# Energy Journal

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Turn on the light on Africa's possibilities

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**Energy Journal** Cesi's house organ

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## **Editorial**



Salvatore Machì / Chairman, CESI Matteo Codazzi / CEO, CESI

Why Africa? Because that's where the most important challenges of our planet are playing out. Among these, the most decisive is access to energy. Despite undeniable progress achieved in recent years, 620 million Africans still remain without any access to electricity. In light of current demographic trends, we run the risk that in 2030 there will be 45 million additional people without electricity if we don't act quickly to turn this disparity around.

Nobody can remain indifferent to such a scenario. We all know too well that access to modern forms of energy means a better quality of life, more opportunities to study, functioning hospitals... It means development. It means climbing up out of poverty. Overcoming this African challenge requires new forms of collaboration between industrialized and developing countries. We need to take full advantage of all Africa's rich energy potential and make it available for consumption both in capital cities and in the continent's more remote areas.

There's only one way to accomplish that: by taking advantage of all the extraordinary technological know-how that industrialized countries have developed over recent years. Today developed countries are in the middle of a transition to overcome their historical, centralized, fossil fuels energy production system. Our past is slowing us down. To the contrary, the delayed development of African countries has put the African continent in a position to take advantage of an important opportunity: the chance to skip one level in the evolution and organize their own energy systems directly around new renewable resources, betting on distributed generation, intelligent networks, integrating on-grid and off-grid systems...and actually taking the best possible advantage of technological innovation in order to grow in a sustainable way. As Kofi Annan says in an article published in this issue, "African governments must harness every available energy option, in as cost-effective and technologically efficient manner as possible, so that no one is left behind."

There's something else that must be taken into consideration. Innovation is a bi-directional process: it doesn't always travel from richer, more developed countries to poorer countries. Today we're hearing more and more about reverse innovation: innovation moving in the opposite direction, from underdeveloped to developed countries, as theorized by Vijay Govindarajan, professor at the Tuck School of Business.

This is exactly why we've focused this issue of EJ on Africa's energy transition. Africa is a testing ground, a captivating challenge, as well as a formidable learning opportunity. We don't precisely know in what direction things will move, but we know for sure that by the time we turn our attention back to Europe, we'll have a new, enriched wealth of experience, knowledge and technology to take advantage of. This is precisely the reason everyone is now focusing on Africa. And it is with this spirit that CESI is working in Africa, where we are involved in a number of different projects. Our skills and experience are being applied to major regional interconnection projects, as well as micro-grid initiatives. After all, there's always something new coming out of Africa!

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## Pliny the Elder, Historia Naturalis

Book VIII, section XVII, paragraph 42, AD 77/79



Christine Lins, Executive Secretary REN21 Energy Journal

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News

# Latest from CESI





## Metering in Oman

In July 2017, Cesi was selected by Oman's Electricity Holding Company to roll out the second phase of a metering project, in particular the Automated Meter Reading (AMR) technology implementation project by EHC Oman. The goal is enhancing the quality and speed of processing metering data with the implementation of a central system to obtain customer readings remotely. With such a system, the Authority for Electricity Regulation in the Sultanate will be able to provide companies and customers with interface access to their AMR information; enable competition and customers switching between supply companies; and provide consumption analysis that will allow better loss management strategies and theft detection.



Implementation of innovative processing metering data





## Integrating Renewables in Bahrain

Cesi was appointed to develop the grid connection guidelines and standards for decentralized solar PV systems designed for low and medium voltage distribution networks in Bahrain. Cesi is also focusing on developing all the necessary fire, safety and other international compliance measures, working closely with Bahrain's Sustainable Energy Unit. The project is in line with the extensive solar program defined by the Minister of Electricity and Water Affairs.

Strategic study on solar PV systems

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## HVDC Cable Testing for 3 German Corridors

Germany's four main operators selected CESI to create an innovative testing program aimed at verifying the appropriateness and integrity of HVDC cables, which form the backbone of new interconnection corridors that will carry wind power from the North and Baltic Seas to major cities and large industrial complexes in the Ruhr region and southern Germany. Tests are currently being conducted at CESI's laboratories in Mannheim.

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2,000 km of underground cable; 30 years of cable lifetime simulated

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## Joint Venture with GCC Lab

In October 2017 CESI signed an initial accord defining a thirty-year joint venture with GCC Electrical Testing Laboratory, a joint-stock company owned by the main utilities, institutions and electromechanical companies in the Gulf region. The joint venture was designed for creation of the largest electric testing laboratory in the entire Gulf area. This facility will be located in Dammam, and will host qualification and certification activities for all electromechanical components that make up the core electric systems and networks. The laboratory's activities will also provide concrete support for the development of a local electromechanical industry.

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Agreement for the Middle East's largest electric testing laboratory

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## **Top stories**

# Leapfrogging the West

We are used to think that things proceed in the same direction: from those who have a lot to those who have less. But today innovation runs also in the opposite direction, from the emerging countries where it was adopted for the first time to rich countries.

For Africa, this revolution can be a progenitor of hope.



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op-down. We're accustomed to thinking that things, ideas, wellbeing, all proceed in the same direction: from on high to down low;

from those who have a lot to those who have less; from rich countries to those still developing. We also believe that's the way markets work: consumers in richer countries demand products with increasing levels of performance, and therefore spark innovation, while one after the other obsolete products sink down to find new life in the markets in emerging counties. Everything seems to run from high to low. But today, this model is beginning to show signs of age.

"There is no way to design a product for the American mass market and then simply adapt it for the Chinese or Indian mass market," explains Vijay Govindarajan, professor at the Tuck School of Business and a prophet of reverse innovation. "Buyers in poor countries demand solutions on an entirely different priceperformance curve. They demand new, high-tech solutions that deliver ultra-low costs and good enough quality." That's reverse innovation: innovation that runs in the opposite direction, from the emerging countries where it was adopted for the first time to rich countries.

For a continent like Africa, this is the progenitor of hope, of the possibility to bet directly on the massive introduction of more innovative technologies into its society on a massive scale; technologies designed ad hoc for the needs of its own native consumers, for the characteristics of its native market, thereby avoiding the path leading through Western countries, and most importantly numerous errors along the way.

#### **Telephony versus Energy**

The most striking case of the transformation underway in Africa

concerns telecommunications. Over the course of a few short years spanning from 2004 to 2007, an entirely unexpected boom on the continent quadrupled the number of people who own a cell phone and, according to forecasts provided by the GSMA (Groupe Speciale Mobile Association), by 2020 nearly 80% of Africa's sub-Saharan population will have a cell phone. This is already double the current situation. This boom is due not only to the low prices of the projects, but especially to the flexibility of a tool that has made it possible to access a series of innovative services that respond specific needs, for example the possibility of sending, easily, safely, reliably and at modest cost, money to someone else. Or the possibility of purchasing goods directly over the phone. It's what's known as "mobile banking" or "mobile finance." This is a sea change which has, according to the International Monetary Fund, "in less than a generation transformed, within developing countries, agriculture, markets, fishing, transportation, irrigation, banks and small businesses." Today, the paradigm of reverse innovation may well transform the energy sector as well.

The parallel between development in mobile phones and development in renewable energy production models is starting to look inevitable. Both these sectors boast a history built of need, network infrastructures, as well as a rigid, fixed and costly structure. Today, as far as telecommunications are concerned, the shift has already taken place both in the West and in emerging countries, as the data cited here above underlines.

But when it comes to energy, the West is paying the price for the difficulties it has in dealing with a rigid production and distribution system that is slowing down its move toward a carbon-neutral model. In Africa, on the other hand, things are different. That which just a short while ago was considered a serious problem for emerging countries, today may prove to be a valuable competitive advantage. In other



words, Africa may well be in a position to take the path to a green economy directly, leapfrogging an entire industrial development phase that has characterized the industrial history of the West and which, thanks to progress achieved in the clean tech sector, today no longer appears to be the only route available.

