing microgrids also creates an innovative environment where entrepreneurs can thrive. In Kenya, microgrid technology company SteamaCo, has introduced the use of mobile phones to provide power to rural communities using microgrids.

Through smart technology, solar-grid users are able to monitor their power consumption and make payments via their mobile phones. The company focuses on developing tools that can be used by microgrid users to ensure sustainable operation and stimulate social and environmental benefits. The company has expanded operations to Tanzania, Benin and, even as far as, Nepal.

In South Africa, Accenture Development Partnerships, in conjunction with the University of Notre Dame's Initiative for Global Development, and The Rural Development Company, have looked into stimulating microgrid development in the Kwazulu-Natal province. The partnership will look at stimulating economic growth in farmlands by providing power for irrigation equipment and a storage facility where farmers will be able to process and package crops. In addition, the microgrid initiative will also power a classroom in which farmers will be trained in farming skills and other occupations. The programme hopes to initiate entrepreneurship within the community while also providing much-needed power access.

“Through smart technology, solar-grid users are able to monitor their power consumption, and make payments via their mobile phones.”



High fertility rates and the accelerating effects of climate change means that increasing power for irrigation, refrigeration and food processing will be necessary to feed Africa's population in the future. Above: A woman displays a weeks' worth of food aid in Harare, Zimbabwe.

Below: A man brings freshly harvested bananas to a market in the Mount Kenya region. Photos courtesy Kate Holt/Africa Practice/Flickr; Neil Palmer/CIAT/Flickr



In other sectors, such as mining, private sector entities have also looked to move toward off-grid power via microgrids. On the back of elevated power costs as well as lack of reliability, various companies in Africa's large mining countries have looked to implement hybrid diesel-solar power systems to ensure prolonged access to electricity while also reducing costs. In Zambia, the country's hydro power sector has been hard hit by the drought that has ravaged Southern Africa over the last three years. Coupled with this, global commodities prices have caused a considerable slump in Zambia's mining industry – the main contributor to GDP in the country. Power costs have skyrocketed amidst low output and weaker financial yields, making it difficult for mining companies to stay profitable. Resultantly, greater emphasis has been placed on implementing solar microgrids to power mines with diesel-generator sets acting as backup storage and supply units.

A similar trend is emerging in South Africa where independent power producers, such as Chronimet Mining Power Solutions, have begun operation of a photovoltaic/diesel hybrid system for a South African chromium mine owned by their parent company – Chronimet Mining Group – that has seen diesel costs reduce by up to 30%. Making greater use of microgrids within the mining industry has the further potential of significantly reducing greenhouse gas emissions.

The main pitfall of implementing renewable energy initiatives through microgrids is the initial costs which make it a more expensive option than diesel generators, for example, but only in the short term. They also do not hold as much benefit as large public projects which work on economies of scale, and are susceptible to geographic localisation, depending on the type of energy source utilised.

A mobile phone stand in the town of Paoua in the north-west Central African Republic (CAR). Development experts advocate that Africa's rapid adoption of mobile phone technology, over traditional cumbersome communications infrastructure, provides a roadmap for adopting off-grid power solutions.
Photo courtesy Simon Davis/UK Department for International Development (DfID)/Wikimedia Commons



In the coming years microgrids will become the new norm while the strengthening of power pools continues

In the long term, it will be important to continue strengthening regional power pools with an aim to provide greater power sharing within centralised grids and stimulate power trading.

These will have a positive lasting effect on larger industries and trigger more intra-Africa trade and economic development.

Power pools are more beneficial on a macro scale of operation but still lack the necessary infrastructure in terms of transmission and distribution to rural areas. This is where microgrids can step in and alleviate the pressure to construct large power projects in shorter timespans.

“Power pools are more beneficial on a macro scale of operation but still lack the necessary infrastructure in terms of transmission and distribution to rural areas.”

Microgrids can provide an avenue to electrifying rural areas at lower costs and with a shorter roll-out period. In the short term this will alleviate energy poverty across rural Africa and drive forward growth and small-scale entrepreneurship.

Such microgrids will also hold benefit to various industries such as mining that operate in more remote areas across Africa.

These initiatives will also lower operational costs and have a positive knock-on effect on adjacent communities that are looking for ways to meaningfully participate through economic development.



AFRICA CONFLICT MONITOR

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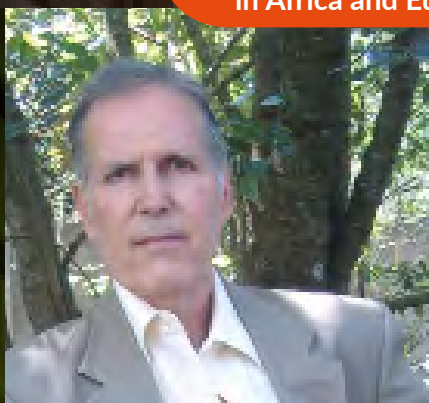
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- ACM subscriber Joel Krauss is a retired US Army officer with extensive experience in Africa and Europe



James Hall, the Founding Editor of IOA's Africa Conflict Monitor (ACM) and critically acclaimed author, columnist and filmmaker, pioneered insider coverage and analysis of Africa, in Africa. James holds extensive and diverse experience in commentating on African issues, with six books and thousands of articles and news stories for publications worldwide.

In On Africa (IOA) and MTS have recently partnered to produce a first-of-its-kind report to establish the promulgation and effectiveness of education and training programmes within South Africa's mining sector.

The IOA / MTS partnership aims to provide fully-informed insights and strategic recommendations to positively influence the growth of the sector. This will be done through ground-breaking thought leadership that encapsulate a considerable scope within diversity, education and localisation as experienced within the South African context.

