POWER PEOPLE PLANET

SEIZING AFRICA'S ENERGY AND CLIMATE OPPORTUNITIES

Africa Progress Report 2015

AFRICA PROGRESS PANEL

AFRICA PROGRESS REPORT 2015

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The Africa Progress Panel (APP) consists of ten distinguished individuals from the private and public sector who advocate for equitable and sustainable development for Africa. Mr Kofi Annan, former Secretary-General of the United Nations and Nobel laureate, chairs the APP and is closely involved in its day-to-day work.

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 in Africa and across the globe. 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 APP contributes to generating evidence-based policies that can drive the transformation of the continent.

ABOUT THE AFRICA PROGRESS REPORT

The Africa Progress Report (APR) is the annual flagship publication of the Africa Progress Panel. The APR draws on the best research and analysis available on Africa and compiles it in a refreshing and balanced manner. The Panel makes policy recommendations for African political leaders and civil society who collectively have the primary responsibility for spurring Africa's progress. In light of the continent's dynamic links with the rest of the world, the APR also highlights critical steps that must be taken by leaders in the international public and private sector.

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The report is also available on Worldreader Mobile at read.worldreader.org for any data enabled mobile phone. Background papers prepared for the report are available at africaprogresspanel.org.

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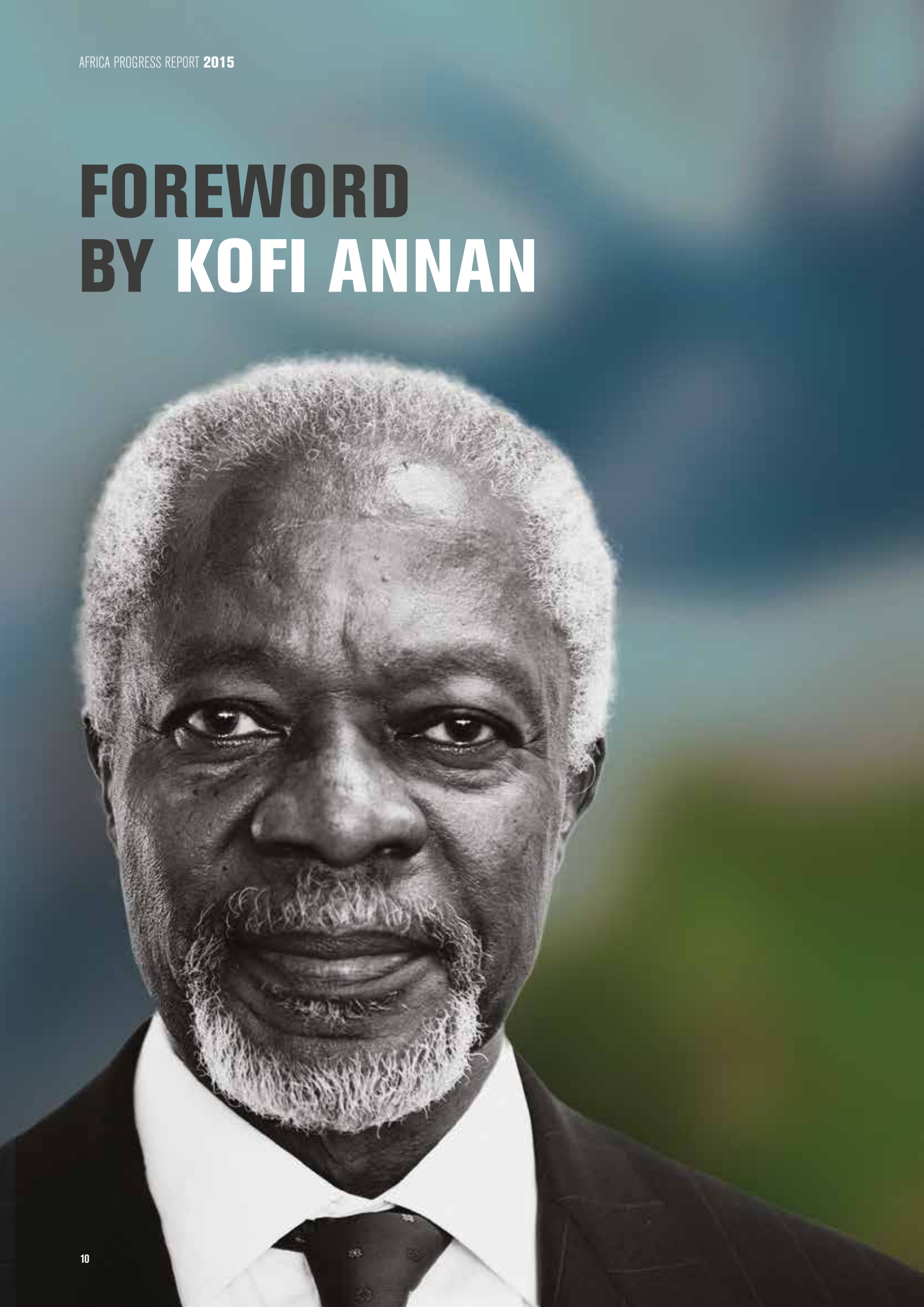


Can the world prevent catastrophic climate change while building the energy systems needed to sustain growth, create jobs and lift millions of people out of poverty? That question goes to the heart of the defining development challenges of the 21st century, and is the focus of this year's report.

It is a vital question for Africa. No region has done less to contribute to the climate crisis, but no region will pay a higher price for failure to tackle it. This year governments around the world will sign up for an ambitious new set of international development goals. These bold plans could turn to dust if world average temperatures are allowed to increase by more than 2°C. There is now a real and present danger that climate change will stall and then reverse the fragile gains made over the past two decades. Meanwhile, over half of Africa's population lacks access to basic electricity and clean cooking facilities – and the numbers are rising.

Climate change demands that we rethink the relationship between energy and development. The carbon-intensive energy systems that drive our economies have set us on a collision course with our planetary boundaries. We can avoid that collision. As a global community, we have the technology, finance and ingenuity to make the transition to a low-carbon future, but so far we lack the political leadership and practical policies needed to break the link between energy and emissions.

The central message of this report is: Africa is well placed to be part of that leadership. Some African countries are already leading the world in low-carbon, climate-resilient development. They are boosting economic growth, expanding opportunity and reducing poverty, particularly through agriculture. African nations do not have to lock into developing high-carbon old 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. Africa stands to gain from developing low-carbon energy, and the world stands to gain from Africa avoiding the high-carbon pathway followed by today's rich world and emerging markets.

Unlocking this "win-win" will not be easy. It will require decisive action on the part of Africa's leaders, not least in reforming inefficient, inequitable and often corrupt utilities that have failed to develop flexible energy systems to provide firms with a reliable power supply and people with access to electricity. Tackling Africa's interlocking climate and energy problems will also require strengthened international cooperation. The major summits planned for 2015 – on finance, the Sustainable Development Goals and climate – provide an opportunity to start the change.

Our report shows that Africa's energy challenge is substantial. Over 600 million people still do not have access to modern energy. It is shocking that Sub-Saharan Africa's electricity consumption is less than that of Spain and on current trends it will take until 2080 to for every African to have access to electricity.

Modern energy also means clean cooking facilities that don't pollute household air. An estimated 600,000 Africans die each year as a result of household air pollution, half of them children under the age of five. On current trends, universal access to non-polluting cooking will not happen until the middle of the 22nd century.

The December 2015 talks on a new global climate treaty are approaching fast. Africa is already experiencing earlier, more severe and more damaging impacts of climate change than other parts of the world. Left unchecked, it will reduce agricultural productivity, create conditions for mass hunger and reverse human development.

Africa's lack of energy means it has a tiny carbon footprint. African leaders have every reason to support international efforts to minimize greenhouse gas emissions. At the same time, they urgently need more power to boost and transform their economies and to increase energy access. Their challenge is to embrace a judicious, dynamic energy mix in which renewable sources will gradually replace fossil fuels.

Africa has enormous potential for cleaner energy – natural gas and hydro, solar, wind and geothermal power - and should seek ways to move past the damaging energy systems that have brought the world to the brink of catastrophe.

The waste of scarce resources in Africa's energy systems remains stark and disturbing. Current highly centralized energy systems often benefit the rich and bypass the poor and are underpowered, inefficient and unequal. Energy-sector bottlenecks and power shortages cost the region 2-4 per cent of GDP annually, undermining sustainable economic growth, jobs and investment. They also reinforce poverty, especially for women and people in rural areas. It is indefensible that Africa's poorest people are paying among the world's highest prices for energy: a woman living in a village in northern Nigeria spends around 60 to 80 times per unit more for her energy than a resident of New York City or London. Changing this is a huge investment opportunity. Millions of energy-poor, disconnected Africans, who earn less than US$2.50 a day, already constitute a US$10-billion yearly energy market.

What would it take to expand power generation and finance energy for all? We estimate that investment of US$55 billion per year is needed until 2030 to meet demand and achieve universal access to electricity. One of the greatest barriers to the transformation of the power sector is the low level of tax collection and the failure of governments to build credible tax systems. Domestic taxes can cover almost half the financing gap in Sub-Saharan Africa. Redirecting US$21 billion spent on subsidies to wasteful utilities and kerosene to productive energy investment, social protection and targeted connectivity for the poor would show that governments are ready to do things differently. I urge African leaders to take that step.

Additional revenues can be mobilized by stemming the haemorrhage of finance lost through illicit financial transfers, narrowing opportunities for tax evasion and borrowing cautiously on bond markets. Aid must play a supportive, catalytic role. Global and African investment institutions already see the growth and revenue prospects of African infrastructure in a world where demand is slowing in developed countries.

