

ABOUT THE AFRICA PROGRESS PANEL



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The Africa Progress Panel consists of ten distinguished individuals from the private and public sectors who advocate for equitable and sustainable development for Africa. Kofi Annan, former Secretary-General of the United Nations and Nobel laureate, chairs the Africa Progress Panel and is closely involved in its day-to-day work. The other Panel members are Michel Camdessus, Peter Eigen, Bob Geldof, Graça Machel, Strive Masiyiwa, Linah Mohohlo, Olusegun Obasanjo, Robert Rubin and Tidjane Thiam.

The Africa Progress Panel brings about policy change through a unique combination of cutting-edge analysis, advocacy and diplomacy. The life experiences of Panel

members give them a formidable capability to access the worlds of politics, business, diplomacy and civil society at the highest levels, globally and in Africa. As a result, the Panel functions in a unique policy space with the ability to influence diverse decision-makers.

The Panel builds coalitions to leverage and broker knowledge and to convene decision-makers to create change in Africa. The Panel has extensive networks of policy analysts and think tanks across Africa and the world. By bringing together the latest thinking from these knowledge and political networks, the Africa Progress Panel contributes to generating evidence-based policies that can drive the transformation of the continent.

ABOUT THIS POLICY PAPER

This policy paper is a follow-up to the Africa Progress Panel's annual flagship report *Power, People, Planet: Seizing Africa's Energy and Climate Opportunities*, published in June 2015. The 2015 report explored the links between energy, climate and development in Africa. It documented the risks that would come with a business-as-usual approach and highlighted the opportunities for African leaders. As a global community, the report stated, we have the technology, finance and ingenuity to make the transition to a low-carbon, renewable energy future, but so far we have lacked the political leadership and practical policies needed to break the link between energy and emissions. The report concluded that Africa is well placed to be part of that leadership.

Power, People, Planet, was circulated widely among policymakers, business leaders, civil society and heads of state, globally and in Africa. Since its publication, the Panel has carried out high-level advocacy for the report's recommendations on climate and energy policy, working closely with a wide range of partners.

This new paper seeks to build on the political momentum that has been created over the past year to increase energy access in Africa. Its main aim is to provide additional policy-relevant information and insights to support the implementation of ambitious new public and private initiatives now underway that aim to increase energy access swiftly across Africa, especially the New Deal on Energy for Africa, spearheaded by the African Development Bank. In light of the continent's dynamic

links with the rest of the world, the paper also highlights critical steps that must be taken by leaders in the international public and private sectors.