## New responses to the continent's energy challenges

Today one billion people live on the African continent. Six hundred million people have no access to modern forms of energy. But Africa is also the continent on which populations are growing most rapidly: in 2100 the African population is projected to be four times its current size, swelling to roughly 4.2 billion souls. Within this context, favoring access to energy becomes an absolute priority. The possibility of developing projects connected to the distributed generation of renewable energy resources, with connections to micro-networks for

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Africa may well be in a position to take the path to a green economy directly, leapfrogging an entire industrial development phase that has characterized the industrial history of the West

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communities or villages, or even entirely off-grid options, open up entirely new scenarios that may make it possible to take full advantage of renewable energy resources – photovoltaic, wind, hydroelectric, geothermal – that the African continent is extremely rich in, initiating a virtuous process that provides access to modern energy forms for most of the population, even in the continent's most remote areas.

Kofi Annan, ex-General Secretary of the United Nations, is clearly a believer. In the 2015 Africa Progress Panel Report he stated, "African nations do not have to lock into developing old, high-carbon technologies. We can expand our power generation and achieve universal access to energy by leapfrogging into new technologies that are transforming energy systems across the world."

Lighting Africa, a project promoted by Sustainable Energy for All together with the World Bank, has already made it possible to provide a small photovoltaic solar panel and a solar lamp to roughly 20.5 million in sub-Saharan Africa. First established in 2009, today the project is



active in 11 countries – Burkina Faso, the Democratic Republic of Congo, Ethiopia, Kenya, Liberia, Mali, Nigeria, Rwanda, Senegal, Tanzania, Uganda – and plans to involve 250 million people by 2030. A photovoltaic solar panel, a solar lamp, the possibility of charging a cell phone and cook without relying on wood-burning kitchen fires or old kerosene lamps represents a clear, tangible improvement in quality-of-life for these areas. But it also means significant savings in terms of GHG emissions: the World Bank has cited a total 3,986,000 metric tons of GHG avoided.

Furthermore, according to SolarAid this minor change along – from kerosene lamps to solar lamps – makes it possible to save one dollar a week, an amount that represents a quarter of one month's wages for most of the sub-Saharan population.

Alongside projects like this one, there are a growing number of strategic projects based on international partnerships that aim to create renewable energy resources capable of important production capacities that can sustain industrial development and growth. The natural resources are already there. A recent report by IRENA (the International

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South Africa is the engine driving the continent in this fundamental challenge. But Egypt, Ethiopia, Kenya and Morocco aren't sitting on their thumbs

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Renewables Energy Agency) that was based on six different regional studies has supplied an estimate of the potential for solar and wind energy in Africa: photovoltaic solar energy can boast 300 million megawatts of potential energy; while wind can boast around 250 million megawatts.

South Africa, which looks to Germany and Denmark for models, is the engine driving the continent. But Egypt, Ethiopia, Kenya and Morocco aren't sitting on their thumbs. Following specific indications elaborated by the Council for Scientific and Industrial Research (which worked to identify the most appropriate areas for investments in renewables, interweaving data relative to resource potential with data connected to demand, environmental and economic impact, as well as the presence or absence of networks) the South African government recently approved a plan that calls for the creation of eight Renewable Energy Development Zones. These areas, which overall cover a surface equal to Scotland and Ireland put together, are destined to host new photovoltaic solar facilities. Morocco is betting heavily on solar energy in order to achieve a target of 42%

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![](_page_13_Picture_2.jpeg)

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Political instability in many African countries continues to deter international funds and slow down the process. With its project "Scaling solar", the World Bank Group provides investors the guarantees that individual governments are unable to supply

renewable energy set for 2020. In February 2017 the first thermodynamic solar facility began operating in Ouarzazate (population 500,000), and a second, similar facility is already under construction. In Ethiopia, where the hydroelectric sector has entered a crisis due to the perfectly evident effects of climate change, officials are betting on wind power. In 2013 the country inaugurated one of the largest wind farms on the planet (120 MW), followed by a second, 153-MW-facility in 2015, and shows no signs of slowing down. Ethiopia's Growth and Transformation Plan, a strategic development plan promoted by the government, calls for the realization of at least five wind parks over the next five years, for overall energy production equal to 5,200 MW. Meanwhile Rwanda is aiming to produce 100% of its energy from renewable sources by 2020: an objective that the Bloomberg New Energy Finance believes is both achievable and sustainable.

Certain data and reliable investments: this is what Africa needs to make this important leap forward. Grace Wu, a researcher at Berkeley University in California, together with her research group, is elaborating an atlas of renewable resources across the continent for IRENA, mapping everything in great detail. "Most existing maps of wind and solar resources in Africa do not contain enough detailed information to allow companies to select sites for projects," stated the researcher in the magazine Nature. "The study is the most comprehensive mapping effort so far for most of those countries. It weighs the amount of solar and wind energy in the nations, along with factors such as whether power projects would be close to transmission infrastructure and customers, and whether they would cause social or environmental harm."

![](_page_13_Picture_7.jpeg)

The World Bank is working on an analogous project, and has placed a myriad of sensors in strategic points across different countries that record solar radiation or wind speed every ten minutes. Their aim is to provide a user-friendly tool that will provide all the information necessary in clear, simple, straightforward manner, and is available and accessible for anyone who is interested.

Having such clear data available will undoubtedly favor investment planning, but political instability in many African countries continues to deter international funds, even as they recognized extremely interesting perspectives within this overall scenario.

One path that may prove effective is the activation of intermediary projects and organizations that provide investors the guarantees that individual governments are unable to supply: this is precisely what the World Bank Group is doing with its project "Scaling solar." Through it, the World Bank Group guarantees that the governments involved will effectively commit to purchasing the energy produced. Zambia, Senegal, Ethiopia and Madagascar have already signed onto the project. Specific guarantees are also included for critical and unforeseeable situations, for example civil wars and conflicts.

### **Consumer experiences**

Catherine Wolfram of Berkeley University's Haas School for Business recently conducted a survey of 2,500 Kenyan farmers, interviewing three different, distinct typologies: those without electricity, those with solar panels, and those who are already connected to an energy network. The investigation explored the farmers' experiences with energy consumption, exploring the kinds of devices they connected (clothes irons, refrigerators, lights, telephones, etc.). It asked about the results of their experience and the ways in which it has changed their lives. According to the investigation, both typologies - those who had solar panels and those who had no form of energy at all - considered connection to an energy network to be an important achievement. But some experts believe that omitting the involvement of traditional sources like coal from the overall energy mix would be a mistake. Yet once again, in this case Africa is looking to innovative technologies through, for example, carbon capture and sequestration processes. "Coal will be part of the energy mix," stated Nkosozana Dlamini-Zuma, ex-Chairman of the African Union Commission. "I don't think it should be the sole source of energy, but it will be a part of the mix."

#### Conclusions

The portrait that emerges from this brief review is one of an African energy scenario in the midst of deep and nonstop transformation. What counts is the capacity - which forms the foundation for reverse innovation thinking - to move beyond fixed schemas and stereotypes, playing the technological innovation card to best effect in order to respond to real needs. It's about guaranteeing access to energy for everyone while limiting environmental impact as much as possible. The path has been clearly outlined by Kofi Annan: "African governments must harness every available energy option, in as cost-effective and technologically-efficient manner as possible, so that no one is left behind."