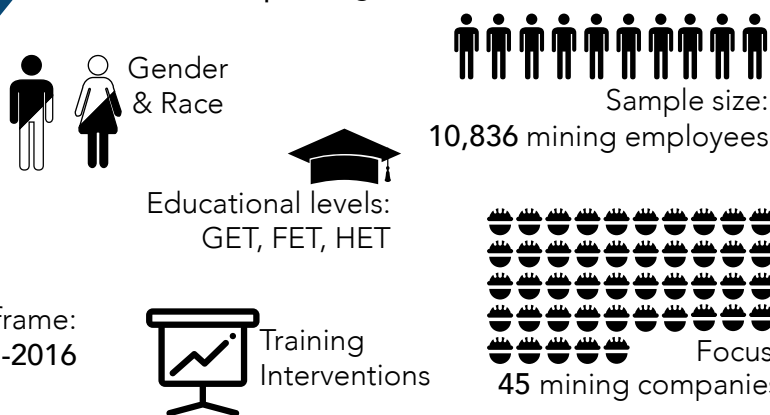
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The Case for Renewable Energy Technology in Africa

By Mike Veysie, Raldu Nel, Surisa Nel and Maryke Kelly

Two-thirds of the world's poorest countries are located in Africa. According to 2013 data from Gallup World, the 10 countries with the highest proportion of residents living in extreme poverty were all in sub-Saharan Africa. IN this region, almost half of the population live on the minimum US\$1.25-a-day requirement for sustenance. In a 2013 "State of Food Insecurity in the World" The Food and Agriculture Organization (FAO) estimates that roughly one-third of those living in sub-Saharan Africa lack sufficient food access - the highest rate in the world. Additionally, more than 40% of all Africans are unable to access food on a regular basis as noted by the UN Millennium Project.

One of the main drivers of lacking access to food and high incidence of poverty is the stable access to power. Close to 600 million people within sub-Saharan live without electricity. As a result, a massive 80% of Africans rely on biomass products including wood, charcoal and dung, for household cooking activities.

Of the over 700 million people globally who have no access to clean water, more than one-third live in sub-Saharan Africa. Poverty in Africa results in half a billion people being affected by various waterborne diseases, and according to the UN Millennium Project, more than 50% of Africans have suffered from some form of water-related illness such as cholera.

It is estimated that every year, sub-Saharan Africa loses US\$28.4 billion to water and sanitation problems. This amount accounts for approximately five percent of the region's gross domestic product (GDP)—exceeding the total amount of foreign aid sent to sub-Saharan Africa in 2003.

The utilization of solar water heaters and biodiesel resources in South Africa within recent years has revealed that renewable energy can significantly diminish poverty. The implementation of clean energy systems has led to improvement in health, and general welfare of the people. The assimilation of these programs also generates employment, and develops empowerment of the people due to a localized level of energy operation. Energy can facilitate the development of schools, and help teachers gain access to a wide variety of teaching mechanisms, including personal computers and tablets.

According to a 2012 World Bank report, the most tenuous link is between economic and environmental sustainability; i.e., green growth is not inherently inclusive. This indicates that specific interventions will be required to make the benefits of sustainable development accessible to all. These benefits include:

- **Improved environmental quality:** Spanning a range of benefits from basic human welfare (e.g., air quality, sanitation, food security, access to energy, etc.) up to higher-order needs such as conservation and biodiversity

Blank Canvas[®]

FOR SUSTAINABILITY™

- **Enhanced efficiency and quality of resources:** Repurposing materials, redesigning processes, and investing in the base of natural, physical and human capital
- **Increased resiliency to supply/demand shocks:** Preventing or mitigating climate-related price volatility across industries (e.g., food, water, transport, energy)
- **Sustained job creation and enterprise development:** Profiting from the development, deployment, transfer and trade of climate-friendly products, services and business models.

Recent successes in Africa have demonstrated that inclusive green growth is not only feasible, but potentially profitable as a market opportunity.

Through renewable energy technology, Africa has the opportunity to LeapFrog development and ensure security of decentralised energy supply, and implement cost-efficient and self-sustaining modular energy solutions including solar, wind, and waste-to-energy.

Resilient Business Performance through Clean Technology Enablement

Technology enablement allows organisations to LeapFrog their competitors through effective adaption and rapid implementation.

The value of fit-for-purpose technology enablement for business will include:

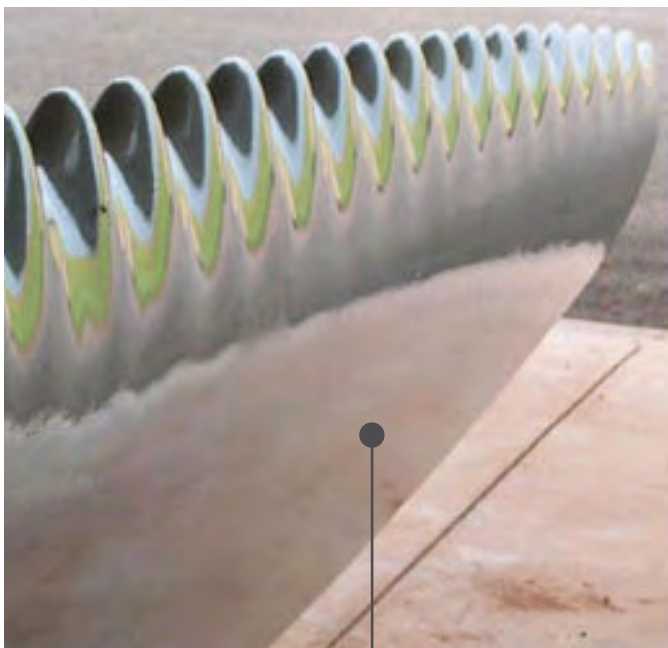
- Increased productivity while institutionalizing a culture of high performance leadership
- Increase local and global collaboration
- Reduction of complexity by simplifying complex tasks and decision making
- An empowered Workforce

An example of a high impact clean technology enablement is the renewable energy IPP's in South Africa, one of the South Africa Public Private Partnership success stories. In order to be successful in the operationalising of these clean technology solutions, leadership has to drive implementation of new "Clean Technology" enablement throughout government and private organisations, and especially when implementing new projects. This requires a new design brief that encapsulates shareholders, businesses, project managers, design engineers and the supply chain. This brief can be summarised in three core areas of development:

- Energy Efficiency e.g. Optimised Equipment, Variable Speed Drives natural ventilation
- Water Efficiency and Recycling Technology e.g. Constructed Wetlands
- Zero Waste to Energy Technology

A value engineering design brief that supports circular systems thinking and drives the goals just mentioned includes designs inspired by nature. The two approaches that are highly successful internationally are Biomimicry & Ecological Engineering.