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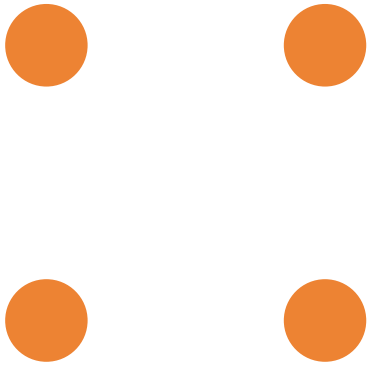
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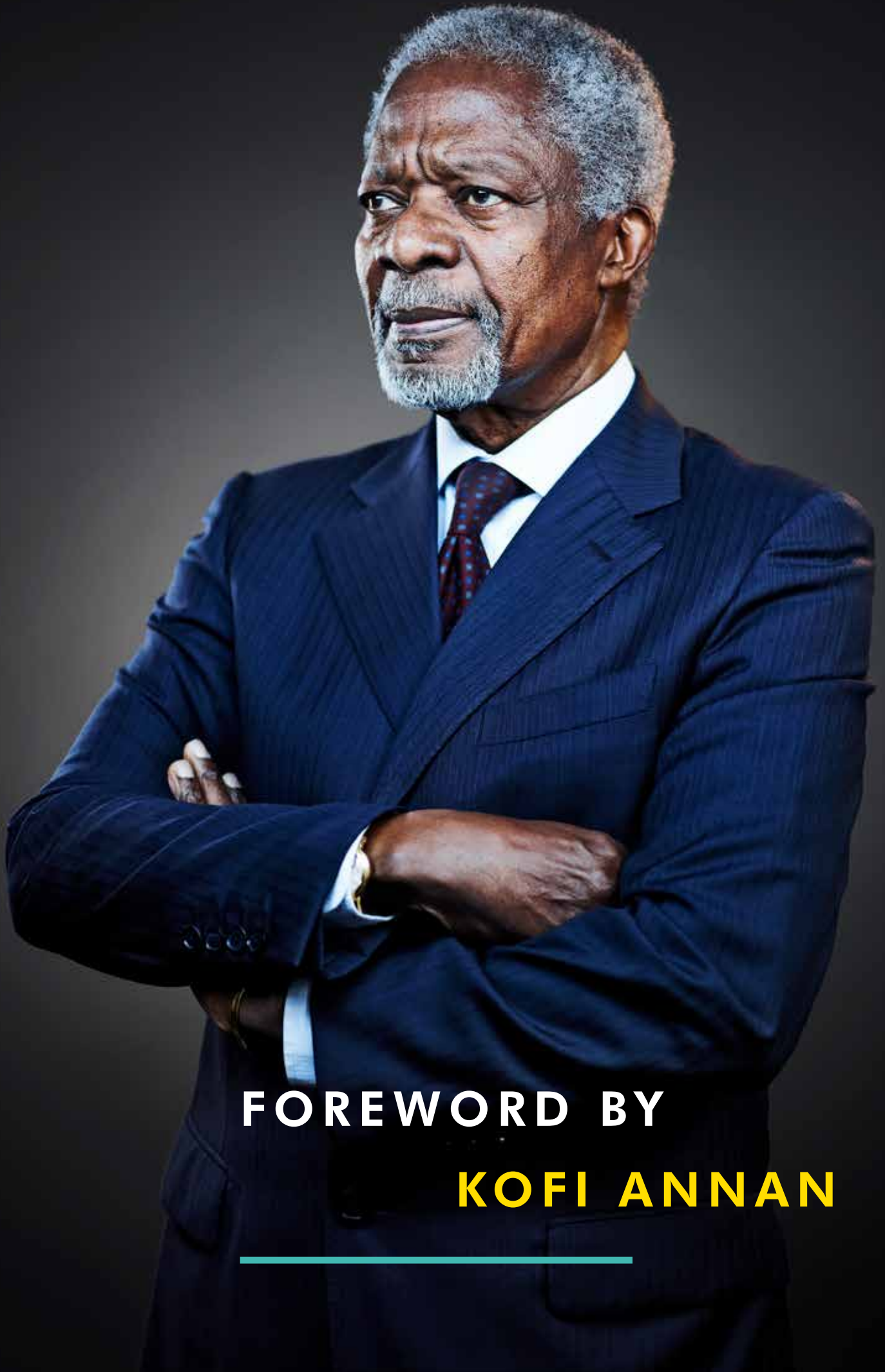
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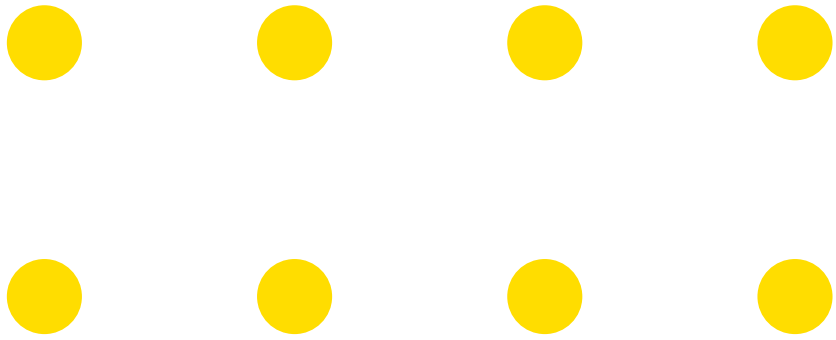
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The report is also available on Worldreader Mobile at read.worldreader.org for any data enabled mobile phone. None of the above individuals or institutions is responsible for errors in the report or for the wider content, which reflects the views of the Africa Progress Panel.



FOREWORD BY

KOFI ANNAN



WE KNOW WHAT TO DO. EVERY GENERATION TO COME DEPENDS ON US GETTING IT RIGHT.

Africa's energy needs are massive. They are also urgent. The traditional way of expanding energy access – increasing electricity generation capacity and extending the grid – is still vital. But it is slow. We have to electrify Africa faster.

To bring modern energy to all their citizens as soon as possible, African countries are exploring every available means. This report shines the spotlight on two promising options – off-grid solar power and mini-grids – while also outlining the steps to put Africa's grids back on track. It sharpens the vision we laid out 2015 Africa Progress Report, *Power People Planet: Seizing Africa's Energy and Climate Opportunities*.

The cost of not taking action is clear. Economic growth, industrialization, jobs, business, sustainable agriculture and social development all depend on governments making energy a top priority. And our ability to limit global warming depends crucially on making the transition to renewable energy.

Meeting the double energy imperative – to increase both the scale and the pace of electrification – is a huge task. But it's also an exceptional opportunity, as we show in this report.

It's an opportunity for countries to kick-start the social and economic transformation they need. It's an opportunity for entrepreneurs and investors, African and non-African. It's an opportunity for the continent to show what it can do by combining the latest technology with African ingenuity.

Africa can lead the world in low-carbon power development, by embracing the revolution in clean energy and using the latest tools to manage energy demand and increase efficiency. Africa can lead in creating markets for renewable energy, fostering the growth of mini-grids, building diversified modern grids and interconnecting them across the continent.

It's a huge task, but we know it can be done – because it's happening already.

Many countries have set ambitious targets for increasing energy access or for advancing other elements of the energy transition. At the core of Africa's electricity system, the utilities that manage national grids are following an international path towards greater efficiency and accountability, by separating generation, transmission and distribution. Governments are amending electricity laws and improving regulatory frameworks, clearing a path for investors. Independent power producers are increasing the involvement of the private sector and showing how to scale up renewable power generation capacity.