![](_page_14_Picture_8.jpeg)

**C** In 2100 the African population is projected to be four times its current size... access to energy becomes an absolute priority **Energy Journal** 

## Scenario

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# **Electrifying Africa**

The progressive electrification of the African continent is moving at slower pace than population growth. Overcoming this gap will be possible only by taking advantage of the opportunities that technological innovation provides.

To win the battle against energy poverty, one should consider offgrid systems, mini-grids, on-grids not as alternatives but rather as complementary solutions capable of responding to immediate, diversified needs.

![](_page_15_Picture_5.jpeg)

![](_page_16_Picture_0.jpeg)

rom 2000 through today, 145 million Africans have been able to establish access to some form of electric energy. And yet even these impressive numbers aren't enough. The progressive electrification of the African continent is moving more slowly than population growth. If this doesn't change, and despite undeniable improvements, by 2040 there will be an additional 45 million Africans without access to power.

This paradox was recently the focus of a report titled Lights Power Action. Electrifying Africa, published by the African Progress Panel. The research, which was released in its complete form in the panel's annual report Power, People, Planet: Seizing Africa's Energy and Climate Opportunities, underlines the need to accelerate things by providing solutions – strategic, in approaches, technological – that can truly be considered innovative, because in Africa there are "600,000 people who cannot afford to wait for long."

Overcoming this gap will be possible only by taking advantage in the best manner possible of the opportunities the African continent offers in terms of available energy sources, and which technological innovation provides: offgrid systems, mini-grids, on-grids not considered as alternatives to one another, but rather integral with each and capable of responding to immediate, diversified needs, all of which are fundamental in order to help the country advance in terms of the battle against energy poverty.

Having a solar panel in order to turn on a solar lamp means taking a first step along the energy ladder.

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The level of electrification in sub-Saharan Africa (32%) is the lowest in the world

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The second is a domestic energy supply system built with solar panels; at the top of the ladder stands an e-highway power system fed by renewable energy sources. While this first step is fundamental in order for consumers to undertake an incremental process of energy demand that feeds and supports overall economic development, it is important not to overlook how vital it is to invest in avantgarde, fixed network structures. The model and integration of these different elements must be identified starting with an analysis of the costs and benefits among the various options, as well as the diverse mixes, interweaving data on population density, available energy resources, the cost of technologies, the level of general infrastructure, energy demand...

The approach proposed by the African Progress Panel involves "a dynamic, resilient system that presents multiple options and expansion opportunities for smart grids, mini-grids, hybrid networks, all the way to cross-border super-grids that connect different regions across the continent," as the long-term scenario toward which the continent must move.

## The current state of Africa's electric grid

The level of electrification in sub-Saharan Africa (32%) is the lowest in the world. To provide just one striking example, the Democratic Republic of the Congo, which vaunts one of the largest hydroelectric facilities on the planet (the Inga Dam), also has the lowest level of electrification on the continent: 9%.

Networks are insufficient, poorly distributed across the territory, inefficient and technologically obsolete: losses

![](_page_17_Picture_0.jpeg)

during the transmission and distribution process go unmeasured; continuous blackouts consume roughly 2% of African countries' GDP; and in several countries this percentage rises as high as 5%.

These structural deficiencies are joined by problems of management, maintenance, negligence and actual energy theft (from unpaid electric bills to illegal and dangerous attempts to leach energy from the grid). According to the World Bank, 20% of all energy produced in Africa is lost, divided equally between technical and nontechnical causes.

The report notes that what is needed now is a leap forward in quality, encouraging Africans to think about the power value chain in an organic manner, and therefore intervening coherently along the entire production and distribution process: only this way will it be possible to fully take advantage of the continent's real energy potential. It is an urgent consideration if Africa wants to truly meet the challenge of integrating the energy it produces with renewable energy sources that require an ability to modulate demand and supply in a way that is anything but simple.

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In the continent, networks are insufficient, poorly distributed across the territory, inefficient and technologically obsolete: continuous blackouts consume roughly 2% of African countries' GDP; and in several countries this percentage is as high as 5%

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While the issue of access to energy in rural areas is a well-known critical factor that innovative projects are beginning to address, a less well-known and less well-analyzed aspect (though one that is emerging clearly from current research) is that of energy distribution in areas just outside urban centers, in the peripheral suburbs of the continent's megalopolises. From this point of view, an interesting example can be seen in the Indian company TATA Power: this utility company has managed to extend network connectivity into 217 slums around New Delhi, thereby reaching an additional 175,000 consumers, adopting a model based on community involvement and linking access to energy with a socio-economic development agenda. Over the past five years, this intervention method has also made it possible to reduce non-technical losses, expand the consumer network and increase revenue, which has grown from 0.3 to 17 million dollars overall.

## Electric grids in Africa: future projects

According to Lights Power Action, things are headed toward a single,

![](_page_18_Figure_0.jpeg)

## **Emerging System** Transforming and Dynamic

![](_page_18_Figure_2.jpeg)

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Pan-African network that will harmonize and integrate diverse cross-border interconnection projects. While the capacity for interconnection has almost doubled between 2005 and 2011, moving from 5.4 GW to 9.3 GW, the initiatives remain fragmented and energy exchange between countries is still less than 8% of all energy produced.

The ultimate objective is to adopt a single approach for the entire continent when it comes to developing and managing infrastructures. Reinforcing and building new strategic infrastructures, increasing exchange and protecting the network and its consumers, as well as guaranteeing safe, reliable energy supply.

The Programme for Infrastructure Development for Africa, born of collaboration between the African Union Commission, NEPAD and the African Development Bank, and underwritten in 2012 by the Assembly of African Union Heads of State and Government, represents the strategic framework leading development of network infrastructures in cross-border projects. The program, headed by the African Development Bank, aims to accelerate the creation of regional interconnection projects. By 2020, no fewer than 15 projects currently under construction should become functional, all of which are considered priorities: nine are in the hydroelectric sector; four are transmission corridors; and the remaining two are pipelines. Overall investments for these projects total 40.5 billion dollars.

Alongside interconnection networks that are already active – Southern African Power Pool (SAPP), West African Power Pool (WAPP), Central African Power Pool (CAPP), East African Power Pool (EAPP), and North African Power Pool (NAPP)– another four priority corridors will be added:

- > The North-South transmission link from Egypt to South Africa;
- > The Central corridor from Angola to South Africa;
- > The North African transmission link from Egypt to Morocco;
- > And the West African power transmission corridor from Ghana to Senegal.

![](_page_19_Picture_11.jpeg)

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## Investments in sub-Saharan Africa in energy production facilities

(Enerdata, 2017)

## 500 billion dollars

## International partnerships

Enerdata (2017) estimates that between 2015 and 2030, sub-Saharan Africa will have to invest a total 500 billion dollars in order to realize energy production facilities, and at least as much for transmission and distribution infrastructures. Guaranteeing universal access to energy in this part of the world, therefore, may cost roughly 70 billion per year: an objective that cannot help but be achieved through international partnerships.

As of today, China and the United States have been the main protagonists working alongside African countries. According to data supplied by the IEA, 30% of new (constituted between 2010 and 2015) electric capacity in sub-Saharan Africa is connected with Chinese companies. Overall, these companies have invested a total 13 billion dollars to initiate projects in 37 of the 54 countries in sub-Saharan Africa. It should be noted that only a small percentage of these facilities will be powered by renewable energy sources (7%). Most of them will utilize fossil fuels - coal (20%), gas (19%) - and hydroelectric (49%).