Biomimicry looks to approach innovation from an angle that utilises already existing patterns found in nature, and create sustainable solutions to global resource challenges. The aim of this approach is to formulate new ways of developing products, driving production processes and adjusting governance policies, that are suitably adapted to earth life in the long term.



Ecological engineering is an emerging study of integrating ecology and engineering, concerned with the design, monitoring, and construction of ecosystems. The utilisation of this system seeks to combine sciences used in the fields of engineering, ecology, economics and the natural sciences, with an aim to formulate both aquatic and terrestrial ecosystems.

In the field of ecological engineering, ecosystems are designed, monitored and constructed in an enclosed-systems model. Photo courtesy A-SDA

African Sustainable Development Association introduces the “Sustainable African Village” Concept

It takes a village to raise a child – empower the village and you empower the children of Africa.

Taking the 2012 World Bank Report to heart, the African Sustainable Development Association has developed the Sustainable African Village concept as a solution on micro level to provide a sustainable infrastructure that is not only energy producing but also food producing.

The African Sustainable Development Association (A-SDA) was launched in September 2016 out of the Sustainability Summit hosted at the JSE and was convened by Blank Canvas International. One of its objectives is to address green growth through the creation of synergies among the three aspects of sustainability — social, economic and environmental – and developing a membership base comprised of industry, academia, civil society and government entities, in a space of trusted collaboration to bring anchor projects to fruition through which the strategic objectives of the A-SDA can be achieved.

Biomimicry design principles look to capture already existing designs found in nature like the application of whale fins on wind turbine blades. Photo courtesy of Inhabitat



This is done through the organisation's active cross industry 'Wisdom Board' network and "Deep Dive Engagements" in the form of focused sessions facilitated by experts, and attended by cross-industry participants with the purpose to identifying and driving anchor projects.

The A-SDA is working toward the goal of a "Sustainable Africa for All" and with this in mind the Project Focus Areas of the organization for the next 12 Months are intended to include:

1. Resilient Business Performance, through Business Model Innovation (refer to Resilient Business Performance through Clean Technology Enablement")
2. Sustainable Financing Strategies and Resilient Infrastructure Management
3. Management of Technology: "Leapfrog while Maximizing the Value" (IoT / Clean Technology)

Two main events will be hosted during 2017 aimed at covering these core areas of focus:

MAIN EVENT 1 - Sustainability Summit – 29 June 2017 taking place at the Johannesburg Stock Exchange

- Management of Innovation for Growth, Differentiation and Sustainable Development
- Agriculture, Food Security, Agri-Processing and the Green Economy
- Responsible Investment (ESG)

- Management of People: Systems Thinking - "Gearing the Workforce of the Future"

MAIN EVENT 2: Collaborate and Sponsor the "Sustainable Business Performance Excellence" Awards – Da Vinci TT100 Business Innovation Awards Programme November 2017

- Climate Change Response (Mitigation & Adaptation "Resilience") & Impact of Carbon Tax

The Sustainable African Village

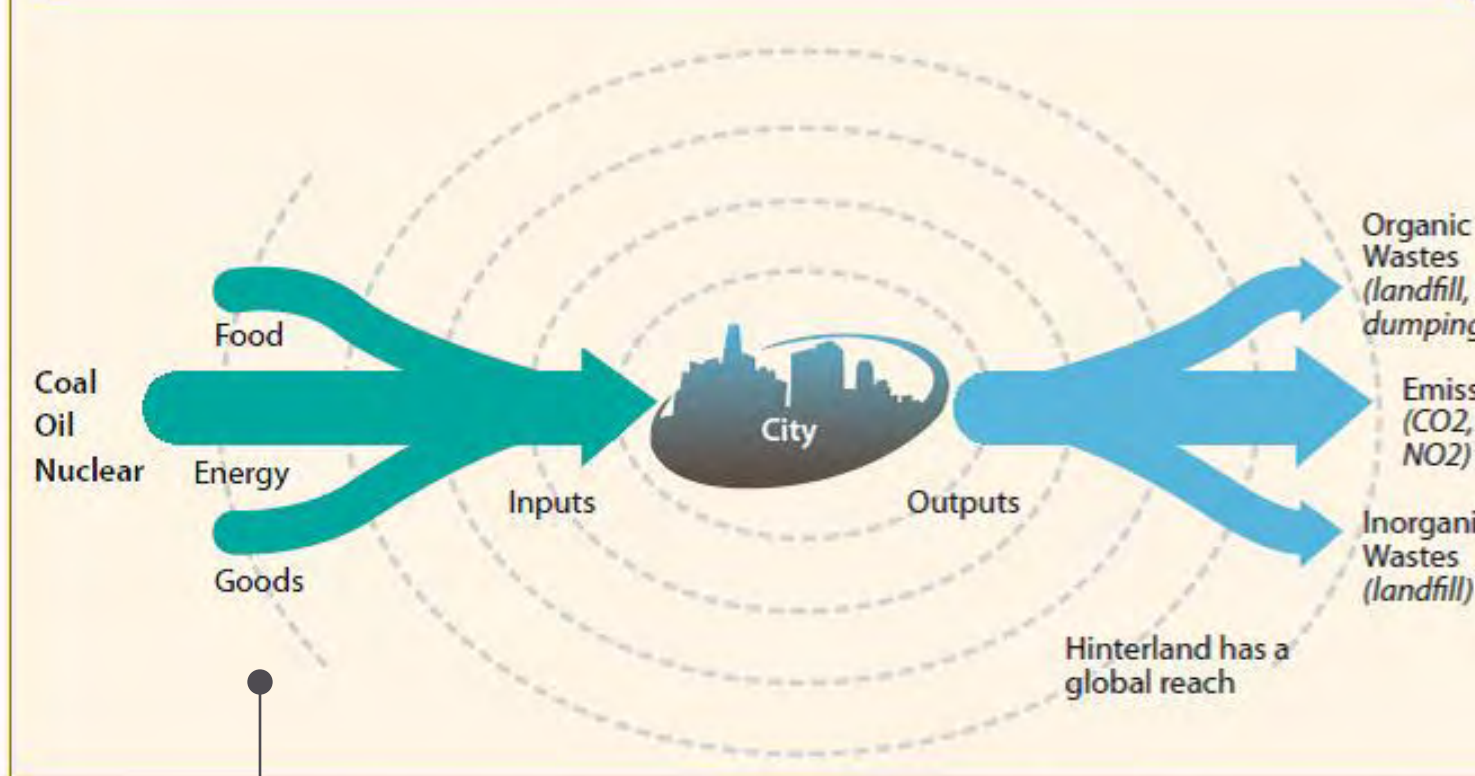
The "Sustainable African Village" is a concept developed by the A-SDA and as such provides a solution at a micro-level to the circular metabolism cities.