Building and extending grid infrastructure can be slow, however. Even before the work can start, legal, financial and technical frameworks have to be adjusted or created from scratch. The 620 million Africans who lack electricity can't wait – and shouldn't have to wait. Luckily, mini-grid and off-grid energy solutions are plentiful. Africans are rapidly adopting and adapting them, particularly to meet the needs of areas that are remote or neglected by the grid.

Off-grid and mini-grid power by renewable sources of energy has a crucial role to play in meeting the three great energy challenges that African governments face: providing all their citizens with access to secure and affordable energy services; building the energy infrastructure needed to drive inclusive growth and create jobs; and limiting carbon emissions.

To meet these challenges, governments must also look beyond their own borders and think on a continental scale. Africa is rich in energy resources but they are not all evenly distributed, so cross-border power trade is essential.

Here, too, we know what to do, and much is being done already. Major interconnection projects are under way. Five regional power pools have been created that cover the continent. But so far, only 8 per cent of electricity is traded across borders – and those power pools are not connected to one another. To unlock Africa's energy potential for all Africans, governments must cooperate to ensure regional power trade thrives.

Fortunately, the future looks promising for African energy cooperation, with several new frameworks emerging. In 2015, the New Partnership for Africa's Development (NEPAD) established the Africa Power Vision, and the African Development Bank launched its New Deal on Energy for Africa. Both reflect the increased commitment to ensuring universal access to modern energy, and adequate power to enable economic growth and prosperity. The African Development Bank has made energy one of its five top priorities.

Africa's energy and climate needs are rising up the global development agenda. In September 2015, the world's governments adopted the Sustainable Development Goals, which include a goal to ensure access to affordable, reliable, sustainable and modern energy for all. This energy goal includes objectives advocated by the Sustainable Energy for All (SE4All) initiative and endorsed by Africa's energy ministers at their conference in 2012.

Africa made its voice heard at the 21st Conference of Parties to the UN Framework Convention on Climate Change (COP21) in Paris, where governments came together to agree a far-reaching, legally binding deal aimed at keeping global warming below 2°C. New measures were agreed to support international cooperation and build the resilience of communities affected by climate change.

The Paris agreement was a triumph of multilateralism in an era marked by a worrying trend towards unilateralism and away from international cooperation. That trend has since continued and deepened, restoring some of the pessimism that preceded the Paris accord. But the agreement remains a strong, indispensable, global commitment. African governments must now play their full part in delivering on their Paris pledges. They made their commitment clear in Paris by launching the Africa Renewable Energy Initiative, an unprecedented effort to give all Africans access to energy that is based on renewable sources by 2030.

In return, Africans have a right to expect more and better international support for low-carbon energy. After all, they have contributed least to the underlying problem.

That support should include technical and financial assistance for developing renewable power, on-grid and off-grid.

Bilateral and multilateral donors have pledged billions of dollars to Africa's energy transition, but little of that money is moving yet. If funds don't start arriving in 2017, countries may lose heart, and leaders who fought for the Paris agreement may face attack at home and be undermined. Donors need to realize that Africa's energy imperative is urgent – not just for Africa but for the world. Investing in the continent's clean energy is a key way to put the planet on a low-carbon growth path.

At home, African governments have a vital task to do, one that goes to the heart of the continent's energy problems: fixing national energy grids that are unreliable and financially fragile. Many energy utilities suffer from mismanagement and inefficiency, reflected in failures to set tariffs, collect revenue, support private partnerships and investments in energy and stem major energy losses in transmission and distribution. A lack of accountability and transparency nurtures corruption. In our report, no finding brings this home more forcefully than the fact that some electricity theft – a problem across the continent – is carried out by a few government organizations, including the armed forces in some countries.

At the same time, renewable sources of energy because of their flexibility, modularity, and adaptability are the basis of Africa's new modern electricity systems. Africa's electricity future is emerging today where consumers are becoming producer and the monopoly and centrality of electricity is being challenged.

There are serious and persistent problems, yet they are solvable. The will exists to solve them, as many countries are demonstrating. Governments are showing leadership. But they need support to put in place the necessary integrated plans and policies, to overcome market barriers, and provide incentives for the business models and finance that can scale up Africa's energy transition. I hope that this report will be a catalyst for further action.

Across the continent, there is a general acceptance that modern energy is an indispensable ingredient of the growth and progress that Africa needs to bring prosperity to every citizen – women and men, rural and urban, of every ethnicity and every origin. **(See infographic: The Sustainable Development Goals will only succeed if they succeed in Africa)**

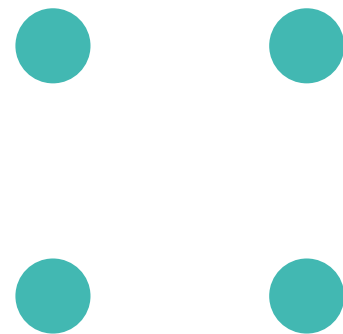
Africa stands at a crossroads. There is global attention and support for fixing Africa's energy problems, interest from investors, and demand from Africans for rapid expansion of reliable and carbon-friendly power. There are successes to build on. It's time for African leaders to act.