In 2014, the United States further expanded the Power Africa program it launched the previous year, aiming to create 30 GW of new electric capacity and add 60 million new consumers by 2030. In 2014, the main program was joined by another –Beyond the Grid – designed to finance off-grid and mini-grid projects. While the United States and China have adopted a clear strategy for interventions

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As of today, China and the United States have been the main players working alongside African countries

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on the African continent, the European Union's approach appears more dispersive and less effective. According to the research report "Electrifying Africa: how to make Europe's contribution count," produced by Think Tank Bruegel, the E.U. has set up a host of initiatives that are not coordinated with one another, limited their efficiency and the reach of their effects. In the report, Simone Tagliapietra surveyed the most important of these, highlighting 14 that are managed by different European organisms or directly by different nations: "In the past, a number of different programs have proliferated in this field, often without taking into consideration potential complementarities and overlaps with existing EU initiatives. There is no reason why this situation should be perpetuated. Instead of creating additional initiatives (as most recently done with the launch of the EU External Investment Plan), the EU should first rationalize its current activities in the field. This would allow a more efficient use of European taxpayers' money, and also enable greater impact in sub-Saharan African countries, because of the greater scale and visibility." Bruegel's proposal is to create an ad hoc organism that would coordinate these interventions: "The European Commission and the EIB should progressively channel existing and prospective programs related to electrification in sub-Saharan Africa via a clearing house - that might be named the 'EU Electrify Africa Hotspot.'" If Europe wants to remain a protagonist in the development of a carbon neutral era, redefining its presence in Africa will be undeniably important.

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#### Interview

## Fast-Tracking Electrification for a Growing Population

## with Christine Lins, Executive Secretary, REN21

Universal access to energy is a dramatic challenge, and Africa will have to outpace its exponential demographic growth in order to overcome it. We spoke with Christine Lins, Executive Secretary of REN21, the global publicprivate network on renewable energy to learn how the continent can leapfrog industrialized countries and switch to sustainable technologies from the start.

![](_page_21_Picture_6.jpeg)

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![](_page_22_Picture_0.jpeg)

![](_page_22_Picture_1.jpeg)

Christine LINS Executive Secretary of REN21

Christine Lins was appointed as Executive Secretary of REN21, the Renewable Energy Policy Network for the 21st Century, in July 2011.

Christine Lins came to REN21 from the European Renewable Energy Council, the united voice of Europe's renewable energy industry, where she served as Secretary-General for 10 years from 2001 - 2011. REN21 is a global public-private multistakeholder network on renewable energy regrouping international organizations, governments, industry associations, science and academia as well as NGOs working in the field of renewable energy. REN21's Secretariat is based at the UN Environment Programme in Paris/France. ?

1. Ms. Lins, despite progress achieved, today 620 million Africans remain without access to electric energy. Unprecedented demographic growth across the region means that unless we quickly improve the rate of electrification, by 2030 that figure will increase by an additional 45 million, for a total of 665 million Africans without access. Will we be able to beat the clock on this?

**Christine Lins:** Today roughly 16% of the world's population lives without electricity. That's about 1.9 billion people, most of whom live in Africa, and given current trends the progress toward providing universal access remains low. The world is committed to energy access for all, and I would say that technology is available. Renewables are making progress; investments in off-grid solar PV

continued to grow in 2015. Companies operating in this market have increased revenues to 223 million USD per year, an increase of about 40% over the preceding year. So there's progress and new business models. It's clear, however, that the current policy is not enough for us to achieve our energy access goals. We need to accelerate. That's the key.

![](_page_23_Picture_4.jpeg)

2. For industrialized countries, overcoming the phase of fossil fuel-driven centralized energy production remains anything but simple. Practices and approaches we've employed in the past are still holding us back. Paradoxically, delays in development accumulated by African countries have placed Africa in a potentially advantageous position for important opportunities: they can organize their own native electricity systems directly around renewable resources, betting on things like distributed generation, smart grids, integrating on-grid and off-grid systems... Basically taking full advantage of technological innovation's potential in order to move toward sustainable development. What would be the best way to build an energy-technology blend for this kind of challenge?

**CL**: I think we need adequate planning. Often countries don't agree on whether electrification should be provided centrally through a central grid, or decentralized. I think it's clear that relying on centralized generation is very difficult. It has considerable costs, and will take too long. What is needed is a smart mix of technologies. On the renewables side you have hydro, biomass, biogas, solar... There are a number of good, viable options being rolled out. I think it's very important that Africa has this opportunity to leapfrog industrialized countries; to avoid investing in dirty fossil fuel infrastructures that would need to be decarbonized the way they are being dealt with in industrialized nations. The African continent can switch to sustainable technology right from the start... I also think it is extremely important that this is done in truly coordinated manner, creating local companies and local jobs. This will only happen if there is a clear governmental strategy for the market rollout of technologies.

A good example is the initial design of the South Africa Renewable Energy Independent Power Producer Program. The South

![](_page_23_Picture_9.jpeg)

African government has set clear targets for how much renewable electricity they will procure in a given time period. If the level of procurement is high enough, this will create a local industry and jobs. The program is also interesting because it introduced some social measures (black empowerment) that benefit local communities.

So we have a lot of different models available, not in South Africa but in other countries too. Morocco, for example, is another place where we're seeing best practices: the Moroccan government decided to create a one-stop shop company – Masen – that acts as a central player committed to facilitating renewable energy deployment. Their goal is not only to take advantage of the full potential of renewable energy, but to create economic opportunities and strong development in the market.

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3. Given the magnitude of the challenge, a solution would require a joint effort involving African countries and international public and private parties. China has invested heavily in large-scale electricity projects, while the US has put in place a comprehensive initiative – Power Africa – to scale-up electrification. European states have, instead, created a myriad of fragmented initiatives to promote electrification. More coordinated interventions, including by the European Union, might guarantee greater efficiency and consolidate the role the EU plays within the geopolitical framework. In your opinion, what is keeping the European Union from getting involved in Africa in a more direct and important manner?

**CL**: I wouldn't necessarily underestimate Europe's contribution. There are different Africa-Europe energy partnership initiatives, and the European Member States are involved in Africa just as individual countries. Naturally there may be some inefficiencies due to the fragmented nature of this approach. In some ways this is a historical issue: some European countries enjoy closer relationships with African countries due to their experiences during the colonial period, and therefore tend to invest in those areas. For example that's the case for Italy and Ethiopia.

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#### 4. What role did African countries play in the most recent edition of COP?

**CL**: We had two intense weeks in Bonn. COP23 was all about effectively trying to define rules on how to implement the Paris agreement; how to make some of the commitments more ambitious... I think there's still a lot left to do. One of the first results of COP23 was that the number of countries formally committed to fighting climate change rose to 197. Now that Syria has signed the accords, the United States remains the only country in the world that refuses to ratify the Paris Agreement. Countries all around the world are strongly in favor of finding a solution, and the world has acknowledged that climate change is a reality.

For Africa, I think what matters most is financing, as well as the fact that countries are staying on track to replenish the green climate fund. We need to see more commitments and progress.

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I think it's very important that Africa has this opportunity to leapfrog industrialized countries; to avoid investing in dirty fossil fuel infrastructures

Christine Lins

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**Energy Journal** 

## **CESI's Solutions to Africa's Challenges**

The energy transition phase that Africa is experiencing represents a challenge extending beyond the continent's borders. It's a thrilling challenge, one that can only be overcome by bringing the most reliable, innovative skills and technologies to bear. For several decades now CESI has been partnering with national governments and regional organizations to develop avant-garde projects for transmission and distribution networks, as well as to integrate renewable energies. The challenge is how to boast the enormous energy potential of the entire continent.