Reforming energy utilities is also key. Long-term national interest must override short-term political gain, vested interests, corruption and political patronage. Energy-sector governance and financial transparency will help bring light in the darkness. Energy entrepreneurs can join the reformed utilities in investing revenues and energy funds in sustainable power that saves the planet and pays steady dividends. Some countries in the region are already at the front of the global trend of climate-resilient, low-carbon development, including Ethiopia, Ghana, Kenya, Nigeria and South Africa.

Better and more accessible energy can also power up Africa's agriculture. Governments should take advantage of "triple-win" adaptation opportunities that integrate social protection with climate-smart strategies to raise agricultural productivity and to develop rural infrastructure, including crop storage, agro-processing and transport, cutting poverty while strengthening international efforts to combat climate change.

Actions taken by African leaders are essential, and so are actions by the world.

The 2015 summits provide a platform for deepening international cooperation and providing a down-payment on measures with the potential to put Africa on a pathway towards an inclusive low-carbon energy future and the world on a pathway to avoid climate catastrophe. All countries stand to lose if we fail to achieve the international goal of restricting global warming to below 2°C above pre-industrial levels. Africa will lose the most.

Governments in the major emitting countries should place a stringent price on emissions of greenhouse gases by taxing them, instead of continuing effectively to subsidize them, for example by spending billions on subsidies for fossil-fuel exploration. The political power of multinational energy companies and other vested interest groups is still far too strong.

Unlocking Africa's energy potential and putting in place the foundations for a climate-resilient, low-carbon future will require ambitious, efficient and properly financed multilateral cooperation. As we show in this report, the current global climate finance architecture fails each of these credibility tests.

The window of opportunity for avoiding climate catastrophe is closing fast. The only promises that matter at the Paris climate summit are those that are kept. Africa's leaders must rise to the challenge. They are the voice of their citizens in the climate talks – and that voice must be heard. Social movements, business leaders, religious leaders of all faiths and the leaders of the world's cities can join governments and create an irresistible force for change to win the war against poverty and avert climate catastrophe.

Future generations will surely judge this generation of leaders not by principles they set out in communiqués but by what they actually do to eradicate poverty, build shared prosperity and protect our children and their children from climate disaster.

Let us act now and act together.

KOFI A. ANNAN
Chair of the Africa Progress Panel

OVERVIEW

"We can no longer tinker about the edges. We can no longer continue feeding our addiction to fossil fuels as if there were no tomorrow. For there will be no tomorrow. As a matter of urgency we must begin a global transition to a new safe energy economy. This requires fundamentally rethinking our economic systems, to put them on a sustainable and more equitable footing." Desmond Tutu, Human Rights activist and Nobel Prize winner

"Africa, too, has no choice other than join hands to adapt and mitigate the effects of climate change. However, Africa can make a choice on how it can adapt and mitigate and when it can do so in terms of timeframe and pace. For Africa, this is both a challenge and an opportunity. If Africa focuses on smart choices, it can win investments in the next few decades in climate resilient and low emission development pathways." H.E. Jakaya Mrisho Kikwete, President of the United Republic of Tanzania

2015 is a watershed year for international development. In September, global leaders will gather at the United Nations in New York to adopt a new set of sustainable development goals. Before then, in July, governments meet in Addis Ababa, Ethiopia, to agree on the financing framework that underpins the goals. At the end of the year, the summit spotlight will shift to Paris and the crucial negotiations on a new climate change agreement. The stakes could hardly be higher. The risks that will come with failure are immense. Yet this is a moment of great opportunity for the world and for Africa.

Energy is the link connecting the global poverty agenda and climate change. The carbon-intensive energy systems now driving economic growth are locked into a collision course with the ecological systems that define our planetary boundaries. Averting that collision – while eradicating poverty, building more inclusive societies and meeting the energy needs of the world's poorest countries and people – is the defining international cooperation challenge of the 21st century.

Nowhere are the threads connecting energy, climate and development more evident than in Africa. No region has made a smaller contribution to climate change. Yet Africa will pay the highest price for failure to avert a global climate catastrophe. Meanwhile, the region's energy systems are underpowered, inefficient and unequal. Energy deficits act as a brake on economic growth, job creation and poverty reduction, and they reinforce inequalities linked to wealth, gender and the rural-urban divide.

This year's *Africa Progress Report* explores the links between energy, poverty and climate change. We document the risks that would come with a business-as-usual approach. More important, we highlight the opportunities for African leaders both at home and on the world stage.

Energy policy is at the heart of the opportunity. For too long, Africa's leaders have been content to oversee highly centralized energy systems designed to benefit the rich and bypass the poor. Power utilities have been centres of political patronage and corruption. The time has come to revamp Africa's creaking energy infrastructure, while riding the wave of low-carbon innovation that is transforming energy systems around the world. Africa cannot afford to stand on the sidelines of the renewable energy revolution. It can play its part in this revolution and tackle the challenges of transitioning away from fossil fuels.

Low-carbon technologies can be rapidly deployed to expand power generation and to extend the reach of energy systems. With the right policies in place, low-carbon development can correct one of the world's greatest market failures. Millions of Africa's poorest people are paying among the world's highest prices for energy because of the cost barriers separating them from affordable, efficient and accessible renewable technologies. Removing that barrier would unlock market opportunities and unleash a productive power to reduce poverty and build inclusive societies that dwarfs what could be achieved through aid.

The message of this report is that Africa can lead the world on climate-resilient, low-carbon development. Some countries in the region are already doing so, and others should follow. Many of the policies needed to build more resilient societies that can cope with climate change are long overdue. Raising agricultural productivity, conserving land and forestry resources, and planning more sustainable cities would reduce vulnerability and drive down poverty. In each of these areas there would be significant global benefits for climate change through reduced greenhouse gas emissions. This is a triple-win scenario for economic growth, poverty reduction and climate.

In this report we emphasize Africa's leadership role.

This is not to downplay the critical importance of international cooperation. Keeping global warming below the 2°C threshold above pre-industrial levels demands collective action to address a shared threat. Similarly, unlocking Africa's energy potential and putting in place the foundations for a climate-resilient, low-carbon future will require ambitious, efficient and properly financed multilateral cooperation. As we show in this report, the current architecture fails each of these credibility tests.

Based on extensive consultations with African energy planners, climate negotiators, researchers and governments, this report sets out the Africa Progress Panel's perspective on the energy and climate challenges. It also provides an agenda for change and a call to action directed not just to Africa's leaders, but to the wider international community.

More power with equity - Africa's energy challenge

Universal access to energy systems that provide a reliable and adequate supply of power to homes, firms and service providers is a condition for sustained human development. Africa's energy systems are not fit for the purpose of supporting shared prosperity.

Despite 15 years of sustained economic growth, power shortages, restricted access to electricity and dependence on biomass for fuel are undermining efforts to reduce poverty. The energy gap between Africa and the rest of the world is widening. Fifteen years ago, per capita energy use in Sub-Saharan Africa was 30 per cent of the level in South Asia, now it is just 24 per cent and still falling.

Sub-Saharan Africa is desperately short of electricity. The region's grid has a power generation capacity of just 90 gigawatts (GW) and half of it is located in one country, South Africa. Electricity consumption in Spain exceeds that of the whole of Sub-Saharan Africa.

Excluding South Africa, consumption averages around 162 kilowatt-hours (kWh) per capita per year. This compares to a global average of 7,000 kWh.

It would take the average Tanzanian around eight years to consume as much electricity as an American uses in one month.

Average figures mask the extent of Africa's energy deficit. Two in every three people – around 621 million in total – have no access to electricity. In Nigeria, an oil-exporting superpower, 93 million people lack electricity. Angola has five times the average income level of Bangladesh but Bangladesh has far higher levels of access to electricity (55 per cent versus 35 per cent).

Access to clean, non-polluting cooking facilities is even more restricted. Almost four in five rely for cooking on solid biomass, mainly fuelwood and charcoal. As a result, 600,000 people in the region die each year of household air pollution. Almost half are children under 5.

The international community has set the goal of achieving universal access to modern energy by 2030. Sub-Saharan Africa is not on track to achieve that target. It is the only region in which the absolute number of people without access to modern energy is set to rise, by 45 million for electricity and 184 million for clean cooking stoves.

On current trends, it will take Africa until 2080 to achieve universal access to electricity. Universal access to clean cooking facilities would occur around 100 years later, sometime after the middle of the 22nd century.

The social, economic and human costs of Africa's energy crisis are insufficiently recognized. Energy-sector bottlenecks and power shortages cost the region 2-4 per cent of GDP annually, undermining job creation and investment. Companies in Tanzania and Ghana are losing 15 per cent of the value of sales as a result of power outages. Most of Africa's school children attend classes without access to electricity. In Burkina Faso, Cameroon, Malawi and Niger, over 80 per cent of primary schools lack access to electricity.

Governance of power utilities is at the heart of Africa's energy crisis. Governments often view utilities primarily as sites of political patronage and vehicles for corruption, providing affordable energy can be a distant secondary concern.

Far too much public finance is wasted on inefficient and inequitable energy subsidies. Governments spend US$21 billion a year covering utility losses and subsidising oil-based products, diverting resources from more productive energy investments.

Africa's poorest households are the unwitting victims of one of the world's starkest market failures. We estimate that the 138 million households comprising people living on less than US$2.50 a day are spending US$10 billion annually on energy-related products, such as charcoal, candles, kerosene and firewood. Translated into equivalent cost terms, these households spend around US$10/kWh on lighting, which is about 20 times the amount spent by high-income households with a connection to the grid for their lighting. The average cost for electricity per kWh in the United States is US$0.12 and in the United Kingdom is US$0.15.