We know what to do. Every generation to come depends on us getting it right.



KOFI A. ANNAN

Chair of the Africa Progress Panel



THE SUSTAINABLE DEVELOPMENT GOALS WILL ONLY SUCCEED IF THEY SUCCEED IN AFRICA:

URGENTLY POWERING AFRICA TO DELIVER THE GLOBAL GOALS

AFRICA UNPLUGGED



Africa's poorest people are paying among the world's highest prices for energy



The challenge is food loss and waste. More than enough food is being produced. Up to 1/3 of all food is spoiled or squandered rather than being consumed



36,000 women die in childbirth each year in Nigeria. Lifesaving medical care is hampered by a lack of lighting



In 9 African countries more than 80% of primary schools have no electricity



600,000 Africans are killed every year by air pollution caused by the use of firewood and charcoal for cooking. Women and children are the primary victims



Energy-sector bottlenecks and power shortages cost the region 2-4% of GDP annually undermining sustainable growth, jobs and investment



60% of operator network costs for mobile-phone operators are spent on diesel fuel



50% of Africans will be living in cities by 2030, placing a huge strain on energy infrastructure



The energy gap between Africa and the rest of the world is widening



Collecting firewood and producing charcoal are the main causes of deforestation in Africa




No region has contributed less to climate change. Yet Africa pays the highest price for failure to avert a global climate catastrophe



Climate finance is fragmented and poorly governed. African countries are unable to leverage the finance needed to manage climate risk and deliver energy for all



620 MILLION
unconnected Africans

 Energy is the 'golden thread' connecting growth, equity and sustainability. Energy access is essential to ensure that all SDGs succeed.



AFRICA CONNECTED



EFFECTIVE INTERNATIONAL COOPERATION can increase investment in Africa's renewable energy. A global movement is growing around an energy transition that is clean and affordable

CUTTING THE COST OF ENERGY generates savings that can be invested in productive activities, health and education

The use of clean cook stoves **PREVENTS DEFORESTATION**

INCREASING ACCESS TO POWER can help reduce food loss through improved refrigeration facilities

Climate change presents Africa with a unique 'leapfrogging' opportunity to become a **GLOBAL LEADER IN LOW-CARBON DEVELOPMENT**

ACCESS TO RENEWABLE ENERGY SOLUTIONS can help save lives. In Uganda, the use of solar-powered radios to contact traditional birth attendants led to a reduction of maternal mortality by 54%

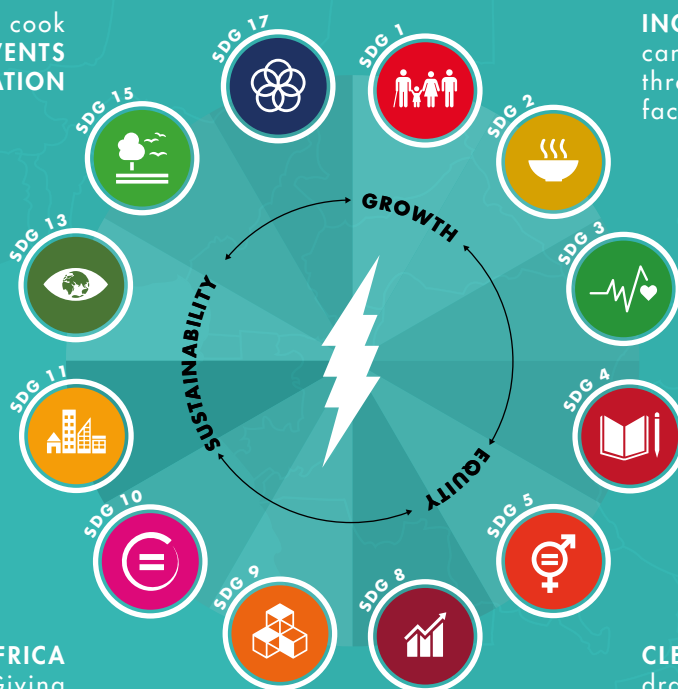
INNOVATIVE ENERGY SOLUTIONS in and around cities and rural communities will reduce pressure to migrate and make all areas more sustainable

ACCESS TO SOLAR ELECTRICITY in primary and secondary schools in Sudan and Tanzania improved completion rates from less than 50% to almost 100%

A MORE CONNECTED AFRICA will reduce inequalities. Giving poorer Africans greater equality of opportunity will make it possible to achieve all the SDGs

GREEN POWER ALTERNATIVES could save more than 80% of what is spent on powering the 145,000 off-grid telecom sites in Africa

The renewable energy market is booming. Affordable electricity and clean cooking facilities **PROMOTE GROWTH AND JOBS**



CLEAN COOKING STOVES dramatically reduce household and ambient air pollution and improve resource efficiency



INTRODUCTION

Across Africa, lack of electricity prevents many children from doing their homework at night. Evariste Akoumian, from Côte d'Ivoire, decided to solve this problem by creating backpacks with built-in solar panels that collect energy while children walk to school. During the day, the solar panels can absorb enough energy to power a lamp for four to five hours at night¹.