![](_page_25_Picture_3.jpeg)

![](_page_26_Picture_0.jpeg)

t only takes a few facts and figures to communicate the nature of the challenge the African continent is facing. Africa has an extraordinary wealth of energy resources, yet the level of energy consumption is stuck at 4% of total consumption worldwide, and the rate of electrification in the sub-Sahara is barely 35%. While average consumption in the West stands at roughly 13,000 kWh per year, Africa's average is a mere 160 kWh per year. A total 620 million people - roughly two thirds of the population - do not have any access to electricity. Unfortunately, despite progress achieved (from 2000 to present day a total 145 million African citizens have been able to connect to electric networks), there's still a risk that by 2030 another 45 million people will be added to these already overwhelming numbers. The speed with which more modern forms of energy spread is unable to keep up with demographic growth.

Facing down this contradiction is one of the key objectives of the new millennia, as indicated by the United Nations (Sustainable Development Goals). The way to do so is a challenge that may be decisive for the health of our planet, putting the energy world to the test on a global level. For Africa, thanks to its symbolic presence, as well as in technological and financial terms, this is a battle that can only be won through cooperation: international bodies, research institutes, companies, investment funds, governments and nonprofits are all committed to helping African countries - which remain the protagonists of this revolution - move forward with projects that create the conditions for sustainable energy development. International organizations like the Africa Progress Panel, REN21 and the IEA have underlined the importance of intervening on more than one front at the same time, mixing in the best manner possible the characteristics of different technologies available on the market thanks to an extremely flexible

approach, capable of responding to specific needs within a given territory and/or country: from supranational to national networks; off-grid facilities; micro-networks; systems for stockpiling renewable energies; efficiency strategies and more. One of the most promising intervention areas, however, can be found in inter-regional connections. On one hand it's true that Africa can boast important renewable resources; but on the other hand it is equally true that these are often located far from centers of consumption: from hydroelectric resources in sub-Saharan African to wind and solar potential in North Africa. Guaranteeing outlets in large regional or supranational markets will be key to taking advantage of these resources. This can only be accomplished through the realization of major transmission corridors which, thanks to their inherent technologies, can transport significant amounts of energy over long distances without loss or waste. These "electricity highways" are of primary importance, and CESI has been working since 2013 to create one between Ethiopia and Kenya.

CESI has been working in Africa since the 1980s through projects in South Africa and the Mediterranean basin, all the way to more recent work in the sub-Saharan region and individual projects all over the continent. The company's technical-engineering consultancy services include: assistance for new interconnection projects; research studies on integration of renewable energies in electric networks; studies to realize systems of renewable mini- and/or micro-grids for rural areas; and aligning operations and practices for local operators with international best practices. **Energy Journal** 

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## E-highway between Ethiopia and Kenya

60% of the hydroelectric potential of the sub-Saharan area is located in Ethiopia and the Democratic Republic of the Congo. Taking advantage of this resource in the best manner possible is a precondition for development across the entire sub-Saharan area. For this reason the African Development Bank, World Bank and the Agence Française de Développement, together with other partners, chose to finance the construction of an "e-highway" between Ethiopia and Kenya: an HVDC (High Voltage Direct Current) transmission line extending for 1,068 km and boasting 2,000 MW capacity, designed to carry electric energy between the two conversion stations located respectively in Wolayta-Sodo (Ethiopia) and Suswa (Kenya).

Realization of this infrastructure will make it possible to transfer hydroelectric power produced in Ethiopia not only to Kenya, but also to the other countries in the Southern Power Pool, and from there even as far as Egypt and the Sudan. In 2018, the year the line will be inaugurated, this network is destined to supply demand in 870,000 homes, and may reach as many as 1.4 million homes by 2022.

It is a technological challenge that has put CESI on the front lines, since the company is charged with oversight and controls during the engineering phase and construction of the infrastructure. CESI is also responsible for verifying the technical adequacy of these infrastructures, making sure they are in line with international standards. The company is handling design review, support for utilities, technical and quality certifications for the principal components of the line, and even training local resources. CESI has also been asked to draw up the documentation for international tenders, which are conducted according to clear, transparent rules set up by international institutions, and support utilities in selecting subcontractors. It is a considerable challenge, one that will continue down the road with inspections for certifying that all the individual technological elements (valves, transformers, electrodes, etc.) are up to speed and can guarantee efficiency for the transmission network.

Over the long term, the project will have considerable effects from both an environmental and an economic standpoint. The electric corridor between Ethiopia and Kenya will make it possible to limit the use of fossil fuels across the area, thereby reducing CO<sub>2</sub> emissions. According to estimates, use of hydroelectric energy through this new interconnection will save 3.59 million tons of  $CO_2$ . From an economic point of view, the African Development Bank estimates an increase in GDP of 130 base points by the end of 2018. The project will also create 4,000 new jobs across the two countries while it is being built.

This process favored acquisition of new skills among a large group of local workers, as well as the creation of new professions. CESI also helped train professionals for specialized capabilities, allowing them to acquire advanced skills (including through internships in Italian laboratories) that will help further an empowerment process designed to guarantee future management autonomy.

## From Sub-Saharan Africa to South Africa and the Mediterranean

CESI has been working within Africa since the 1980s, first concentrating on countries in the Mediterranean basin for interconnection projects with Europe, then expanding its horizons all the way to

![](_page_27_Picture_11.jpeg)

## **Energy & electricity**

of total energy consumption

worldwide

Africa

comes from

Southern and sub-Saharan Africa. Within the Mediterranean area in particular, over recent years CESI has developed projects that cover a broad range of activities in Libya, Tunisia, Morocco and, most recently, in Algeria and Kenya. With respect to these last two countries, CESI was hired by RES4Med and RES4Africa to conduct a study for integrating renewable energy sources into the national network. While both countries share the same objectives and key criteria, the study points out that both must grapple with the non-programmability of renewables, highlighting the importance of diversity in the energy arrangement for each, as well as the need to elaborate two different intervention strategies.

The heart of the issue is definition of the right energy mix to favor achieving strategic sustainability objectives, guarantee success and access for consumers. This study showed that in Algeria, the current mix is made up almost exclusively of gas and thermal. These sources will be progressively substituted by renewables (solar and wind). According to studies conducted by CESI, the goal set for 2020 - integration of 2,950 new MW of renewable energy (1,000 wind and 1,950 solar) into the national network - can be achieved in a safe, stable manner. The goal for 2030, however (integration of an additional 15,600 MW) appears much riskier. Kenya is facing a complex challenge:

already today the country's energy mix can count on positive contributions from renewable sources - geothermal and hydroelectric first and foremost - which are to be augmented by solar and wind. Therefore this country's mix needs to take into account a plurality of renewables, each with its own specific characteristics. According CESI's studies, in 2030 these sources should achieve overall penetration equal to 14%: a goal that can be achieved by installing 570 MW of solar energy capacity and 400 MW of wind. Both of these sources are destined to grow in the medium- to long-term, but the aim is to keep them from cannibalizing other renewables in the meantime.

## Custom-tailored Projects and a Dual Focus

Africa is presenting industrialized countries, repositories of the necessary technology and know-how, with an extremely complex challenge that requires the ability to intervene on two different levels at the same time: on one hand setting up projects custom-tailored to the needs of a specific territory; on the other thinking in supranational terms and focusing on a regional strategy. It is important to respond both to the consumer's immediate and banal needs – lighting a light bulb, cooking without biomass – and to sustain, through access to reliable energy sources, development among small- and mediumsized businesses in order to favor growth. Intervening in both areas at the same time is challenging, but not impossible. Today it's clear that complexity will remain the common denominator in mankind's upcoming global challenges. Africa may well constitute the perfect training ground, and Cesi is supporting the changement by helping the continent through its recognized know-how.