The size of the market points to significant opportunities for investment and household savings. Halving costs would save US$5 billion for people living below US$2.50, or US$36 per household. Plausible price reductions of 80 per cent would raise these figures to US$8 billion overall and US$58 per household. Such savings could release income for investment in productive activities, health and education. We estimate that the monetary saving from cost reductions would be sufficient to reduce poverty by 16-26 million people.

What would it take to expand power generation and finance energy for all?

Current energy-sector investment levels are just US$8 billion a year, or 0.49 per cent of gross domestic product (GDP). This is inadequate. We estimate the investment financing gap for meeting demand and achieving universal access to electricity is around US$55 billion, or 3.4 per cent of Africa's GDP in 2013.

While this financing gap figure is large, it has to be placed in context. Energy financing is an investment with the potential to generate high social and economic returns by increasing productivity, job creation and economic growth.

Almost half of the gap could be covered by increasing Sub-Saharan Africa's tax-to-GDP ratio by 1 per cent of GDP. Additional revenues could be mobilized by halting the wasteful subsidies now transferred to loss-making utilities, stemming the finance lost as a result of illicit financial transfers, and cautious recourse to bond markets.

Aid can play a supportive, catalytic role. African governments themselves should mobilize around US$10 billion to expand on-grid and off-grid energy access. The international community should match this effort through US$10 billion in aid and concessional finance aimed at supporting investments that deliver energy access to populations that are being left behind.

Opportunity Africa

Africa's energy deficits stand in stark contrast to the region's potential.

Africa has abundant reserves of fossil fuels and an even greater abundance of renewable energy assets. Rising demand for energy makes it imperative for

policymakers to develop Africa's resources for Africa's needs, with less emphasis placed on the "three e" model of exploration, extraction and export.

Urbanization, population growth and economic growth are driving an increase in energy demand. Modelling by the International Energy Agency (IEA) suggests that electricity generation will need to increase by 4 per cent a year to 2040. The Africa Progress Panel regards this scenario as unambitious. Africa's per capita energy consumption would be one-third of the level in Thailand today. It would leave millions of Africans quite literally in the dark, with over 500 million people lacking access to electricity in 2040, a decade after the target date for universal access to energy. Such an outcome would be indefensible.

African governments need to set a higher level of ambition. Policies should aim at a 10-fold increase in power generation and universal access to energy by 2030. Countries such as Brazil, Thailand and Vietnam have demonstrated that, with sustained political leadership, these outcomes are attainable.

Renewable energy has a critical role to play. As highlighted by the Global Commission on Economy and Climate, headed by former Mexican president Felipe Calderón, the idea that countries face a choice between green energy and growth is increasingly anachronistic. Prices for renewable technologies, especially solar and wind-power, are falling at an extraordinary rate to the point at which they are competitive with fossil fuels.

From an African perspective, renewable technologies have two distinctive advantages: speed and decentralization. They can be deployed far more rapidly than coal-fired power plants and they can operate both on-grid and off-grid. In considering investment decisions today, Africa's governments should take every opportunity to lay the foundations for a low-carbon future, while recognizing that the transition away from existing high carbon infrastructure will take some time.

Africa's energy transformation

After decades of neglect, a powerful current of energy reform is sweeping across Africa.

Governments increasingly recognize that underpowered and unequal energy systems are a barrier to developing dynamic economies and more inclusive societies. While there is a long way to go and the record is mixed, the potential for a breakthrough in energy is increasingly evident.

Part of that potential is reflected in what some countries are already achieving. Since 2000, net electricity generation has increased by 4 per cent a year or more in 33 countries. Looking forward, the Africa Progress Panel has reviewed the energy plans of some 30 countries and most aim well beyond doubling capacity by 2020.

Financing for energy development is on the increase. African governments are investing more, albeit from a low base. Many are supplementing energy investments by turning to sovereign bond markets.

Domestic and foreign private investment is rising, reflecting a move towards liberalization. Nigeria has one of the world's largest and most ambitious energy-privatization plans.

Some 130 independent power providers (IPPs) are now operating across Sub-Saharan Africa. A new generation of private equity investors is also emerging. There were around 27 private equity investments in energy and natural resources, with an aggregate value of US$1.2 billion between 2010 and 2013.

International development finance has played a significant role in unlocking private investment. President Barack Obama's Power Africa initiative, which promises US$7 billion over five years, has acted as a focal point for a range of US agencies and the private sector. Energy cooperation between the European Union and Africa is deepening. The game-changer, though, is the emergence of China as a source of integrated project finance for large-scale energy projects.

Encouraging as these developments are, they fall short of a breakthrough. African governments are mobilizing insufficient resources through domestic revenues. Moreover, while recourse to bond markets offers some benefits, countries are incurring significant foreign-currency risks. International development finance is constrained by excessive fragmentation, high transaction costs and poor coordination. Looking ahead, the challenge is to scale up domestic resource mobilization and to secure access to long-term financing from pension funds and other institutional investors.

Sustained regulatory reform is critical for investment. Unbundling power generation, transmission and distribution is one step towards creating more efficient and stable energy markets. Independent regulation is another. But private investors require an energy buyer such as a utility or dedicated power-purchasing agency and it is hard to build a convincing business case when the main buyer is a highly-indebted, corrupt and inefficient utility.

Renewable energy – riding the wave of global innovation

Renewable energy is at the forefront of the changes sweeping Africa.

Hydropower continues to dominate the investment landscape. Countries as diverse as Ethiopia, Ghana, Kenya, Nigeria and South Africa are developing very large power-generation plants that use renewable energy. But the renewables revolution is also being driven from below, as innovative companies respond to household demand for lighting and power. On one estimate, 5 per cent of households in Sub-Saharan Africa now use some form of solar lighting, compared with 1 per cent in 2009.

New business models are emerging. One example comes from Kenya. M-KOPA has brought together solar and mobile technology to bring affordable solar technologies to off-grid villages. Customers pay a small deposit for a solar home system that would usually retail for US$200, including a solar panel, three ceiling lights, a radio and charging outlets for mobile phones. The balance is repaid in small instalments on a pay-as-you-use basis through M-PESA, a widely available mobile-payment platform that is used by a third of the population.

Some governments are partnering with the private sector to extend the reach of electricity. The Ignite Power project in Rwanda brings together several private companies, the government and philanthropic agencies. The project aims to install off-grid technology through a pre-paid system that can power four lights, radios and televisions, and charge cell phones.

Despite such compelling examples, progress remains far too slow. While poor households stand to save over time from adopting new technologies, the initial costs of solar panels are too high for many.

This is a classic market failure. Consumers, investors and the wider economy are losing out because of the absence of institutional mechanisms to link supply and demand. However, the market failure can be corrected through a combination of public policy action, business innovation and international cooperation.

Climate change – an opportunity for transformation

The risks associated with climate change in Africa are well established. High levels of background poverty, dependence on rainfall, weak infrastructure and limited provision of safety nets combine to make climate risk a major source of vulnerability, even without global warming. Climate justice demands international cooperation and basic human solidarity to contain these risks.

Viewed from a different perspective, climate change provides African governments with an added incentive to put in place policies that are long overdue and to demonstrate leadership on the international stage. Countries such as Ethiopia, Kenya and Rwanda have already developed climate-resilient development strategies aimed at reducing poverty, raising productivity and cutting greenhouse gas emissions.

From an African perspective two priorities stand out for the Paris climate summit in December 2015. The first is an ambitious deal that delivers on the commitment to keep global warming within the 2°C threshold. Second, the climate agreement must address the financing and capacity-building challenges that Africa faces in responding to the climate challenge.

Africa will be hit hard by climate change

Climate change will have local impacts in Africa but their timing and severity will be determined by global emissions.

The most severe and immediate effects will be felt by the rural poor. If global average temperatures are allowed to increase by 4°C, large areas used for cropping sorghum, millet and maize would become unviable. In some areas drought could become more protracted and severe. In other cases, productivity levels will be affected by unpredictable rainfall, increased temperature and flooding.

The Fifth Assessment of the Intergovernmental Panel on Climate Change (IPCC) identifies Africa as the region at greatest risk from global warming. Regional heating will exceed

the global average. While climate modelling does not provide cast-iron predictions, it does point to high levels of risk in many areas. Rising sea levels could threaten coastal cities such as Accra, Dar es Salaam and Lagos. Hydropower systems could be compromised by reduced rainfall and increased evaporation. New health threats could emerge. In each of these areas, the poor will bear the brunt.

Seizing the opportunity – land use and transformative adaptation

The severity and immediacy of the risks posed by climate change have deflected attention from opportunities to build more climate-resilient approaches to development.

These approaches offer "triple-win" benefits: boosting agricultural productivity, reducing poverty and strengthening international efforts to combat climate change.

Land use should be a focal point for strategies aimed at unlocking these benefits. Much of African agriculture is locked in a vicious circle of low productivity, poverty and environmental degradation. Around 2 million hectares of forest were lost annually between 2000 and 2010.

Changes in agriculture, forestry and land-use patterns are responsible for emissions equivalent to 10 - 12 gigatonnes (Gt) of carbon dioxide (CO_2), around one-quarter of the global total. Africa accounts for around 20 per cent of these emissions. While the region may account for a small share of overall greenhouse gas emissions, the region's emissions from agriculture, forestry and land-use changes are growing at 1-2 per cent a year. Such changes account for about half of Africa's emissions – and the share is rising.

Reversing the vicious circle of low productivity, environmental degradation and climate change has the potential to unlock far-reaching benefits. One of the most striking examples comes from Niger, where smallholder farmers have transformed the productivity and sustainability of agriculture across 5 million hectares of land.

As shown in last year's *Africa Progress Report*, African governments could also do far more to reduce vulnerability and raise productivity through wider measures. Investment in rural infrastructure, social protection and developing new seeds, allied with greater financial inclusion and the promotion of regional trade, could do far more to enhance climate resilience than the current proliferation of small-scale adaptation projects.