On the other side of the continent, in East Africa, the company M-Kopa provides rural households with home solar-energy systems that provide three lights, five connections for phone charging and a portable radio. Customers pay US\$35 upfront then US\$0.50 daily for a year. M-Kopa has already reached 275,000 homes and plans to reach 1 million homes by the end of 2017².

Evariste's backpacks and M-Kopa's solar household systems offer three striking lessons about Africa's energy story: Demand for electricity is huge; every source of electricity, on-grid and off-grid, will be needed to meet it; and African ingenuity is already matching supply and demand.

Universal access to reliable, affordable, low-carbon electricity is the key to Africa's socio-economic transformation. The continent has enormous potential to generate the energy which it needs to drive inclusive growth and create jobs. Yet most of Africa is mired in an energy crisis. In this report, we examine a range of ways to solve that crisis as quickly as possible.

Accelerating access to electricity in Africa is urgent. Although 145 million Africans have gained access to electricity since 2000, in many places electrification has not kept pace with population growth. Currently 620 million Africans do not have access to electricity, almost two-thirds of the population, and unless the electrification rate increases, the number of Africans without access in 2030 will increase by 45 million. **(See infographic: Mind the gap: Africa's energy deficit is large and growing)**

Alongside the access deficit is a wider power deficit. The average American consumes over 13,000 kilowatt hours (kWh) of electricity a year and the average European somewhat less. The average African (excluding South Africa) uses just 160kWh.

Africa could lead the world in building sustainable energy systems that couple efficiency and equity, as we showed in the 2015 Africa Progress Report, *Power People Planet: Seizing Africa's Energy and Climate Opportunities*. Demand for modern energy is set to surge in Africa, fueled by economic growth, demographic change and urbanization. As the costs of renewable energy sources fall, Africa could leapfrog into a new era of power generation. New energy and electricity systems (including utility reform), new technologies and new business and energy/electricity delivery models could be as transformative in energy as the mobile phone has been in telecommunications.

To achieve this vision and solve Africa's energy problems, it seems logical to focus on big projects such as large dams and power pools that will scale up national and regional infrastructure. But these projects are expensive, complex and slow to implement, particularly in rural areas. Africa's 600 million households cannot wait for the rollout of a grid that offers affordable connections for all.

The challenge for governments, their development partners and the private sector is how to move faster to bring the millions of African households, remote communities and small-scale entrepreneurs into the energy loop as quickly as possible. To meet that challenge, countries need to be able to choose from a menu that offers all options, including off-grid household systems and mini-grids as well as the national grid. Of the 315 million people who will gain access to electricity in Africa's rural areas by 2040, it is estimated³ that only 30 per cent will be connected to national grids, and most will gain access to electricity through off-grid household or mini-grid systems.

This report is not advocating a shift in policy emphasis away from on-grid solutions, which will always form the base of energy supply in Africa. It is promoting a broadening of perspective to include new technologies and systems, some of them unproven, that offer promising ways to close Africa's energy gap more quickly than would be possible by relying on grid connections alone. The current static system can evolve into a dynamic, resilient system with many options and possibilities for expansion – from smart grids, mini-grids and hybrid grids to cross-border “super-grids”. **(See infographic: Africa's energy transformation)**

National governments and regional groupings can aim for holistic energy plans that embrace every way of expanding supply, and they can make sure they are integrated with one another. If the policy framework and investment climate are adjusted to support integration of centralized and decentralized energy, the energy transitions will be cheaper and faster.

Off-grid solar technology and mini-grids are breakthrough technologies that have vast potential to advance access to electricity in Africa. Off-grid solar products – including super-efficient appliances designed for low-access environments – can act as rungs on an “energy ladder”, providing a range of energy services to households and enterprises with different energy needs and incomes. Technological innovation means that mini-grids can also offer sustainable permanent alternatives to connecting to the grid, especially as reliable and affordable products come on-stream that are attractive to small and medium-sized enterprises operating far from the national grid.

These systems present households with an opportunity to access lighting and power for charging phones and fridges, to reduce household spending on less efficient fuels and to enjoy health benefits from clean home energy. New business models and pay-as-you-go systems are extending the reach of renewable markets, creating investment opportunities for investors in the process.

Governments can put in place the incentives needed to encourage investment in such systems, protect consumers, and facilitate demand among disadvantaged groups. More than that, governments need to support the development of an enabling environment through which African companies can enter energy generation, transmission and distribution markets, climb the value chain, and build the investment partnerships that can drive growth and create jobs.

To bring power to the two-thirds of Africans who lack access to modern energy, renewable energy development needs to accelerate significantly.

African countries have shown a strong willingness to shift from fossil fuels to low-carbon energy. So what is holding Africa back from exploiting its renewable potential? It is vital that governments implement policies that foster the expansion of Africa's renewable power supply.