The basic principle of a circular city model sees a city in terms of inputs (energy, water, people, materials, products, food) and outputs (solid, atmospheric and liquid waste, noise and people).

The difference between a circular and linear system is that in a circular design the inputs are reduced and outputs are recycled, minimized or optimised. In a linear system the city system has uncontrolled inputs and outputs.

Two of the cities where the circular approach has been adopted and implemented are Amsterdam in the Netherlands, and Glasgow in Scotland.

LINEAR METABOLISM CITIES CONSUME RESOURCES AND CREATE WASTE AND POLLUTION AT A HIGH RATE



The circular city approach works by utilising more waste by-products and in turn releasing less waste Photo courtesy A-SDA

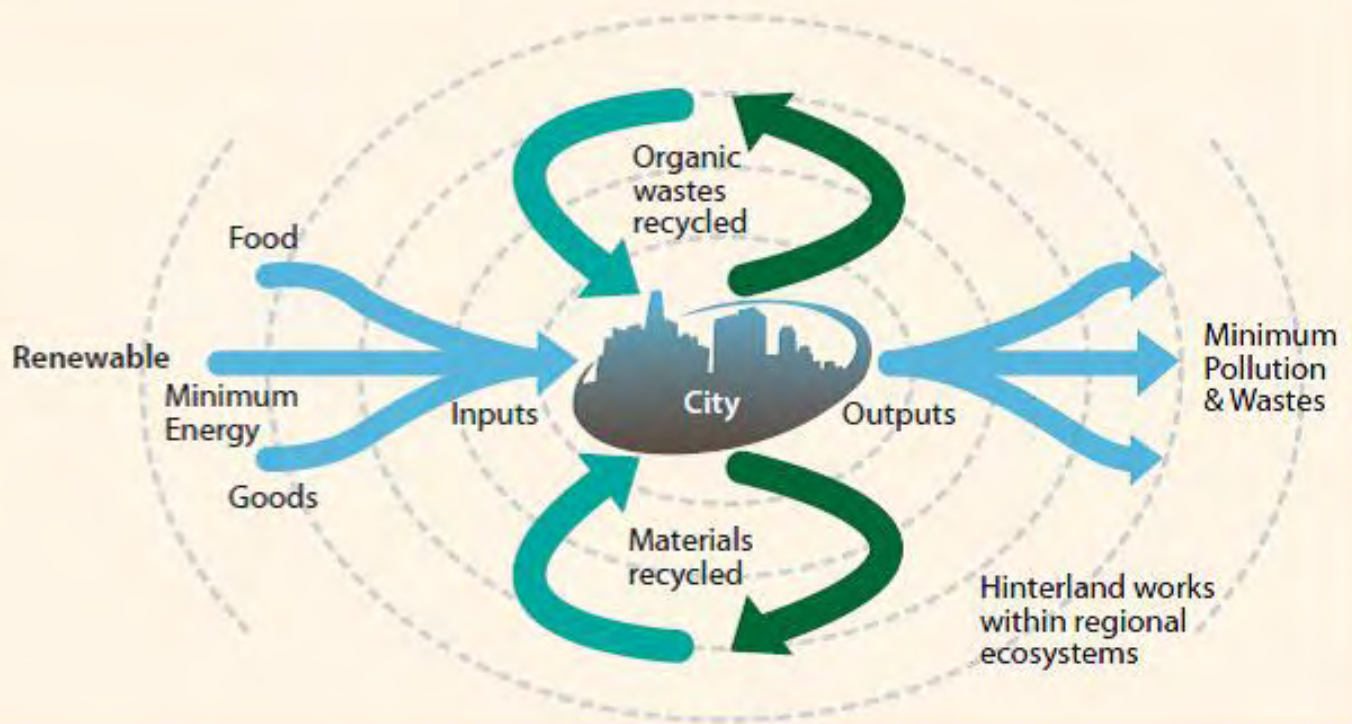
The "Sustainable African Village" Concept is adopted from the REGEN SYSTEM which has been successfully deployed in Europe, but has been localised specifically for Africa's needs. In Europe the REGEN system has been designed as a "Tech-Integrated and Regenerative Residential Real Estate Development" solution for the ever-growing housing, food and resources demand. The aim of the system is to Internet-of-Things (IoT) integrated infrastructure, that is capable of providing sufficient supplies of energy, water and food.

This in turn would allow the system to become an asset in various locales, which aids residents to reduce incurred costs on their mortgage payments.

Additionally, the system will facilitate the creation of integrated neighbourhoods that are self-sustaining both in terms of energy as well as food and water resources.