## "

The electric corridor between Ethiopia and Kenya will make it possible to limit the use of fossil fuels across the area, thereby reducing CO<sub>2</sub> emissions

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of the african

population

do not have any access

to electricity

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**Energy Journal** 

## **Industries & Countries**

More

An efficient energy system guarantees energy access to the highest number of people possible. Making it a priority and promoting the widespread diffusion of products and machines that can boast energy efficiency standards can help Africa achieve its primary objective – universal energy access – more quickly and at lower cost.

But today, policies that have been put in place across the African continent do little to help take full advantage of the energy efficiency potential.

![](_page_29_Picture_5.jpeg)

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### Accelerating Energy Efficiency in Africa

A study commissioned by the Copenhagen Center for Energy Efficiency and conducted by the Energy Research Center in Cape Town, South Africa has analyzed efficiency measures adopted in different countries in detail, ultimately identifying four different countries that represent the different strategies and approaches undertaken.

Traditionally countries use three different tools to intervene in the energy system: first, definition of standards and labeling for products, appliances and engines; second, distribution of innovative products that can boast elevated efficiency standards (particularly important results have been achieved, for example, in every nation that has adopted CFL light bulbs in large numbers); third, outlawing inadequate products, including specific vetoes forbidding their importation.

Overall the study underlines how, despite the fact that all countries have adopted energy strategies, only a few of them (12 in all) have set up specific programs for energy efficiency. And the programs in place are often outdated and rarely renewed or upgraded with new conditions: for example the program Ethiopia has adopted has remained the same for the past twenty years. Furthermore, they almost never include energy monitoring or auditing. Last but not least, the report outlines how local financial barriers, cultural models and established behaviors often work against efficiency policies.

In terms of standards and labeling, the panorama remains inhomogeneous, and a great deal remains to be done. Egypt, for example, has organized an introduction of efficiency standards that remains "voluntary," which evidently remains an obstacle to their diffusion. Malawi has introduced precise standards for coal-burning stoves, saving 20% on consumption. Mauritius has bet on an

## "

South Africa is among the least energy efficient countries in the world. When there is load shedding, South Africans look for more energy, rather than saving energy

Tina Joemat-Pettersson, South African Former Minister of Energy

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educational program aimed at consumers in order to favor a culture of efficient energy use.

Morocco, Kenya, Zambia and Ghana are the four countries the Copenhagen Center for Energy Efficiency selected for in-depth focus.

Following distribution of 4.5 million CFL light bulbs, Morocco saw its consumption levels drop by 25%. The country also paired this policy with a program for rural areas that made it possible to equip 110,000 homes with solar panels. Kenya instituted the Energy Efficiency and Conservation Agency, the primary aim of which is to favor the introduction of energy efficiency models. In Zambia, interventions addressed the introduction of CFL light bulbs for a total savings of 150 MW, as well as 350,000 solar water heaters for an additional 150 MW in energy savings. Unlike other countries, Zambia has also introduced energy audit regulations. The immediate impact of CFL light bulbs was also clear in Ethiopia where, thanks to a program financed by the World Bank, a total five million light bulbs were distributed to consumers.

"After only half of the bulbs had been distributed, they had already saved 80 megawatts of electricity," says Jamal Saghir, the World Bank's Director of Sustainable Development in Africa. As Saghir notes, this kind of intervention has produced savings for both consumers and the government. "To build power plants that generate 80 megawatts of electricity costs about 100 million USD. So, for an investment of just 4 million USD in new light bulbs, the Government saved 100 million USD in energy costs." Within this global scenario, delayed progress in South Africa stands out. The country has only recently adopted this strategy: in May 2016, MEPS-Standard minimal energy performance standards based on European standards were adopted for eight products. Official launch of the program took place during a press conference held during African Utility Week, where South African Former Minister of Energy Tina Joemat-Pettersson made public recognition of what many already consider an uncomfortable truth, saying "South Africa is among the least energy efficient countries in the world. When there is load shedding, South Africans look for more energy, rather than saving energy." In order to accelerate this process, the government recently initiated a program titled Energy Efficiency in Public Buildings, a national energy efficiency program for all of South Africa that calls for a 15% reduction in energy consumption in public buildings, though this objective remains distant from the current reality. Therefore the primary aim of the new program is to promote awareness and concrete actions on energy efficiency, demand and safety across all institutional levels: national, regional and local. Creation of a guarantee fund will insure that the projects enjoy the necessary financial sustainability and banking guarantees.

## Ghana: A Success Story

Ghana was one of the first countries to move in this direction. In 2000 Ghana introduced energy efficiency programs

that defined clear standards and obligated The program addresses several different kinds of popular consumer products like conditioners. According to data gathered so far, the introduction of CFL light bulbs the country to save 124 MW. The new Commission calls for applying this same model to other products, for example televisions and motors. But Ghana's front as well – that of imports – outlawing have energy standards considered too low. According to research conducted efficient standards has made it possible to save as much as 64M USD per year. The Ghanaian experience has proven so successful that if it were exported undoubtedly provide significant results. According to United for Efficiency, it is precisely these four elements refrigerator, light bulb, air conditioners and motors – that should serve as the starting point for energy efficient policies four are common items, used in everyday of life, though all four are by their According to some studies, across the continent it would be possible to register, in 2030, an overall energy savings equal the Enerdate Global Energy Statistics Yearbook - if governments and markets

imposed higher energy efficiency standards on precisely these products. These trends have found ulterior confirmation in estimates supplied by ECOWAS (the Economic Community of West African States), according to which in this region, through the introduction of energy efficiency and clear labeling standards for products – refrigerators, air conditioners and light bulbs in particular – could save as many as 60 TWh (terawatts per hour) by 2030. It is a particularly important number, especially when considering that 60 TWh was more or less the overall amount of energy consumed by the entire region in 2011.

#### Incentives and Barriers

Pricing is still the main obstacle, but specific policies and targeted initiatives can prove extremely effective. In Ghana, for example, there are plans for incentives for scrapping older refrigerator models, with the provision that they be substituted by other, more efficient models.

A policy focused on products may well guarantee greater transparency in energy bills as well. Today, African consumers often find it difficult to pay these bills, and various regional governments handle this difficulty by lowering the cost of energy for end users through subsidies on electricity tariffs: the negative aspect of this approach (in addition to the fact that it is extremely expensive for public administrations), is that it renders the cost of energy opaque, discouraging any free choice for efficient products. In a report titled "EA+EE: Enhancing the World Bank's Energy Access Investments through Energy Efficiency 2015" elaborated by CLASP and the World Bank, the authors note how policies designed to support energy efficiency make can help these countries exit the vicious circle of subsidies in energy bills, sidestepping costs that can be transformed into benefits for consumers in a different manner entirely.

## Efficiency in Off-Grid Systems: A World Apart

On a continent in which 60 million people have no access to electric energy and the rate of electrification stands at around 30%, the theme of energy efficiency cannot help but be relegated to on-grid systems. Efficiency is also, and perhaps especially important for those who use off-grid systems, in particular in internal or remote areas of the continent. Within contexts like these, efficiency can easily make the difference. Applied to off-grid systems, products with high efficiency standards like solar panels for homes or mini-grids represent an extraordinary opportunity: maximizing the value of every single watt and making modern energy services available to many people for the first time.

According to a research study by Amol Phadke titled "Powering a Home with Just 25 Watts of Solar Power," published in 2015, the use of super-energy-efficient products can reduce the overall cost of electric energy supply in off-grid systems by 50%. This is also a market in expansion: according to Global LEAP, the off-grid market is worth roughly 5 billion dollars per year.

Whether the system in question is offgrid or on-grid, efficiency must truly be considered an added renewable energy resource that Africa cannot help but take advantage of as the region evolves toward universal access to energy.