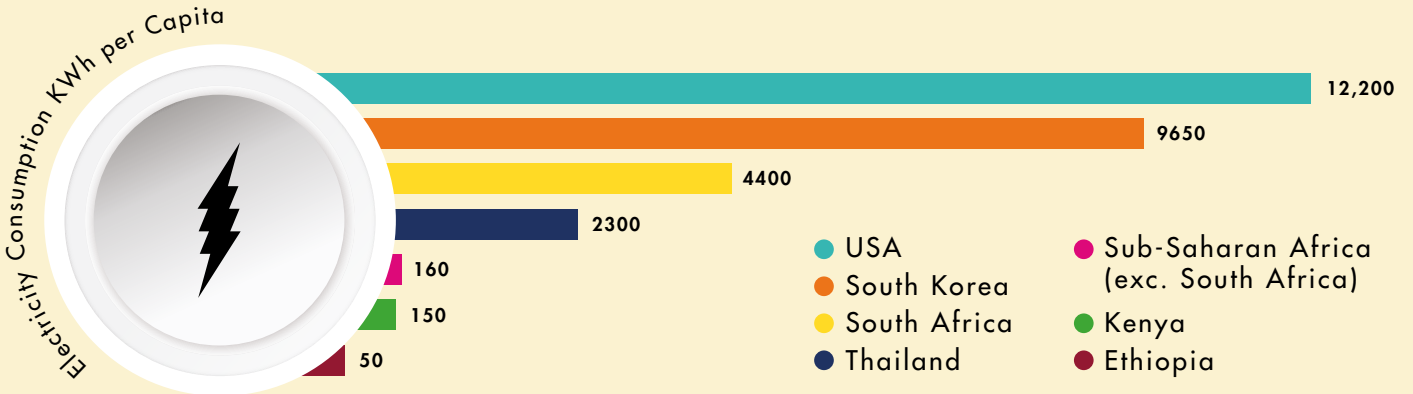
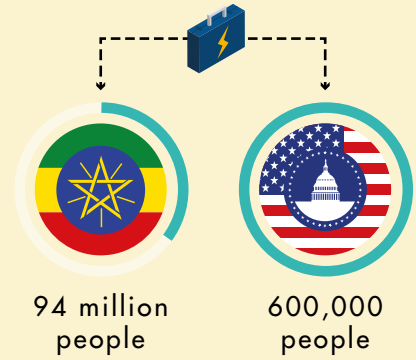
Africa's river systems could support the development of regional hydropower grids. This is already happening in Eastern Africa, where Ethiopia is tapping into its

MIND THE GAP

AFRICA'S ENERGY DEFICIT IS LARGE AND GROWING

Energy consumption in Africa is shockingly low

Ethiopia (population 94 million) consumes one-third the electricity of Washington DC (population 600,000)



By 2030 the energy gap between Africa and other regions will widen

SUB-SAHARAN AFRICA is the only region in which the absolute number of people without access to modern energy is set to rise.

● 2016
● 2030

Energy gaps between African countries are marked



South Africa consumes 9 times as much energy as Nigeria despite having one-third of its population

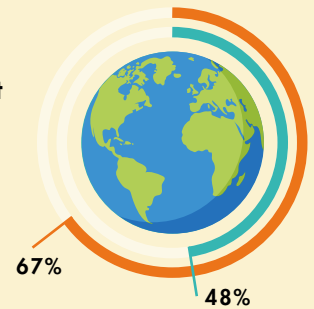


In the Democratic Republic of the Congo, Liberia, Malawi and Sierra Leone, fewer than one in 10 people have access to electricity



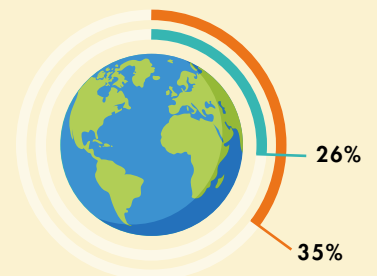
Africa's share of the world population without clean cooking facilities

In 2030, an additional 84 million people will not have access to clean cooking stoves



Africa's share of the world population without electricity

In 2030, an additional 45 million people will not have access to electricity



Within African countries, the electricity grid serves the wealthiest and urban areas

Among the poorest 40% of the population, coverage rates are well below 10%. Connection to the grid exceeds 80% for the wealthiest one-fifth of households

vast hydropower potential to expand access, drive new industries and meet the demand of neighbouring countries.

In the short term, African governments cannot rely solely on renewable energy resources. The abundance of natural gas also presents opportunities to develop integrated regional grids across Southern, Eastern and West Africa. Integration can help close the access gap.

Outside South Africa, coal plays a residual role in power generation in Africa – and governments across the region would be wise to keep it that way. Leaving aside the profoundly damaging consequences of coal-fired power for climate change, this is a 20th century fuel exploited through technologies that are becoming increasingly dated. The smart investments in Africa, as in other regions, are being directed towards the more innovative and dynamic renewable energy fuels of the future. However, the transition to clean energy must be managed carefully. For countries with large deposits of coal, it is still the cheapest source of power. They must choose carefully which technologies to use to mitigate use of coal.

While oil and gas will remain prominent in Africa's energy landscape over the medium term, their shares in the energy mix are likely to decline in the face of technological breakthroughs and continuous improvement in energy efficiency that are disrupting the renewable industry and the whole global energy system. Sustained political and financial commitment from global, regional and national frameworks will be key in facilitating the continent's transition to a cleaner energy infrastructure.