The A-SDA is in the final stages of formalising its first Pilot Project Agri-park in Gauteng, together with Gromac and other collaborative partners, to create a "Centre of excellence" which can act as a launch pad for other Agri-parks and for the development of "Sustainable African Villages" and the creation of community development, food production, education and sustainability for all in Africa.

CIRCULAR METABOLISM CITIES REDUCE CONSUMPTION AND POLLUTION, RECYCLE AND MAXIMIZE RENEWABLES



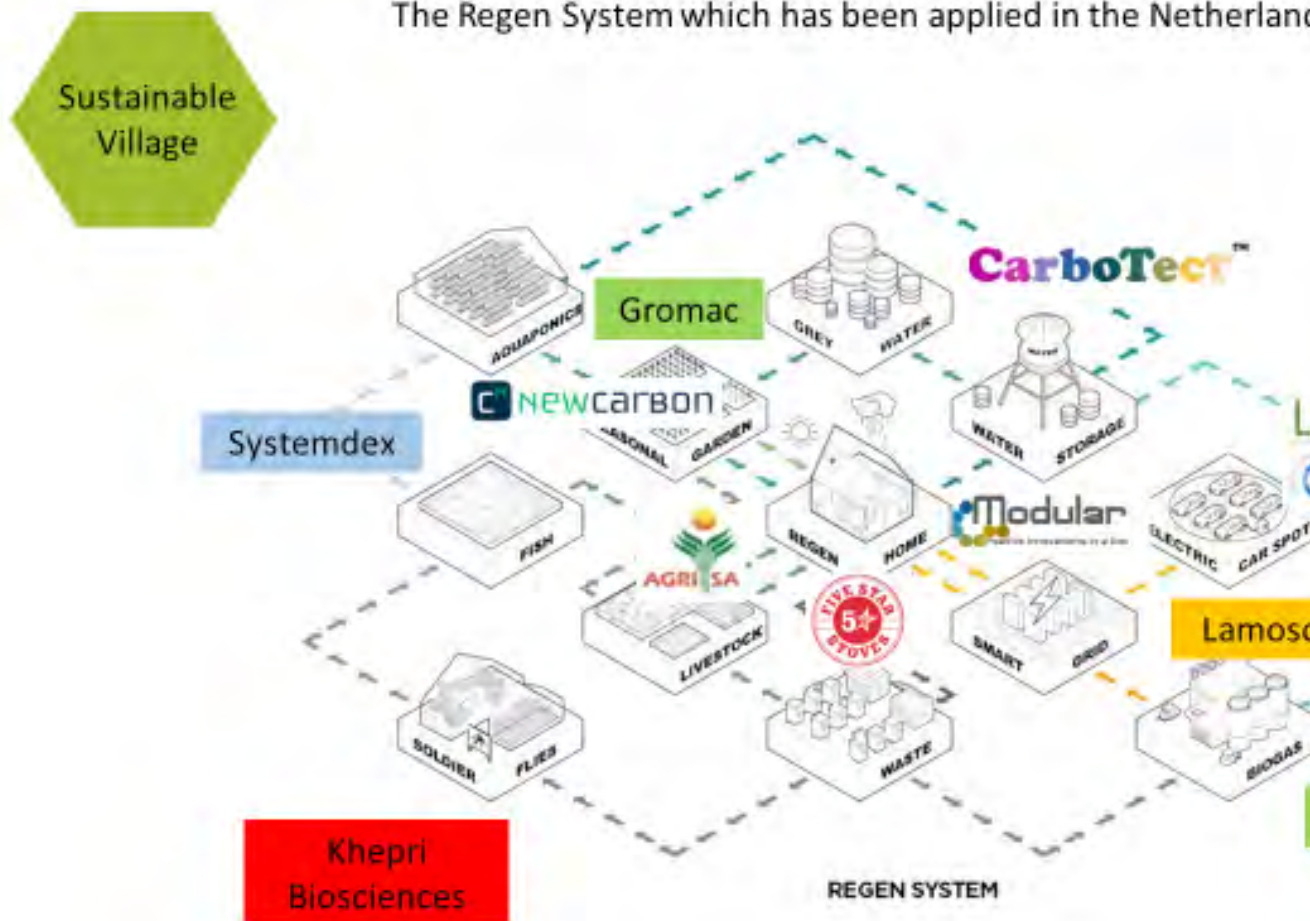
The “Sustainable African Villages” Concept is aligned and will enable the operationalisation of the United Nations Global Sustainable Development Goals 2030, the IFCC or Equator Principles, NEPAD’s Vision 2063 of a “United States of Africa”, as well as South Africa’s National Development Plan 2030.

The Sustainable Village Concept was not developed in isolation but with the A-SDA’s fundamental goals at heart: to stimulate and lead collaboration, empower sustainable development, and make real impact. To demonstrate the power of this collaboration platform, the A-SDA has incorporated the finalists of the inaugural Green Pitch Competition as co-suppliers of the Sustainable Village Concept.

The Green Pitch was initiated last year to bring entrepreneurial development into the scope of the Sustainability Summit. The goal with the initiative is to:

- Showcase the innovative potential of South African entrepreneurial ideas in the field of sustainability
- Select and incubate those entrepreneurs that show the most potential, creating and influencing projects & value chains
- Bring corporate big business closer to start-ups and entrepreneurs
- Be a source of entrepreneurs for incubators who are looking for entrepreneurs to develop

The Regen System which has been applied in the Netherlands



The finalists had the opportunity to go through a mentoring session with some of the top leaders of industry at the Standard Bank Incubator before their final pitching session before a judges panel at the Sustainability Summit on the 28th of September 2016 at the JSE.

Green Pitch nominees had to measure up to a robust "Six Capitals Score Card" to validate their Net Positive contribution towards a sustainable and inclusive economy. Raldu Nel, Chairman of the Summit says: "The purpose of the "Green Pitch" is not only to reward and recognize Africa's top entrepreneurs in the Green Economy, but to also create broadened awareness of the Holistic 6 Capitals Integration and Interdependence Strategy, a key to drive Resilient Business Performance across the value chain.