The dangerous gap between international policy commitments and actions

The Paris climate summit provides an opportunity to negotiate an agreement that will deliver on the commitment to keep the 21st century's global average temperature increase within 2°C.

There have been some encouraging signs. Over the past year the world's largest emitters, which are China, the European Union and the United States, have all pledged more decisive action to cut emissions. Governments have also agreed to table their proposed actions – or Intended Nationally Determined Contributions (INDCs) – before the summit.

On a less positive note, the pledges that have been made leave the world far from a viable trajectory for meeting the 2°C commitment. The most credible scientific evidence estimates that the world is on a pathway that will lead to 4°C warming over the course of the 21st century. Such an outcome would have catastrophic consequences for Sub-Saharan Africa. Averting that outcome should be at the heart of every African government's climate diplomacy.

Despite the known threats, far too many countries are failing to take decisive action. Several countries including Australia and Canada appear to have withdrawn entirely from constructive international engagement on climate. Others have adopted contradictory policy stances. The US$88 billion spent by G20 countries on subsidies for the discovery and exploitation of new fossil fuels is one example. To avoid catastrophic climate change, two-thirds of existing reserves have to be left in the ground, begging the question of why taxpayers' money is being used to discover new reserves of "unburnable" hydrocarbons.

Governments in the major emitting countries should be placing a stringent price on emissions of greenhouse gases geared towards a credible carbon budget. Instead of taxing emissions for the global public good, they are effectively subsidising them. While many factors are at play, the political power of multinational energy companies and other vested interest groups weighs far too heavily in the decision-making processes of many governments.

Securing a better deal for Africa

The INDCs provide African governments with a vehicle to set out their ambition for the transition to a growth-oriented, climate-resilient, low-carbon development model.

Building on existing energy and land-use strategies, the submissions could go beyond outlining what countries are doing now to identify what could be done through deeper international cooperation on financing, technology and capacity development.

Africa's governments should also use the 2015 financing and climate summits to press for wider reforms. Climate finance is a starting point. On one estimate, there are now 50 climate funds in operation under a fragmented patchwork of mechanisms with a total financing pool of around US$25 billion.

Sub-Saharan Africa has not been well served by this elaborate international climate financing architecture. Over the three financial years 2010–2012, just US$3.7 billion was provided in "fast-start" finance. Not all of this represents new and additional aid, some may have been diverted from other projects.

Detailed analysis of financial transfers points to two structural weaknesses in the climate-finance architecture: chronic under-financing and fragmentation. Both weaknesses are apparent in the financing offered for adaptation measures. Detailed costing exercises carried out by the United Nations Environment Programme (UNEP) put annual adaptation financing requirements at around US$11 billion through to 2020. Average annual aid financing amounts to around 5 per cent at this amount.

When it comes to international climate finance for efforts to mitigate climate change by reducing emissions, Sub-Saharan Africa is picking up the small change. Nigeria and South Africa are the only countries to have received support from the Clean Technology Fund. A larger group of low-income countries in Sub-Saharan Africa have received pledges of support to develop solar, wind and geothermal power. However, as of February 2015, only Ethiopia, Kenya and Mali had received financing.

Recommendations

The Africa Progress Panel's recommendations identify a range of practical measures for expanding power generation, accelerating progress towards universal access to energy, and supporting low-carbon development. They also set out an agenda for the Paris climate summit, linking international action to African strategies for climate-resilient development.

Many of the specific proposals are directed to African governments. In the absence of ambitious African leadership, opportunities for an energy transformation will be wasted. By the same token, without strengthened international cooperation the opportunities available will be only partially exploited. The 2015 summits provide a platform for deepening international cooperation, setting a course that avoids climate disaster and delivering a down-payment on measures with the potential to put Africa on a pathway towards future powered by inclusive low-carbon energy.

Core recommendations for African governments:

Raise the ambition of Africa's energy strategies. Governments should aim at a 10-fold increase in power generation by 2040, while laying the foundations for a low-carbon transition. Public spending on energy should be raised to 3-4 per cent of gross domestic product (GDP), supported by measures aimed at raising the tax-to-GDP ratio and avoiding excessive reliance on bond markets. Given the US$55 billion per annum gap in energy financing, governments should prioritize the development of balanced public-private partnerships and create the conditions for expanded private investment. Governments should look beyond national borders to accelerate the development of regional grids.

Seize the low carbon opportunity. Governments should strengthen the market for low-carbon energy through predictable off-take arrangements, utility purchase arrangements, feed-in tariffs and auctions. Recognising that the initial capital costs of renewable energy investment can be prohibitive, governments and regulators should seek to reduce risks and support the development of the market through appropriately subsidized loans.

Leave no one behind. Africa's energy systems combine inequity with inefficiency. They provide subsidized electricity for the wealthy, unreliable power supplies for firms and very little for the poor. National strategies should act on the commitment to achieve universal access to energy by 2030, which means providing access for an additional 645 million people through connections to the grid or decentralized mini-grid or off-grid provision. Every government should map the populations that lack access and

identify the most effective routes for delivery. Better and more accessible energy can also power up Africa's agriculture. Governments should work with the private sector to develop the innovative business models needed to deliver affordable energy to the US$10 billion market of people who live on incomes of less than US$2.50 a day.

Cut the pro-rich subsidies. National strategies should include a roadmap and schedule for phasing out the US$21 billion in energy subsidies geared towards the rich. Subsidizing connections for the poor is more efficient and equitable than subsidizing energy consumption by the rich and subsidizing kerosene is of limited value as a tool for achieving universal access.

Deepen reform of energy governance. Governments across the region need to step up the pace of reform. Unbundling power generation, transmission and distribution is a starting point. But effective governance also requires the creation of robust, independent regulatory bodies empowered to hold utilities to account. Utilities themselves should be required to publish the terms of all off-take arrangements and emergency power-purchase agreements and they should prohibit tendering through offshore listed companies. While encouraging legislation has been introduced, the record on implementation is patchy. Establishing predictable off-take agreements is critical for attracting high-quality, long-term investment.

Adopt new models of planned urbanization. As the world's most rapidly urbanizing region, Africa has opportunities to develop more compact, less polluted cities, alongside safer and more efficient public transport systems. Economies of scale and rising urban incomes have the potential to expand opportunities for providing renewable energy and achieving universal access to basic services. Linking African cities to the growing range of global city networks, including the "C40" group of cities, could unlock new opportunities for knowledge exchange, capacity building and financing. Governments, multilateral agencies and aid donors should work together to strengthen the creditworthiness of cities, while developing innovative partnerships for clean energy.

Develop and act upon an African strategy for the Paris climate summit. The African Common Positions developed by the African Group of Negotiators (AGN) and endorsed by the African Ministerial Conference on the Environment (AMCEN) provide the basis for a strong set of demands that African countries can take to Paris. However, governments have often failed to act upon their collective commitments. Given the power asymmetry in the climate negotiations, this is not in the best interests of Africa's citizens. With one voice, Africa's governments should:

- Reject greenhouse-gas reduction commitments from rich countries and emerging markets that are not aligned with the 2°C commitment.
- Demand that rich countries set a course for zero net emissions by 2050, going further than envisaged in the current proposals of the European Union and the United States.
- Urge Australia, Canada and Japan to adopt a more credible and constructive stance on their climate offers.
- Request that China raises the level of ambition by bringing forward the proposed date for peak emissions.

- Demand increased support for climate-resilient development and transformative adaptation, along with a fundamental overhaul of the current multilateral adaptation finance system.

Engage fully in negotiations on the Intended Nationally Determined Contributions (INDCs). Many African governments have been reluctant to engage in the INDC process in the light of Africa's limited contribution to greenhouse gas emissions. However, the INDCs provide an opportunity to set out policies that could promote growth and reduce poverty in Africa, while limiting global greenhouse gas emissions. The INDCs could be used to identify opportunities for international cooperation, linked to additional financing. To cite some examples:

- Eliminate within five years of gas flaring, which is a potent source of global warming and a waste of Africa's energy resources.
- Identify opportunities for combating soil erosion, conserving land, avoiding deforestation and restoring degraded forests and land.
- Highlight current actions aimed at reducing greenhouse gas emissions and the costs of reducing future emissions by scaling up renewable energy.

Proposals for action by the international community:

Create a "global connectivity fund" under the auspices of the Sustainable Energy for All (SE4All) partnership. The SE4ALL remit includes supporting universal access to energy and increasing the share of renewables in the energy mix but it lacks a bridge to financing mechanisms. Universal access costs are estimated at US$20 billion annually to 2030. These costs could be co-financed by African governments and the wider international community in the form of concessional development finance, supplemented by aid. The SE4All governance framework would be reformed to require governments to submit comprehensive national action plans setting out strategies for universal access, with an understanding that credible plans will secure an appropriate mix of financing for their implementation. SE4All financing would help support innovative business models delivering affordable off-grid energy through risk and credit guarantees, subsidized loans and electricity-purchase agreements.

Unlock private finance. Development finance could play a more catalytic role through increased risk-guarantee provisions and strengthened coordination between international financial institutions, development finance agencies and bilateral donors. The World Bank and African Development Bank (AfDB) should lead an international effort to unbundle risk, structure guarantees and align Africa's risk premium with market realities. The exercise should aim also at reducing the transaction costs associated with financing energy projects. Risk instruments such as the World Bank's Multilateral Investment Guarantee Agency (MIGA) and foreign-currency risk mechanisms should be scaled up.

Strengthen the role of AfDB and World Bank financing. Development finance agencies, the World Bank and donors should commit US$10 billion to the capitalization of the Africa '50' Fund of AfDB, which has the potential to leverage up to US$100 billion in private finance.