If Africa is to exploit the new opportunities fully as they emerge in the energy sector, governments have to tackle old policy challenges. While some encouraging reforms are under way, all too often energy utilities are still opaque, unaccountable and inefficient. Despite its abundance of energy resources and potential, Africa is home to some of the world's worst-functioning grid systems, which have suffered from decades of neglect and mismanagement.

Many of the problems are well-known. Revenue streams are insufficient to cover basic operating costs, let alone new investment, in part because of a failure to collect bills and prevent electricity theft, most of which is carried out by individuals and organizations that consume large amounts of electricity and can afford to pay for it. There is an ongoing challenge to supply basic power and connections that are affordable to poor Africans.

The failure of regulatory authorities to provide secure off-take agreements and predictable prices undermines independent power producers and deters foreign investors. Africa must address these problems to attract the energy-infrastructure investments needed to tackle the power crisis – and to take advantage of the low international interest rates now available to support public investment.

To realize Africa's energy potential and accelerate the continent's wider integration agenda, cross-border power trade is crucial. Yet less than 8 per cent of power is traded across borders in Sub-Saharan Africa. Increasing this figure will require up-grading the grids and harmonizing standards across countries. Cost-effective generation and trade of electricity at the regional level would help to resolve the African energy "trilemma" of ensuring affordable, reliable and sustainable energy.

The ultimate goal should be to bring together and interlink Africa's numerous and fragmented power initiatives to create a single pan-African power grid. To achieve this goal, African countries will have to commit to a much deeper level of cooperation and overcome the dearth of financing for supranational interconnection projects.

In Africa and around the world, there is a deepening awareness not only of Africa's energy crisis but also of the ways to resolve it – through on-grid, mini-grid and off-grid solutions. In this report we explore all three ways of increasing access to electricity.

AFRICA'S ENERGY TRANSFORMATION

CURRENT SYSTEM

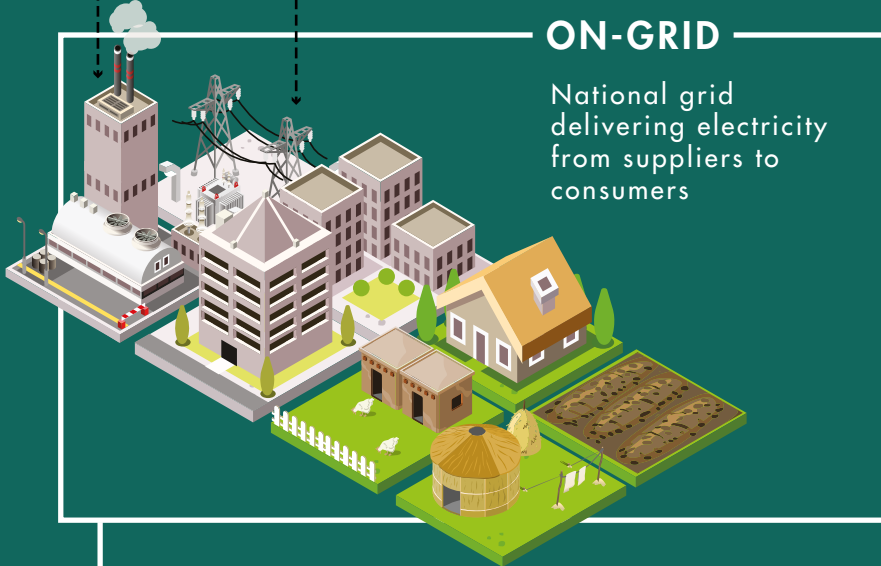
Linear and Static

Small number of big producers

One-way passive agreements with consumers

ON-GRID

National grid delivering electricity from suppliers to consumers



Inefficient supply system



Intermittent power supply



The utility is the only supplier



Corrupt and heavily subsidized utilities



Energy losses and theft



Decline in the price of renewables



Decline in energy storage prices



Increase in awareness of climate change



Near universal internet access and a shift from the Internet of People to the Internet of Things

TRIGGERS

for Transformation



Innovation in technology, business models and payment structures



Ever-increasing demand for electricity due to a rising middle class, increasing population and urbanization



The rise of Africa's energypreneur

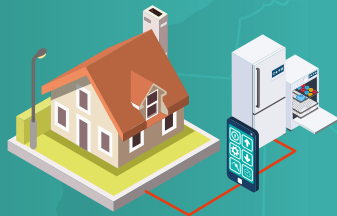
620 MILLION

unconnected Africans

EMERGING SYSTEM

Transforming and Dynamic

Today we're seeing the emergence of a more resilient and diverse system, with many modes, options and scalability.