![](_page_32_Figure_0.jpeg)

![](_page_32_Figure_1.jpeg)

## **City Portraits**

# Cape Town and not only....

What will tomorrow's smart cities look like on a complex continent currently grappling with significant challenges? There is no clear answer, in part because every city has to follow its own path. But Cape Town is unquestionably an African megalopolis that has made the most concrete moves in this direction, carrying out and completing structural interventions that are fundamental for future progress...

![](_page_33_Picture_3.jpeg)

![](_page_34_Picture_0.jpeg)

rban populations are continuously on the rise. The progressive urbanization of the world's population is a global trend that data is confirming year after year. According to United Nation estimates, by 2050 a total 70% of the world's population will be living in cities. This new internal mobility - the movement of an important segment of the population from rural centers into cities - will be especially prominent in Asia and Africa. According to forecasts, in the year 2050 a total 1.34 billion people will live in African cities, and the continent will host six of the largest megalopolises in the world. These forecasts and estimates depict a phenomenon that is overwhelming in terms of speed, considering that in 1960 the continent's population was equal to that of Europe in 1600.

For the African continent the challenge for a new urban model, one that moves toward sustainable, green and resilient cities, is an integral part of a broader challenge: sustainable development and universal access to energy. Within the complexity of this challenge, the continent's trump card is the possibility – a real option in this area, just as it is in the energy sector – to skip several of the phases currently slowing the transition down in Europe, betting right away on the idea of a smart, resilient and green city and adopting avant-garde technology to make it happen. Putting smart cities in Africa is a complex challenge that African countries are now undertaking full steam. The Smart Africa Alliance, an organization promoted by Rwanda, currently unites roughly twenty different countries and functions as a stimulus and support system for initiatives and programs that place technology at the center of development as a fundamental engine for growth. In the same manner, across the continent international opportunities for meeting and bringing together technological partners, financial partners and national governments are on the rise: Transform Africa Summit (Nigeria) and the Smart City Initiative (Rwanda) are perfect examples.

While it is not yet possible to point to a true, genuine African smart city, several different metropolises have already made this bold choice, and their efforts are already being recognized internationally.

## Take Cape Town for example...

In addition to earning an award at COP21 in Paris in 2015, the capital of South Africa was the only city on the African continent to be included among the 22 smartest cities on the planet in the report Smart Cities Playbook, produced

## Population living in cities by 2050

![](_page_34_Figure_8.jpeg)

![](_page_35_Picture_0.jpeg)

by Machina Research and financed by Nokia. The report examines the strategies of 22 cities worldwide as they become smart, safe and sustainable, and provides concrete guidance to city leaders on successful strategies used by municipalities to make their cities smarter, safer and more sustainable. Following the report, Cape Town's progress in implementing its smart city programs was still in the "very early" stages, but two key lessons had already been identified.

First, the report stated that Cape Town was adopting an approach suitable to its local context. "Rather than pursuing grand projects that its citizens cannot benefit from, it is tailoring its efforts to what it perceives are their needs." It also praised the city's strong efforts in investing in the "less glamorous, but necessary" work of providing basic training to ensure that people in the city were equipped to make use of digital services as they were introduced. From this point of view, the strategy is based on four key pillars: Digital Infrastructure, Digital Inclusion, Digital Government, Digital Economy.

Cape Town's principal smart city activities to date have included: public Wi-Fi; closed-circuit television, with 560 cameras located throughout the city; the establishment of an open data portal; and the introduction of a smart grid with several pilots currently under way through the Western Cape Department of Economic Development and Tourism.

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Cape Town is the only city on the African continent to be included among the 22 smartest cities on the planet for Smart Cities Playbook

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The latter is one of the city's most important partners, together with Accelerate Cape Town, a business leadership organization that supports Cape Town's digital city strategy; and Silicon Cape, a network forum that fosters a tech ecosystem in the Western Cape.

### No smart energy, no smart cities

In any case, the heart of a smart city can be found in the efficient and sustainable use of energy. For this reason, Cape Town's strategy places an emphasis on digitalization both in terms of ICT and within the energy sector, as well as on an intelligent use of renewable resources. Particular attention is paid to solar PV and the need to supply knowledge and skills appropriate for solid development within the sector.

As noted IRENA in its latest report: "There is currently no South African

standard for PV installation, nor is there a nationally-accredited PV installation training course. This creates several technical issues for small-scale solar PV, including the lack of standards for inverters, the absence of wiring regulations, and a limited number of qualified electricians who are experienced in the use of direct-current wiring. To address these issues, the City of Cape Town published guidelines to promote safe and legal installation of rooftop solar

![](_page_36_Picture_0.jpeg)

Smart meters

Johannesburg

![](_page_36_Picture_3.jpeg)

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PV systems in commercial and residential settings, which detail the application process to become a small-scale embedded generator in the City of Cape Town." It is a project that lays the groundwork for a net metering program, through which Cape Town has commissioned more than 4.5 MW of grid-connected small-scale solar PV capacity.

Like Cape Town, Johannesburg also won accolades at Paris, earning an award given primarily for projects promoted by its multi-utility, City Power. City Power has initiated a series of projects designed to rationalize consumption and diminish pressure on national networks, significantly reducing the risk of blackouts. In order to achieve this objective, City Power has introduced smart meters in the place of traditional meters on a massive scale, making it possible to monitor consumption and actively involve consumers in this process.

The rollout of the smart meters was the biggest smart meter deployment of its kind undertaken in South Africa. Over 92,000 smart meters have been rolled out across Johannesburg and City Power expects to deploy about 150,000 in total. The introduction of smart meters in Johannesburg was accompanied by another system innovation known as "load limiting," which further amplified the results. Load limiting, which utilizes the smart meter network, allows City Power to remotely disconnect households that fail to reduce their consumption during periods of constrained supply to a stated threshold.

Johannesburg's utility also promoted the introduction, especially in more economicallychallenged homes of what are known as "solar energy geysers". These are used to heat water and have proven particularly efficient tools. Today 150,000 solar energy geysers have been installed in houses around the South African megalopolis. Today these cities are experimenting with tools that are also innovative from a financial point of view. As reported from IRENA in its 2016 report "Renewable Energy in Cities", the city of Johannesburg chose to introduce Municipal Green Bonds, a mechanism used to finance renewable energy investment. Recent analysis shows that only 1.7% of green bonds proceeds flow to cities and citybased infrastructure in developing countries. To date, Johannesburg is the only city in a developing market to have issued a green bond. In June 2014, Johannesburg issued South Africa's first Green Bond (COJGO1) on the Johannesburg Stock Exchange. Maturing in 2024, this 1.46 billion rand (USD 140 million) Green Bond aims to finance a biogas to energy project and a solar waterheating project. The bond auction was oversubscribed by 150%.

## Experiments in other African cities

Nairobi has earned recognition from the Think Tank Intelligent Community Forum two years in a row as the "most intelligent city in Africa", thanks to the progress Kenya has achieved in the ICT sector over the past decade. For example, between 2005 and 2015 the number of people who own a cell phone in Kenya has increased from 13.5% to 81.9%. In 2007 Safaricom launched M-Pesa, a mobile money system that makes it possible for people to transfer money and pay bills using their cell phones. This system clearly bridged an enormous gap in services, one left unfilled by local banks, which were not able to predict such an enormous demand and very real need. Today two thirds of the Kenyan population uses this system in order to conduct transactions, for an overall business

![](_page_37_Picture_9.jpeg)

## **African projects**

![](_page_38_Picture_1.jpeg)

## Island of Victoria, Lagos

#### **The Eko Atlantic**

A new city, (under construction) expected to become the first truly smart city in Africa.