More African governments should be drawing on the World Bank's non-concessional borrowing windows, taking advantage of low interest rates to finance energy infrastructure.

Overhaul the climate finance architecture: Africa is poorly served by the current climate-finance architecture. The separate multilateral agencies offering facilities to support adaptation should be merged into a single Transformative Adaptation Facility, perhaps under the auspices of the Green Climate Fund. Facilities for mitigation finance and support mechanisms for low-carbon development – notably the Clean Technology Fund and the Scaling Up Renewable Energy in Low Income Countries Programme – should be structured to be more responsive to Africa's mitigation potential and the opportunities to back low-carbon development. The broader concern is that the increasingly fragmented global financing architecture is doing little to provide strategic direction in leveraging private investment.

Demonstrate serious intent at the Addis Ababa Financing for Development Summit in July 2015: The summit provides an opportunity to make a down-payment on strengthened international cooperation and build a bridge to the Paris climate summit:

- Aid donors should commit to the longstanding target of devoting 0.7 per cent of gross national income (GNI) to aid.
- Rich countries should set a clear timetable for delivering by 2020 the outstanding US$70 billion per annum in climate finance, which they committed to in Copenhagen, with greater transparency on financial commitments, the identification of new sources of finance and delivery mechanisms.
- A US$15 billion annual commitment to climate-resilient development in Africa, including financing for a transformative adaptation.
- Increase by US$10 billion the development finance available to Sub-Saharan Africa for mitigation through the Clean Technology Fund, Green Climate Fund and other mechanisms.
- Increase the capitalization of the Green Climate Fund to US$20 billion, subject to stringent performance requirements.

Phase out fossil fuel subsidies: The three 2015 summits should aim at a comprehensive phase-out of all fossil fuel subsidies by 2025, with appropriate support for low-income countries. Eliminating subsidies for fossil-fuel exploration and production – especially coal – should be a priority. Developed countries should withdraw by 2018 all tax concessions, royalty relief and fiscal transfers, and all state aid to fossil-fuel industries by 2020. The G20 countries should set a timetable for acting on their commitment to phase out fossil-fuel subsidies, with early action on coal.

Raise the level of ambition at the Paris climate summit: Developed countries should establish carbon budgets aimed at zero net emissions by 2050, with clear interim benchmarks to 2030. The European Union and the United States should revise their initial INDC offers in line with this commitment. Countries should move towards early implementation of credible carbon pricing and taxation systems, linked to carbon budgets.

Redouble efforts to combat tax evasion: In 2012, Africa lost US$69 billion from illicit financial flows. G8 and G20 countries must act on past commitments to strengthen tax-disclosure requirements, prevent the creation of shell companies and counteract money laundering. Implementation of the G20/OECD's planned actions on base erosion and profit shifting should be accelerated; and the international community should support African efforts to strengthen tax and customs administration and reduce illicit financial outflows, especially via trade misinvoicing. Other priority actions to mitigate illicit financial flows include public registries of beneficial ownership of companies and, with the assistance of the IMF, agreeing on how to define, measure and track such flows, especially trade misinvoicing.

For private investors and multinational companies:

Demand an ambitious Paris climate agreement: The business community should work with cities, municipal and regional authorities, civil-society organizations and governments to demand an ambitious Paris climate agreement, backed by carbon pricing and taxation. All companies should establish and publish a "shadow price" for carbon in their company accounts.

Accelerate the exit from carbon through divestment: Institutional investors should urgently review their portfolios with a view to progressively eliminating carbon-intensive assets, starting with equity stakes in coal. Regulatory authorities, investors and stock exchanges should require companies and institutional investors to fully disclose the carbon exposure of their assets. The World Business Council on Sustainable Development should review and report upon the misleading claims made by multinational mining companies with respect to the benefits of coal for reducing poverty.

Engage with governments to identify the conditions for increasing investment in energy-sector infrastructure and lead the development of new low-carbon energy partnerships.

Drive innovation for greater access: Energy investors should develop innovative business models aimed at lowering market-entry costs for electricity and the costs of efficient cooking-stoves. Working with governments, banks and aid donors, they should seek to broaden and deepen emerging mechanisms, such as pay-as-you-go financing, mobile payments, extended repayment periods and low-interest credit, to serve the "bottom of the pyramid" market. Given the limited ability of poor households to meet maintenance costs, governments should link public support to the provision of post-installation servicing.

Stop the secrecy: Foreign investors and African companies should provide full disclosure of their beneficial ownership structures and report transparently on energy-related contracts, including electricity off-take arrangements. Multinational corporations must also recognise that the tax and transparency revolution continues to move ahead at a rapid pace. New G20/OECD reporting standards for multinational companies will require companies to report on their activities more transparently. Companies that keep up with the pace of change are more likely to be able to influence the changes.

INTRODUCTION

"It always seems impossible until it's done," Nelson Mandela once said. He was reflecting on the struggle to overturn apartheid, but his words have a powerful resonance in 2015. This year global leaders will settle on a new set of sustainable development goals, hold a summit on financing for those goals and frame an agreement on climate change. The challenges are immense. To eradicate poverty, create jobs and sustain growth while limiting greenhouse gas emissions, we must fundamentally realign the energy systems that drive our economies with the ecological systems that define our planetary boundaries. The consequences if we fail are beyond estimation. Yet alongside the risks this is a moment of great opportunity for Africa and the world.

"The Africa Progress Panel Report highlights very important continent-wide energy issues that must be solved if all African countries must benefit from their potential."

H.E. Ellen Johnson Sirleaf, President of Liberia

Low-carbon energy systems are at the heart of the opportunity. Climate change raises immensely complex financial, technological and political problems, all of which point towards a single solution. Over the next few decades, governments have to break the link between economic growth and greenhouse gas emissions. Making the transition to a low-carbon future is an imperative for the well-being of future generations. It is also an opportunity to develop green energy strategies that can underpin growth, job creation and shared prosperity.

African leaders have rightly highlighted the immense risks associated with climate change, but insufficient attention has been directed to the opportunities. No region has more abundant or less exploited low-carbon energy resources. Harnessed to the right strategies, these resources could resolve two of the most critical development challenges facing Africa: power generation and connectivity. Renewable energy could do for electricity what the mobile phone did for telecommunications: provide millions of households with access to a technology that creates new opportunities **(See infographic: The energy leapfrog)**.

Some countries in the region are emerging as global leaders in climate-resilient, low-carbon development. The world as a whole stands to gain from Africa avoiding the carbon-intensive pathway that has been followed by today's rich countries, China, India and other emerging markets. Policies to advance climate-resilient, low-carbon development are first and foremost the right policies for Africa. Increased agricultural productivity, land conservation, the development of renewable energy and low-carbon transport systems have the potential not only to reduce future greenhouse gas emissions, but also to reduce poverty, support economic growth and improve people's lives.

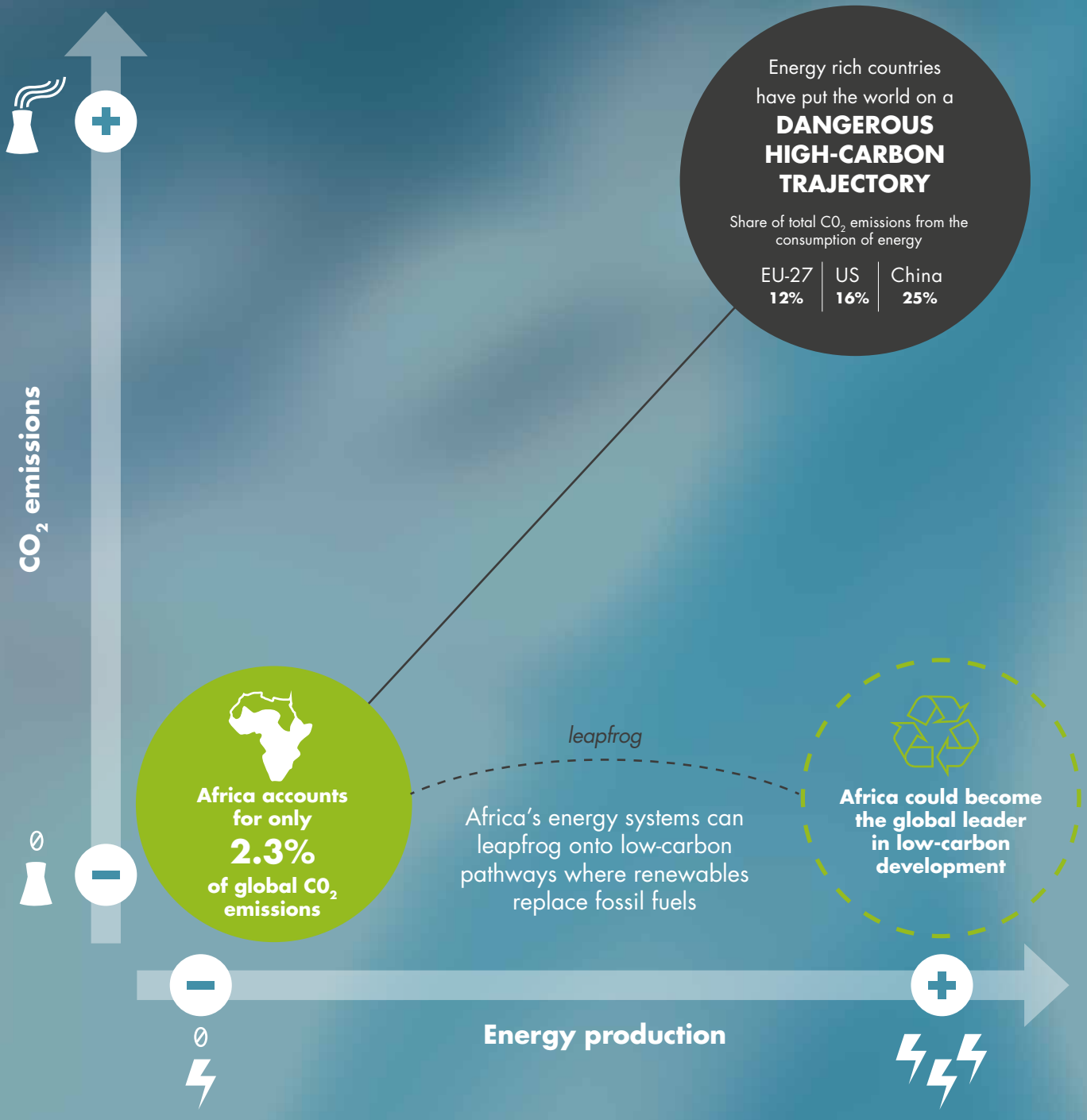
Energy provides the link between climate action and efforts to reduce poverty. Dependence on biomass for fuel contributes to land degradation and loss of forestry resources. The energy crisis is part of a vicious circle that is jeopardizing Africa's prospects for eradicating poverty and achieving the Sustainable Development Goals that are to be agreed this September.