IT enabled transparency

SMART GRID

Smart homes with smart, energy-efficient appliances

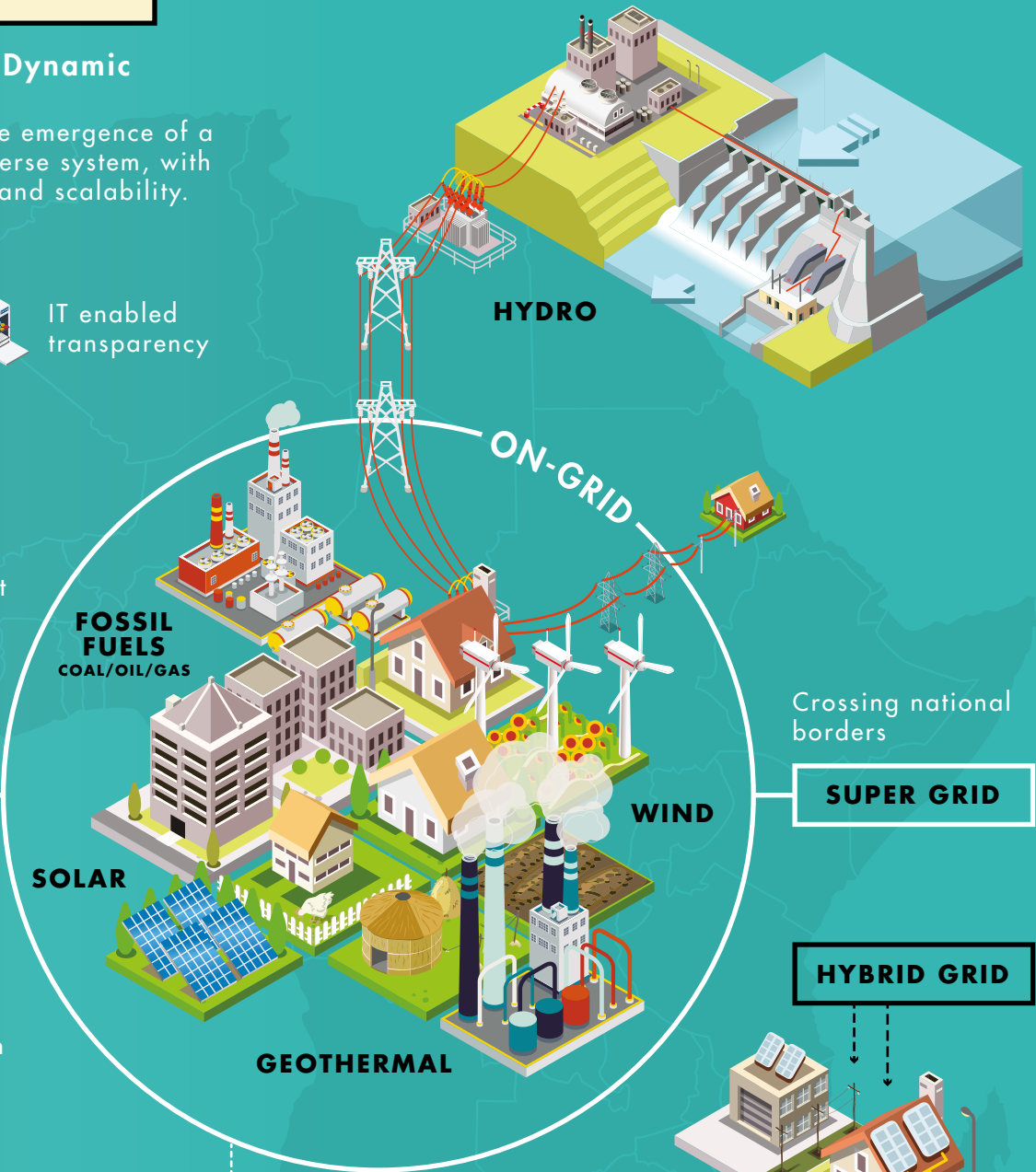


More efficient billing and management often driven by mobile technology



MINI GRID

Super battery storage for backup supply



Crossing national borders

SUPER GRID

HYBRID GRID



OFF-GRID

SOLAR HOUSEHOLD SYSTEMS

The rise of the 'prosumer' consumers are now also producers who generate and store energy

Several key factors influence the choice of a particular energy solution, including the target level and quality of energy access, population density, local grid connection characteristics, the availability of local energy resources and the cost of the technology necessary to exploit them⁴. African countries grappling with limited financial resources, weak energy planning and rapid economic growth need to choose the energy technologies that increase access fastest while offering the best value for money. A comparative assessment of off-grid, mini-grid and on-grid systems is therefore critical to help countries make those choices. This report is divided into three parts that consider the advantages and disadvantages of all three options.

Part I charts the spectacular rise of off-grid solar products in Africa, and shows how off-grid consumers can advance up an “energy ladder” of progressively more high-powered solar household systems. In conclusion, we lay out some concrete measures that African governments and their partners can take to help the continent meet its fast-growing electricity needs. Part II examines the role of mini-grids – whether they are connected to the grid or not – in meeting the needs of the “missing middle”, the energy consumers who lie between grid-connected power and small off-grid solutions. The story of how mini-grids can fast-track inclusion of large numbers of Africans who have never had grid access is told. Part III looks at why Africa’s grids are performing so poorly and what is being done to fix, extend and interconnect them – as well as how to integrate Africa’s huge renewable energy potential.