This competition show-cases creativity and design thinking to business leaders across industry and by doing so, bridge the gap between formal industry and entrepreneurs – the key to Africa's Emerging Economy."

The opportunity born out of the competition was the establishment of a network that is being incubated by the African Sustainable Development Association within the African Sustainable Villages Project. The Summit is taking place in June 2017, and the Green Pitch process will start in February.



Utilising the REGEN system approach ensures that each of the city's needs are catered for through an enclosed system of resource consumption. Photo courtesy A-SDA

Green Pitch 2017 will focus on attracting youth and female entrepreneurs as well with ideas that are not only clean tech and renewable energy, but could be a bright idea that solves an every-day problem in a community or provides economic development for a community. Echoing the Summit's 2017 theme, "Collaborative Solutions, Gearing Africa for a Resilient Future", there will be a specific focus on social innovation and agro-entrepreneurs.

The Green Pitch Process for 2017 will start in February and culminate in the final selections during the Sustainability Summit in June 2017.





IN ON AFRICA
IOA

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EXPERIENCE

A decade of company experience focused solely on Africa across all industries, sectors and interest areas



**WHY
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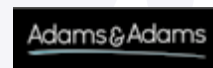
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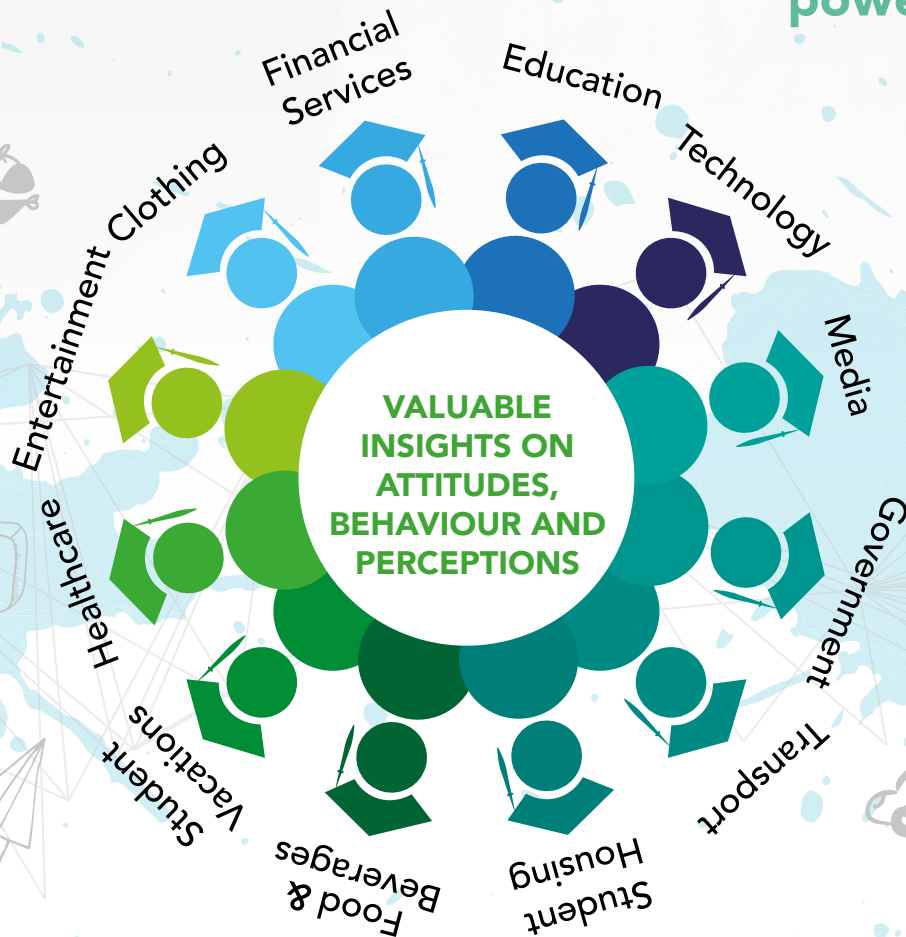