Climate risks reinforce the vicious circle. Africa has made the smallest contribution to global warming but it is experiencing the earliest and most damaging impacts of climate change. Governments around the world have pledged to limit global warming to less than 2°C

THE ENERGY LEAPFROG

African countries need energy strategies that drive growth, and reduce energy poverty, while transitioning to a low-carbon economy

With the region experiencing some of the earliest, most severe and damaging climate impacts, African leaders have every reason to support international efforts to limit greenhouse gas emissions



above pre-industrial levels. Delivering on that pledge will require concerted action. We are currently on a trajectory that will raise average temperatures by 4°C and set the scene for unprecedented reversals in human development in the second half of the 21st century.

So great are the energy challenges and so severe the climate risks that it is easy to lose sight of the opportunities.

So great are the energy challenges and so severe the climate risks that it is easy to lose sight of the opportunities. Increasing power generation and accelerating progress towards energy for all could transform productivity in agriculture and industry, driving growth and creating jobs. Providing every African household with access to affordable electricity and clean cooking facilities would boost efforts to reduce poverty and create new market opportunities for investment.

These are not idle ambitions. The Global Commission on Economy and Climate, headed by Felipe Calderón, the former president of Mexico, has documented the potential that renewable technologies could unleash. The world is on the cusp of a green energy revolution. Africa has some of the world's most abundant and least utilized renewable energy assets and is well placed to join that revolution. Through the African Union Assembly, governments have pledged their political will at the highest level to accelerating the deployment of renewable energy. The focus now is on the honouring of commitments. We have not yet built two-thirds of the energy infrastructure that will be in operation by 2030 and investment decisions made today could lay the foundations for a competitive low-carbon energy system.

The idea that countries in Africa have to choose between low-carbon development and economic growth is becoming increasingly anachronistic. Making the early investments needed to support a low-carbon transition has the potential to boost growth and expand power generation. However, realism is required. Recommendations that Africa abandon fossil fuels in favour of a leap into renewable energy are unrealistic. Fuels such as coal will represent a shrinking share of the region's energy portfolio. The smart money for the future is on natural gas and green-energy sources. But African governments are rightly concerned by the double standards of some aid donors and environmental groups who, having conspicuously failed to decarbonize their own energy systems, are urging Africa to go green at an implausibly rapid rate.

An energy revolution is already under way. In this report we document the extraordinary changes taking place. Utilities are being reformed, independent power providers have emerged as a dynamic new force and companies have developed innovative new business models to reach people who are not yet connected. Renewable energy sources are bringing light to rural communities living far beyond the grid. Planned urbanization could take the energy revolution to the next level through investment in low-carbon transport and energy provision.

The reforms need to be deepened. As a priority, governments should be converting the US$21 billion wasted annually on energy subsidies into productive investment. They should also be attaching far more weight to equity, giving everyone an equal opportunity to obtain energy. Africa's energy systems have been designed and operated to provide subsidized power to small, predominantly urban elites, with scant regard for the poor. Unequal access to energy has reinforced the wider inequalities linked to wealth, gender and the rural-urban divide that have accompanied the economic growth of the past 15 years. Yet here, too, there are encouraging signs of change.

As well as posing risks, climate change provides Africa with opportunities to play a global leadership role. Several countries are pioneering climate-resilient growth strategies that hold out the prospect for "triple-win" scenarios. To take one example, explored in more detail in the report, restoring degraded land and preventing deforestation could increase agricultural productivity, cut poverty and reduce Africa's contribution to global warming. One-fifth of global emissions associated with land-use changes originate in Africa and cutting these emissions is vital to international efforts aimed at avoiding dangerous climate change.

Responsibility for seizing the opportunities associated with energy and climate rests primarily with African governments. These governments will be answerable to their citizens – and to future generations – for the decisions they make at this critical juncture. This report, which is based on extensive discussions with energy planners and climate negotiators, sets out what the Africa Progress Panel sees as some of the priorities for national governments.

National responsibility does not detract from the critical role of international cooperation. The summits planned for 2015 provide opportunities for Africa and the world to forge new partnerships. In September, global leaders will gather at a UN summit to agree on a set of Sustainable Development Goals (SDGs). Before that, in July, governments will meet at the third International Conference on Financing for Development in Addis Ababa, Ethiopia, to set out a comprehensive financing framework for the goals. The global climate negotiations in Paris at the end of the year are charged with framing a successor to the Kyoto Protocol and a multilateral agreement for avoiding dangerous climate change.

Each of these agendas is intertwined with the others. Agreeing to an ambitious set of SDGs without putting in place an appropriate financing strategy is a prescription for failure. Similarly, adopting bold targets on climate change without strategies for financing the necessary low-carbon infrastructure will lead to failure. Conversely, success at the Addis Ababa summit could set the scene for a breakthrough at the Paris climate summit.

Effective international cooperation will transform what is possible in Africa. Increased support for investment in renewable energy and more sustainable land use could greatly expand the scope for development of low-carbon energy, forest conservation and the restoration of degraded land. Reforming a hopelessly fragmented, underfinanced and poorly governed set of climate-finance institutions could enhance Africa's prospects for managing climate risk and delivering energy for all.

International cooperation is a two-way street. African governments are approaching the 2015 summits and wider dialogue on energy and climate with a clear agenda that reflects the region's capacity for leadership. Now, as never before, Africa must be part of an international community that delivers multilateral solutions to shared global problems. The Common African Position on the Post 2015 Development Agenda provides a useful basis for this engagement.[1] It is time to move the debate on Africa and international cooperation well beyond the restrictive confines of aid.

Confronted by challenges of the magnitude of those associated with Africa's energy crisis and climate change, it is easy to slip into fatalism. Yet fatalism is a luxury that Africa and the world cannot afford. The tasks ahead are daunting. Turning the principles of sustainable development into practical national policies and multilateral cooperation may seem impossible.

But it always seems impossible until it's done.

As well as posing risks, climate change provides Africa with opportunities to play a global leadership role. Now, as never before, Africa must be part of an international community that delivers multilateral solutions to shared global problems. It is time to move the debate on Africa and international cooperation well beyond the restrictive confines of aid.

01

POWER TO THE PEOPLE

AFRICA'S ENERGY IMPERATIVE

"We shall make electric light so cheap that only the wealthy can afford to burn candles," said **Thomas Edison**, inventor of the light bulb, one of the breakthrough technologies that unlocked the transformative power of energy for human development. That was in the last quarter of the 19th century.

Today, in the first quarter of the 21st century, most Africans have yet to experience the benefits of modern energy, including the light bulb. Viewed from the world's most affluent countries, it is easy to lose sight of the role that energy has played in development.[2] Affordable and reliable electricity underpins every aspect of social and economic life.

Countries that are able to meet the energy needs of their citizens are wealthier, more resilient and better able to advance human development. It is no coincidence that power generation, access to energy, wealth and human development are closely associated. While there is no single pathway to the high-energy systems that undergird development, universal access to affordable energy in sufficient quantities should be at the centre of any agenda for economic transformation, human development, justice and dignity.

The energy imperative is increasingly recognized.[3] The UN Secretary General's Sustainable Energy for All (SE4All) initiative, launched in 2011, sets a target of universal access to energy by 2030, with a doubling of the share of renewables in the global energy mix. African energy ministers endorsed that target in 2012 **(Box 1)**. The post-2015 Sustainable Development Goals (SDGs) have now put energy on the wider international development agenda, targeting "universal access to affordable, reliable, sustainable and modern energy services", as Goal 7, by 2030.[4]

Africa is far from being on track to achieve this goal. While there are marked variations across countries, the overall region has an energy crisis that demands urgent political attention. According to the International Energy Agency (IEA), 645 million Africans could still lack access to electricity in 2030. Underpinning this gloomy prognosis is a set of widely held assumptions captured in a report on African energy prospects by the

BOX 1 SUSTAINABLE ENERGY FOR ALL – A FRAMEWORK FOR ACTION

Launched in 2011 by UN Secretary General Ban Ki-moon, the SE4All by 2030 initiative has the potential to become a game changer for Africa. The initiative aims at supporting national governments and developing public–private partnerships on clean energy in a range of action areas, including grid infrastructure, large-scale renewable power, mini-grid and micro-grid solutions, transport and clean-cooking. Underpinning the SE4All framework are four 'enabling' interventions: energy planning for high-impact opportunities, business model innovation, finance and risk management, and capacity-building.