![](_page_38_Picture_5.jpeg)

## Nairobi, Kenya

#### **M-Pesa**

Transfer money and pay bills through the cell phones

![](_page_38_Picture_9.jpeg)

## Konza, Kenya

## Smart devices and sensors

Gather data on energy, water consumption, mobility and map emergencies

turnover of 28 billion dollars, of 44% of the country's entire GDP.

Another great success that has been a stimulus for the birth and growth of numerous other high-tech startups is Konza, a technological incubator built 60 km outside Nairobi. For some, Konza city may well become Africa's version of Silicon Valley, and has already been baptized the "Silicon Savannah." Konza intends to become a smart city in every way: smart devices and sensors spread out across the city make it possible to gather detailed data on energy and water consumption, mobility, provide detailed maps of traffic, and map eventual emergencies. It is a small technological gem that extends over just 50 km2, bringing together university campuses, schools, hospitals, technological incubators, residences and more, and will be connected with Nairobi via a highspeed train network. Construction should be completed by 2020.

The Eko Atlantic project is another avantgarde initiative. This new city, currently under construction on the island of Victoria, in Lagos, on a strip of land reclaimed from the sea, is expected to become the first truly smart city in Africa. The project is equal in overall ambition to those established in Saudi Arabia, Masdar City and Kaec City. This last metropolis in particular is a clear point-ofreference, because like Kaec, Eko Atlantic is also presenting itself as a financial and economic nexus for Nigeria and Africa as a whole. Land remediation is currently underway, along with creation of the first infrastructures, and therefore it's too early to tell if Eko Atlantic will truly occupy a propulsive role for the continent and fulfill its destiny as a model of urban development for Africa as a whole.

Alongside projects like these, which are positive examples not only from a technological point of view, but also because they are capable of attracting investments and attention, the concept of smart city will also have to make headway into the heart of historical cities, modifying their underlying service networks: only in this manner will innovation be able to guarantee African citizens around the continent a better quality of life in the years to come.

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The Eko Atlantic project is an avantgard initiative. This new city is expected to become the first truly smart city in Africa

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### **News & Events**

## **Next Energy Events**

#### The Future of Energy Summit

#### April, 9-10

New York City, New York, USA

about.bnef.com/summit/event/new-york/

Since its inception in 2008, the Future of Energy Summit has featured a unique convergence of the old and the new – traditional players and advanced-energy leaders. It continues to create an environment for making new connections, and serves as a forum to discuss the critical energy issues of today and the next decade.

#### **Off Grid Energy Independence**

Applications. Technologies. Opportunities

#### April, 11-12

O Berlin, Germany

www.idtechex.com/energy-harvesting-europe/show/en/

The tenth annual IDTechEx event focuses on providing insight into Off Grid Energy Independence: Energy Harvesting Systems 1kW-10MW. For zero emission distributed energy, the event brings together the complete value chain, from technology developers to integrators to end-users, providing insight on market trends, latest products and emerging technology toolkits.

#### **Power Forward**

## April, 16-19

#### Denver, Colorado, USA

www.ieeet-d.org/IEEE18/public/enter.aspx

The 2018 IEEE PES T&D Conference and Exposition brings together more than six decades of industry innovation. This event will showcase the solutions, technologies, products, companies and minds that will lead energy industry to the next generation of power systems. This year's technical program has been developed to highlight the future while focusing on challenges that have been solved to achieve the current state of the power and energy industry.

#### All Energy

#### May, 2-3

Glasgow, Scotland, UK

www.all-energy.co.uk

All-Energy is the UK's leading renewable energy and low carbon innovation event, showcasing the latest technologies and services for the energy supply chain and both private and public sector energy end users.

#### Power Gen and Renewable Energy Indonesia

May, 3-5

♥ Jakarta, Indonesia

www.powergen-exhibition.net/event-info

Power Gen and Renewable Energy Indonesia will be held in conjunction with Solartech Indonesia, Battery Indonesia, Inalight, and Cable & Wire Indonesia as one stop platform for power generation, renewable energy, energy storage, lighting, cable, and other electrical equipment under one roof.

#### **CO2 Reuse Summit**

#### May, 16-17

 Zurich, Switzerland

reuseco2.com

The world is constantly looking for pathways to sustainable future. Scientists from around the globe developed several technologies enabling us to turn carbon dioxide into useful products like fuels, building materials, chemicals or polymers. However CO2 utilization projects still require further research, industry collaboration, funding or policy changes in order to become feasible and well established on the market.

#### Meeting of the Electricity European Regulatory Forum

#### May, 30-31

Florence, Italy

ec.europa.eu/info/events/meeting-europeanelectricity-regulatory-forum-florence-2018-may-30\_en

The Electricity Regulatory Forum is currently addressing cross-border trade of electricity, in particular the tarification of cross-border electricity exchanges and the management of scarce interconnection capacity.

#### Review

## Climate change in Africa

Camilla Toulmin

Impacts of climate change on Africa's development and prospects for the continent's growth in a new low-carbon economy are among the subjects covered in this book by the director of the International Institute for Environment and Development, Camilla Toulmin.

"If we allow the global average temperature to rise by two degrees, that will spell disaster for many of Africa's people," says Toulmin. "The funds currently on offer for adaptation to climate change are tiny in relation to what the continent needs, and costs will escalate the longer we delay action to cut greenhouse gases in industrialised countries."

In this accessible and authoritative book, Dr Toulmin uses case studies to examine different issues.

Six of the nine chapters are given over to a particular aspect of climate change (water, food, forests, cities, conflict and carbon markets), each delivering a wide-ranging overview and ending with a brief prognosis that often identifies those areas where the author finds some hope for the future. Toulmin avoids making the necessary articulation of facts and statistics overly dull by granting her readers with a degree of both agency and intelligence to unpick some important and recurrent themes. Not least of which is the part world leaders and corporations have played in subordinating Africa to their own interests. Even with her tendency for understatement, Toulmin exposes the injustice that underpins the costly price Africa will pay for events for which they are the least responsible.

"Climate change will be enormously damaging for poorer parts of the world, leading to crises with crops, livestock, water supplies and coastal areas," says Toulmin. "Within Africa, it's likely to be the continent's poorest people who are hit hardest. Yet there will also be new opportunities around global carbon management where African countries have much to offer."

"

Climate change is already having profound effects in Africa. Of all the continents, Africa is least responible for these changes. Camilla Toulmin with her long experience of working in rural Africa, her scholarship and her leadership of the IIED, is especially qualified to analyse and explain the issues and to point to the policies which the world must follow. This is a very clear, reasoned and thoughtful book which will be of great importance in the crucial discussions which lie ahead.

Lord Nicholas Stern, author of the Stern Review on the Economics of Climate Change

![](_page_41_Picture_12.jpeg)

![](_page_41_Picture_13.jpeg)

Camilla TOULMIN

Camilla Toulmin is Director of the International Institute for Environment & Development. An economist by training, she has worked mainly in Africa on social, economic, and environmental development.

This has combined field research, policy analysis, capacity building and advocacy. Her work has aimed to understand how societies evolve to cope with changed circumstances, and to demonstrate the links between global and local levels.

![](_page_42_Picture_0.jpeg)

## **Shaping a Better Energy Future**

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CESI operates in more than 40 countries around the world, with a total network of 1,000 professionals. The company's key clients include Governmental Institutions, Regulatory Authorities, major Utilities, Transmission System Operators (TSOs), Distribution System Operators (DSOs), Power Generation companies, Manufacturers, Financial institutions and International electromechanical and electronic manufacturers. CESI is a fully independent joint-stock company with main premises located in Milan, Berlin, Mannheim, Rio de Janeiro, Dubai, Abu Dhabi and Washington DC.

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![](_page_43_Picture_5.jpeg)

![](_page_43_Picture_6.jpeg)