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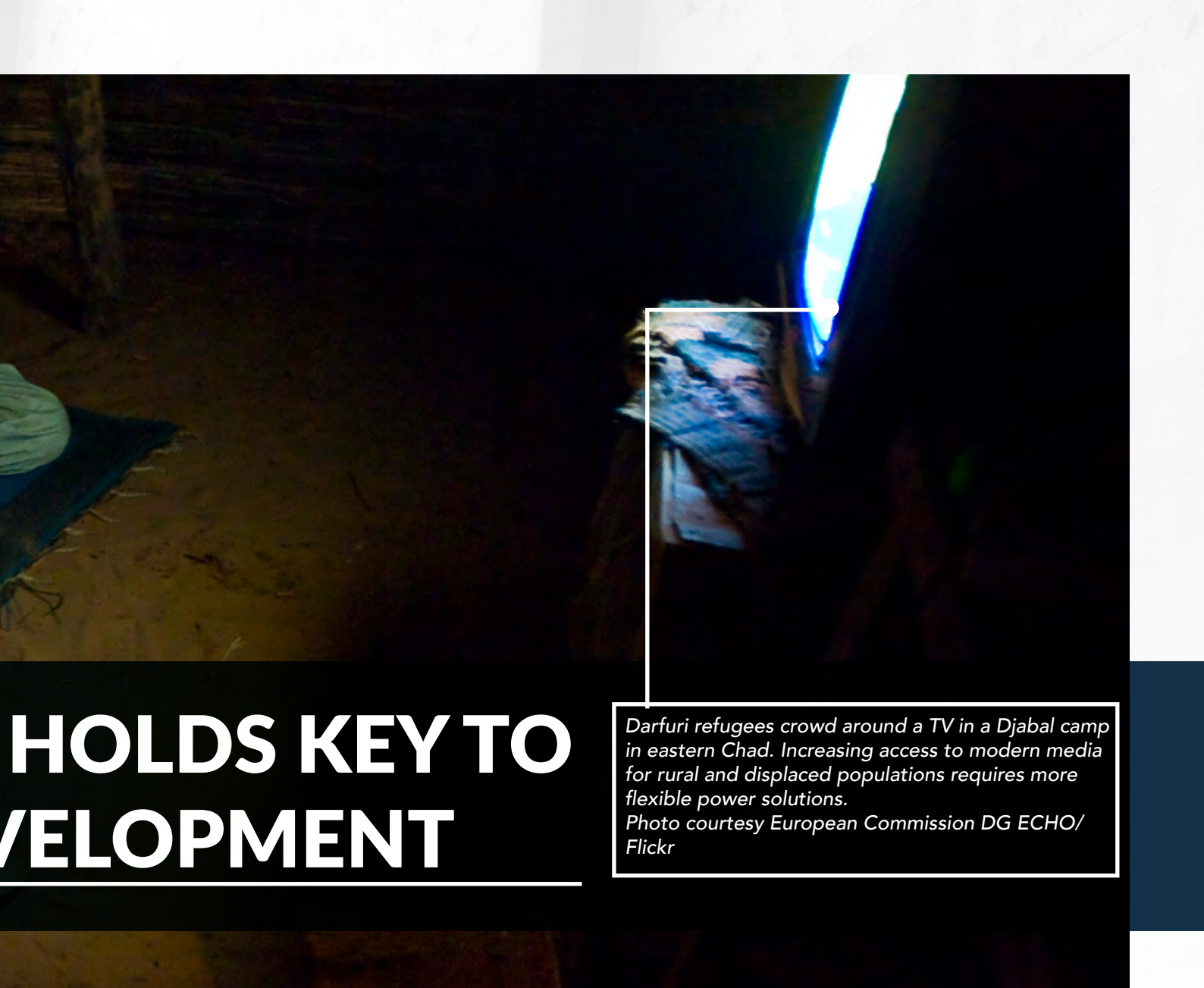
INCREASED ENERGY ACCESS SOCIAL AND ECONOMIC DEV

Spin-off benefits of increased access to energy

Ensuring greater energy access across Africa has multiple knock-on effect. These range from improved quality of education and medical care, to stimulating economic development and entrepreneurship.

In the field of healthcare, World Health Organisation statistics indicate that women giving birth in developing countries die every minute and a half from various complications during pregnancy or childbirth – lack of access to sufficient lighting being a primary cause. Similarly, many students struggle to conduct homework and study after hours due to lack of lighting in their homes.

“In the field of healthcare, World Health Organisation statistics indicate that women giving birth in developing countries die every minute and a half from various complications during pregnancy or childbirth – lack of access to sufficient lighting being a primary cause.



HOLDS KEY TO DEVELOPMENT

Darfuri refugees crowd around a TV in a Djabal camp in eastern Chad. Increasing access to modern media for rural and displaced populations requires more flexible power solutions.

Photo courtesy European Commission DG ECHO/ Flickr

One major advance that Africa has taken is the use of cell phones, which have, in cases, enabled the continent to leapfrog more traditional forms of business such as in the banking sphere. However, due to lack of power access in rural settings, charging these phones is more difficult than it appears which in turn also inhibits communications within rural areas.

Lack of electricity also has the negative effect of unsafe and hazardous cooking and heating methods which, in many areas across Africa, leads to infant death from air pollution or household fires due to poor heating through biomass.

In each case, greater access to electricity and power holds the potential to alleviate problems, which are viewed as common in developed countries, and in turn boost Africa's development substantially.

**tion statistics indicate that women giving birth in
from various complications during pregnancy or
ent lighting being a primary cause.”**



INTRODUCTION

Increasing access to electricity does more for a society than boost raw economic growth – it improves living standards. Smart energy policies that effectively enable access to reliable energy sources creates a myriad of direct and indirect benefits for society.



EDUCATION

About 90% of children in Sub-Saharan Africa attend primary schools with inadequate electricity. Lighting makes class hours more flexible and enables modern learning tools – internet, computers and tablets – to be used in increasing learning outcomes and exposing students to greater information and further learning opportunities.



HEALTH

Modern healthcare services depend on electricity to power facilities, medical devices and auxiliary equipment, and keep medications and vaccines at a controlled temperature in hot climates. The internet allows health professionals to access the latest research, and enables individuals to self-educate on preventative behaviours to mitigate communicable and lifestyle diseases.

POWER & PROSPERITY



FOOD SECURITY

Power for refrigeration and storage of food reduces food wastage, while electric cooking negates the harmful fumes and cost burden of using kerosene for households. Smartphones also make rural farming more efficient by enabling growers to access current market prices and nearest markets, reducing costs, maximising profit and bolstering income.



CRIMINAL JUSTICE

Well-lit areas and surveillance cameras reduce burglary, theft and assault, and power mobile phones that help boost self-reporting of crime. Electric lighting also enables common spaces to be used for arts & culture or sports programmes that can be a diversion for at-risk youth.



ENTREPRENEURSHIP

Electricity powers devices like mobile phones and computers that connect individuals and businesses to prospective investors and customers. Electric lighting also extends businesses' available trading hours past dark.



CONCLUSION

Assessing Africa's path to meeting its present and future energy demands

The current energy outlook for Africa is still quite fixed on fossil fuel sources and the inefficient use of biomass. The larger energy producers around Africa are still considerably ingrained in utilising such inefficient and polluting means of energy production.