Some 42 Sub-Saharan African countries are members of SE4All. Around 20 countries have carried out national assessments to identify opportunities for renewable energy development. The SE4All partnership was instrumental in securing a Sustainable Development Goal (SDG 7) on energy, backed by a target for 2030, "to ensure universal access to affordable, reliable, and modern energy services" through enhanced national action and international cooperation. Increasing the share of renewable energy in national grids is an integral part of the SDG pledge.[5]

McKinsey Global Institute: "Reaching the target of sustainable energy for all – universal access – by 2030 is unlikely, given availability of financing, political will, and the sheer magnitude of effort required."[6]

While recognizing the evidence for such pessimism, the Africa Progress Panel categorically rejects this conclusion. Financing and political will are not fixed parameters. Many countries, including Brazil, Indonesia, Thailand and Vietnam, have demonstrated that it is possible to accelerate progress towards universal energy access.[7] In Africa, countries as varied as Ethiopia, Ghana, Kenya, Rwanda and South Africa are showing that rapid advances are achievable, with political leadership. The AfDB is also more sanguine, noting that around half of the needed finance is already available.[8] The bottom line is that Africa cannot afford a low level of ambition.

With effective leadership, Africa's governments can create a virtuous circle of increased energy access, rising incomes and a more equitable distribution of opportunity.

Restricted access to energy is at the heart of concerns over equity raised in earlier *Africa Progress Reports*. Over the past 15 years, Africa has moved into the fast lane of global economic growth but that growth has often failed to reduce poverty, create jobs and improve people's lives. High levels of inequality are part of the problem and unequal access to energy has reinforced the deep social divides between rich and poor, and between urban and rural areas.

Africa cannot afford a low level of ambition.

The Africa Progress Panel views the advancement of universal access to energy as a core responsibility for every government in Africa. Only the public sector can mobilize resources on the necessary scale, provide an effective legislative framework and create the conditions under which private investment can play a role in financing energy infrastructure. With effective leadership, Africa's governments can create a virtuous circle of increased energy access, rising incomes and a more equitable distribution of opportunity.

This part of the report is divided into three sections:

- Disconnected Africa looks at the scale of current energy deficits and their social, economic and human consequences. It concludes by examining prospects for achieving the goal of energy for all by 2030.
- Opportunity Africa maps the region's vast untapped potential for generating affordable energy. It also looks at positive examples of what is going on in Africa, including emerging delivery and financing models.

- **Africa's energy transformation** highlights the wave of investment, innovation and reform that is reshaping energy policy across the region.

DISCONNECTED AFRICA

In September 2015, governments from Africa will gather with the rest of the international community at the United Nations to adopt the Sustainable Development Goals (SDGs), a new set of international development targets. These ambitious targets include eradicating poverty, eliminating avoidable child deaths, universal secondary education, more inclusive growth, gender equity and sustainable land-use. Africa's energy deficits could hold back progress in all of these areas.

Mind the gap – the energy deficit is large, and growing

Distance from the goal of energy for all can be measured by looking at: how much power generation **capacity** there is, how much power people use **(consumption)** and whether people can actually obtain electricity and modern fuels **(access)**. Whatever the measure, Africa is the world's most energy-deficient region.

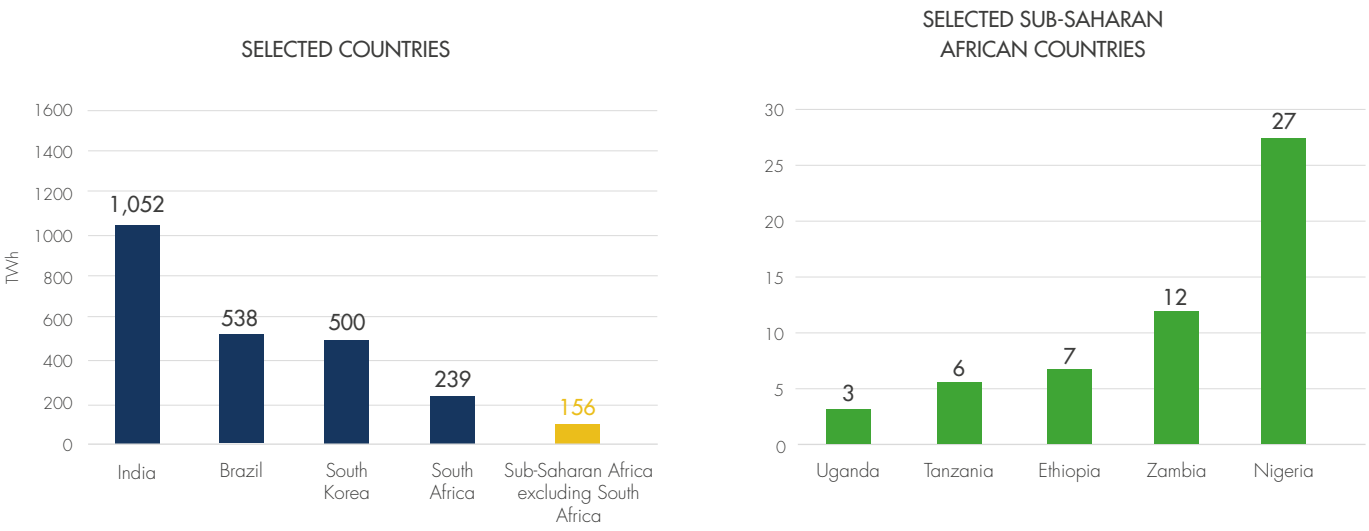
Sub-Saharan Africa is desperately short of electricity. Installed grid-based **capacity** is around 90 gigawatts (GW), which is less than the capacity in South Korea where the population is only 5 per cent that of Sub-Saharan Africa. Moreover, South Africa alone accounts for around half of power-generation capacity. With 12 per cent of the world's population, the region accounts for 1.8 per cent of world capacity for generating electricity and the share is shrinking.[9]

Installed capacity figures understate Africa's energy deficit. At any one time, as much as one-quarter of that capacity is not operational. In terms of real output, South Korea generates over three times as much electricity as Sub-Saharan Africa **(Figure 1)**. As such comparisons suggest, most of the region's grids operate on a very small scale. Around 30 countries in the region have grid-connected power systems smaller than 500 megawatts (MW), while another 13 have systems smaller than 100MW. For purposes of comparison, a single large-scale power plant in the United Kingdom generates 2,000MW.

It is not just comparisons with the rich world that highlight the gap. Nigeria has almost twice as many people as Vietnam but generates less than one-quarter of the electricity that Vietnam generates. The disparity within Africa is equally marked. South Africa consumes nine times more energy than Nigeria, despite having just one-third of the population **(Figure 2)**.

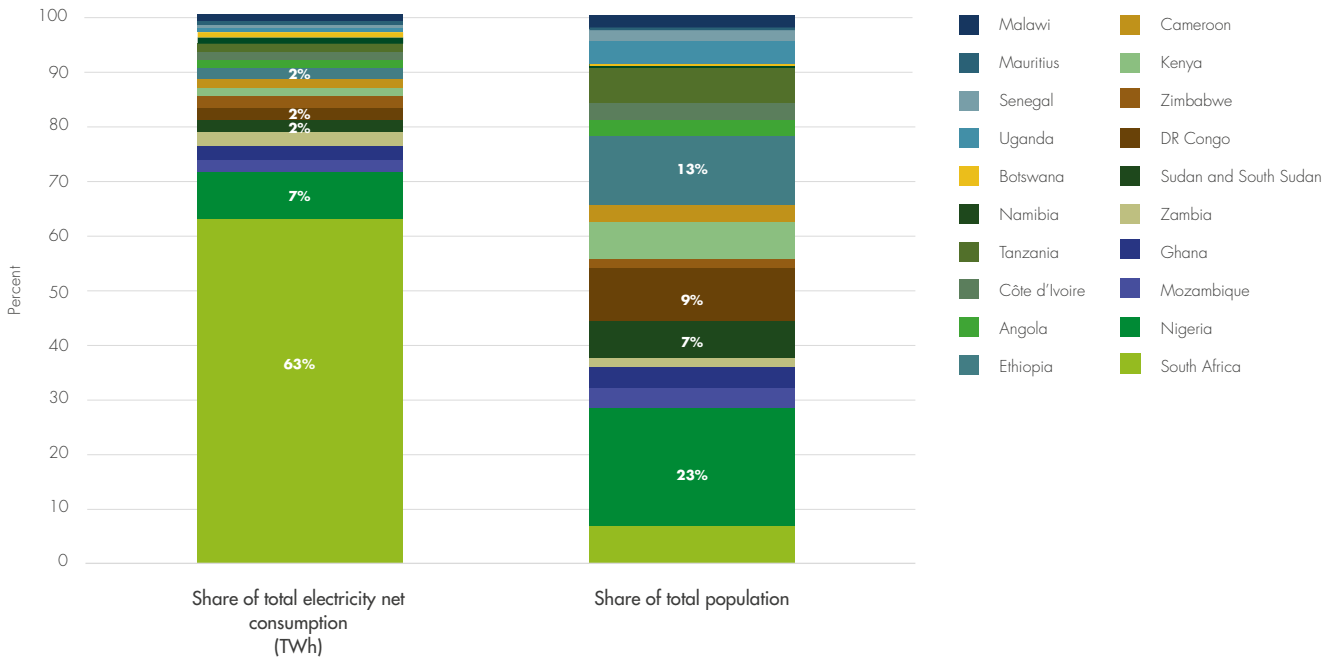
In marked contrast to other developing regions and emerging markets, strong economic growth has not led to an energy transformation **(Figure 3 and Figure 4)**. Over the past 10 years, Sub-Saharan Africa's GDP has increased by 5 per cent to 6 per cent annually. The tide of wealth is rising but per capita use of electricity has stagnated. Nigeria has outperformed India on economic growth and produces almost as much economic output per person. Yet India's consumption per capita remains significantly higher than that of Nigeria.