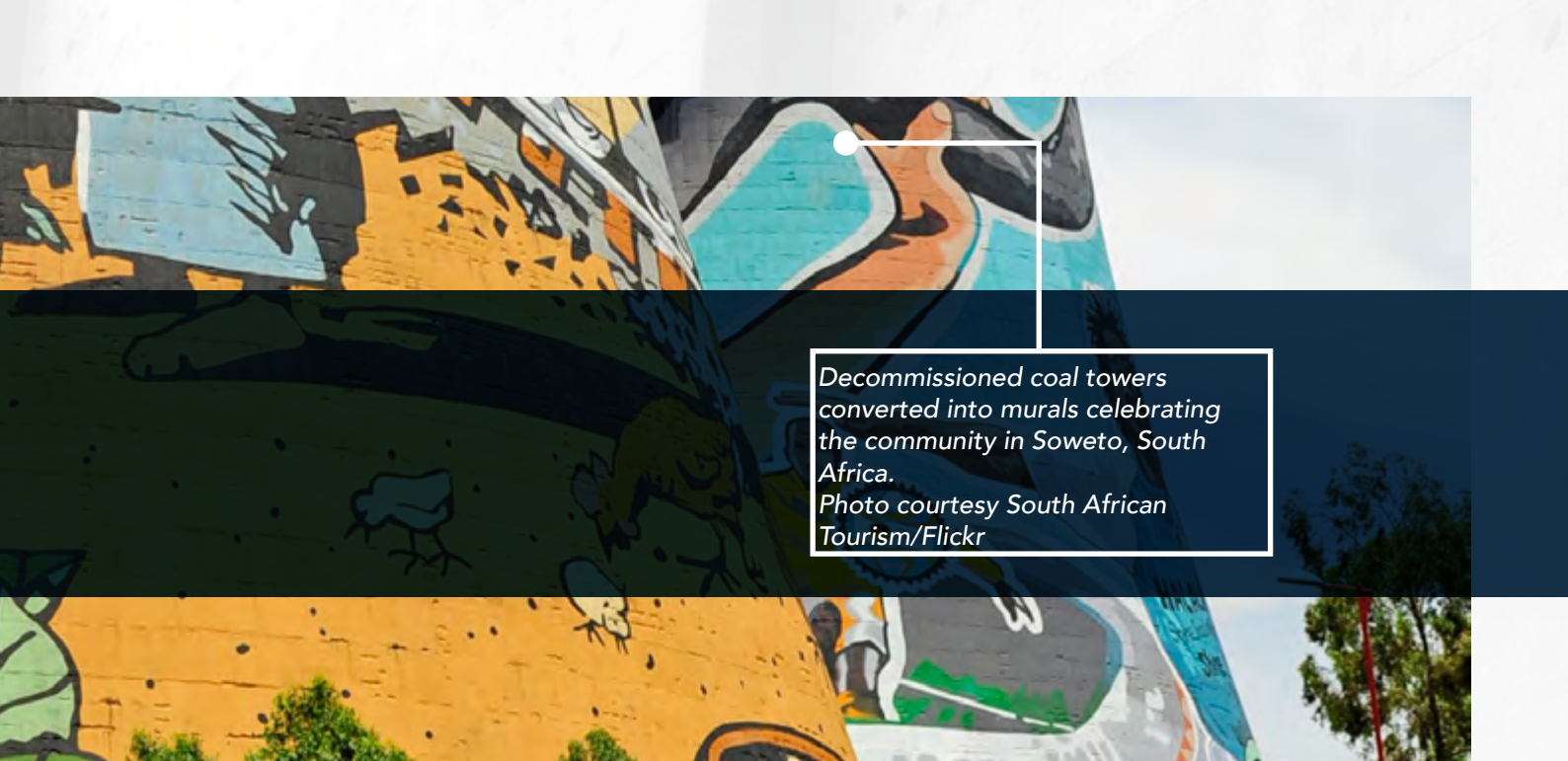
North African countries that have vast oil and gas resources have entrenched their power plants in using these fuels for power generation. Similarly, Southern Africa's largest energy producer, South Africa, is still battling to move away from its overdependence on using coal for power generation.

Some countries, however, have made moves toward utilising the continent's considerable hydropower resources. Countries such as Kenya and even the DRC are looking to increase their hydropower energy generation capacity and have done so to a relative degree already.

However, they are susceptible to weather patterns and prolonged drought conditions do not bode well for such developments.

African power pools have, however, looked to bolster energy sharing and trading within the continent. Utilising such pools provides an avenue for smaller and less energy developed countries to access the resources of larger producers. Though this has been an ongoing initiative since the mid-1990s, there is an overdependence on a number of larger contributors within each power pool, which makes countries dependent on this distributor susceptible to downtimes in supply.

Additionally, due to the lacking availability of transmission lines, such power pools have not been able to provide electricity to more remote areas. This added factor makes them less viable as areas with no access to central grids will essentially stay in the dark until they are connected to supplies.



*Decommissioned coal towers converted into murals celebrating the community in Soweto, South Africa.
Photo courtesy South African Tourism/Flickr*

“Microgrids have shown considerable promise given their benefits: lower project costs, faster turnaround times and less environmental impact.”

A key problem that stands at the core of greater electrification in Africa is the need for considerable investment in power infrastructure development. Here, international entities and local institutions have looked to stimulate investment in energy infrastructure.

Foreign initiatives, such as the US Power Africa, the Africa-EU Energy Partnership and the UK's Energy Africa Campaign, are looking to strengthen energy access in various ways, including large-scale hydropower infrastructure, renewable energy initiatives and solar-powered off-grid solutions. Others, such as China, have been involved in developing the energy resources of a number of African countries, while its Asian rival Japan has also sought to introduce smarter payment systems and additional support for power projects via technology contributions. Localised programs such as the PIDA and AREI are assisting in making these initiatives

more viable while the AfDB contributes additional investment.

Renewable energy solutions are being implemented across the continent with noticeable impacts. However, various large scale projects face problems from local communities, depending on the impact that they may have on indigenous populations. Alternative, and more viable, ways forward for many African countries, have been to introduce microgrid solutions for remote rural settings.

Microgrids have showed considerable promise given their benefits: lower project costs, faster turnaround times and less environmental impact. Additional technology solutions are also making the process of microgrid installations easier for consumers to take up. This trend is likely to continue, going forward, to increase the rate of electrification within countries and remote regions.



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