FIGURE 1 THE ELECTRICITY GAP: TOTAL ELECTRICITY NET GENERATION



Data source: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Generation.

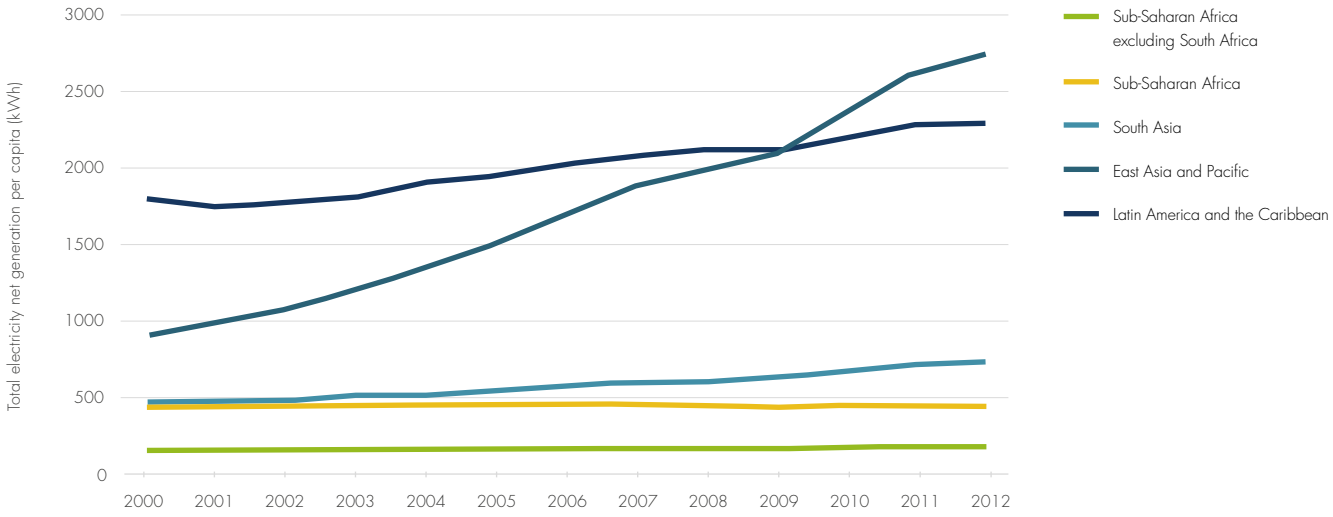
FIGURE 2 UNEQUAL SHARES: SUB-SAHARAN AFRICA'S GRID IS DOMINATED BY SOUTH AFRICA



Data sources: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Consumption. The World Bank Group. (2012). World Development Indicators: Population.

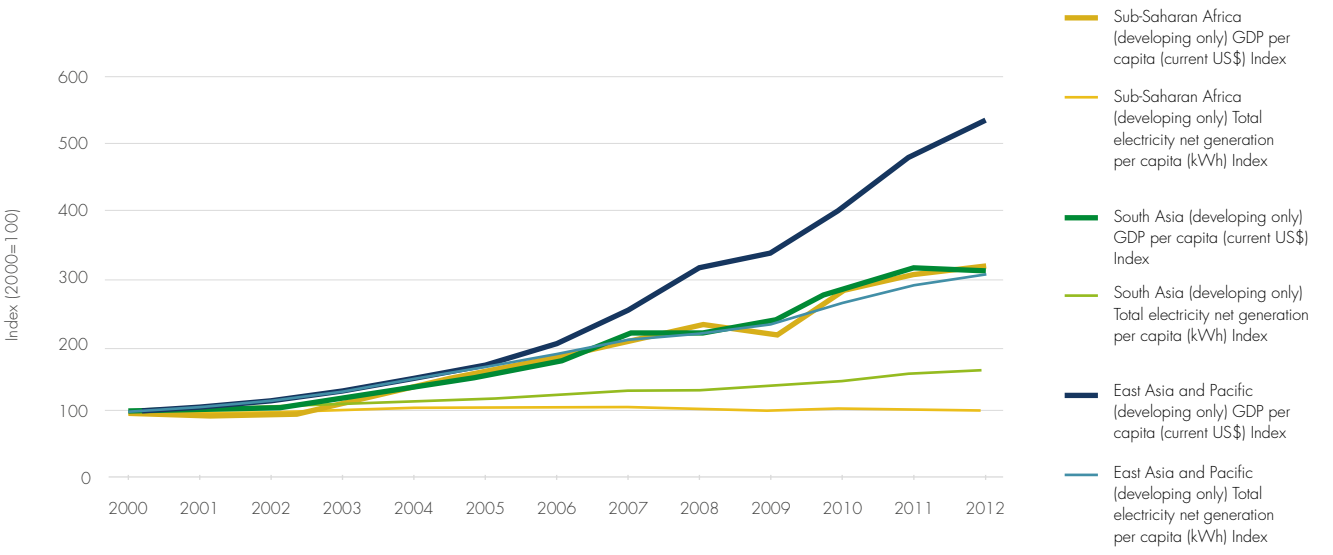
The weak linkage between economic growth and power generation highlights a distinctive public policy challenge. In the manufacturing sector, capital costs might be written down over 10 to 15 years. In the case of power generation, the up-front capital costs are very high, the lifetime of the plant is typically 40 years or more, and returns have to be secured over a far longer time horizon. Perhaps more than in any other sector, one of the conditions for private investment in the energy sector is the creation of an enabling environment through public regulation.

FIGURE 3 THE ELECTRICITY GENERATION GAP BETWEEN AFRICA AND OTHER REGIONS IS WIDENING



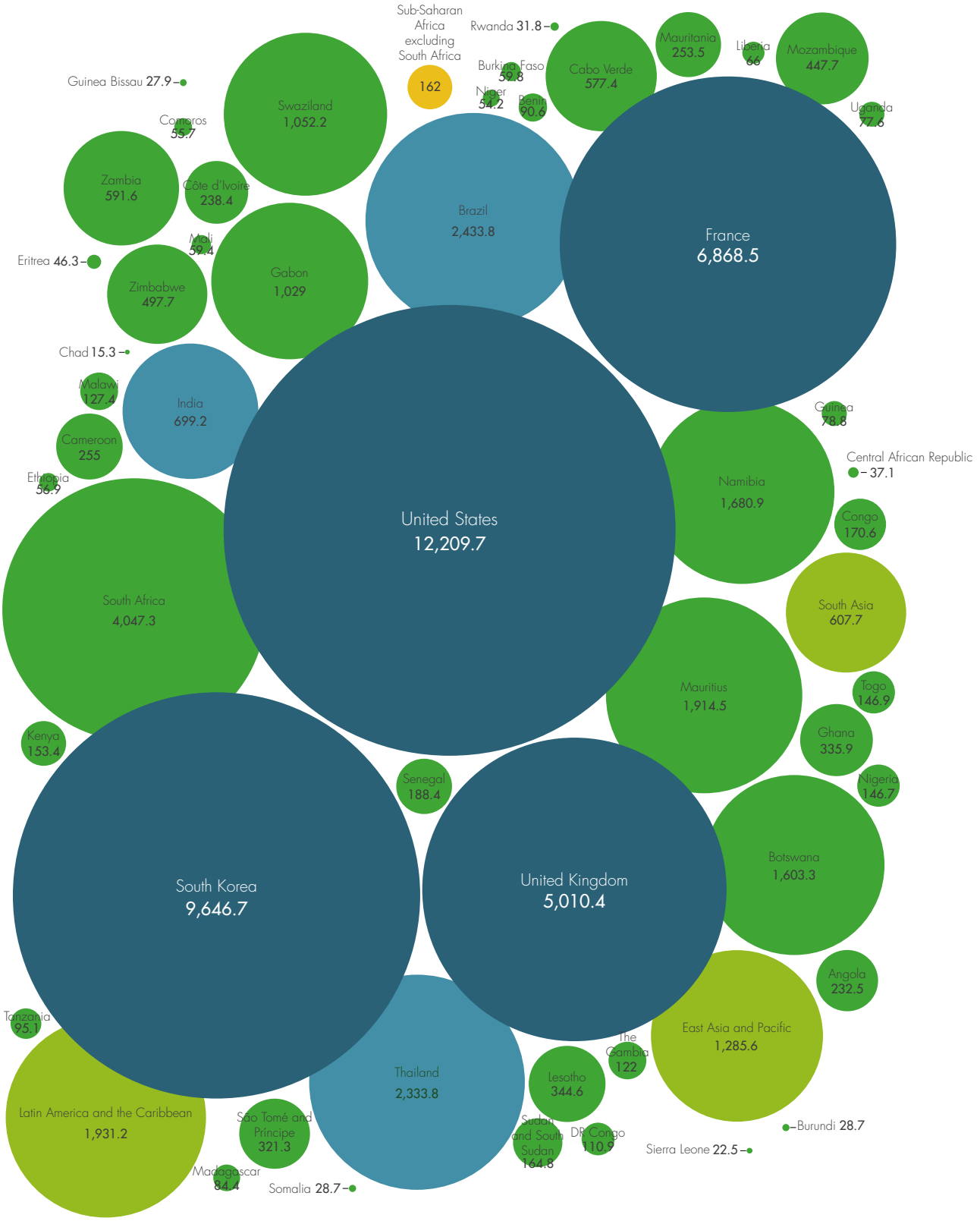
Data source: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Generation.

FIGURE 4 ECONOMIC GROWTH IS NOT TRANSLATING INTO UNIVERSAL ELECTRICITY GENERATION



Data source: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Generation.

FIGURE 5 MIND THE GAP: ELECTRICITY CONSUMPTION FOR SUB-SAHARAN AFRICA AND SELECTED COUNTRIES/REGIONS (kWh PER CAPITA, 2012)



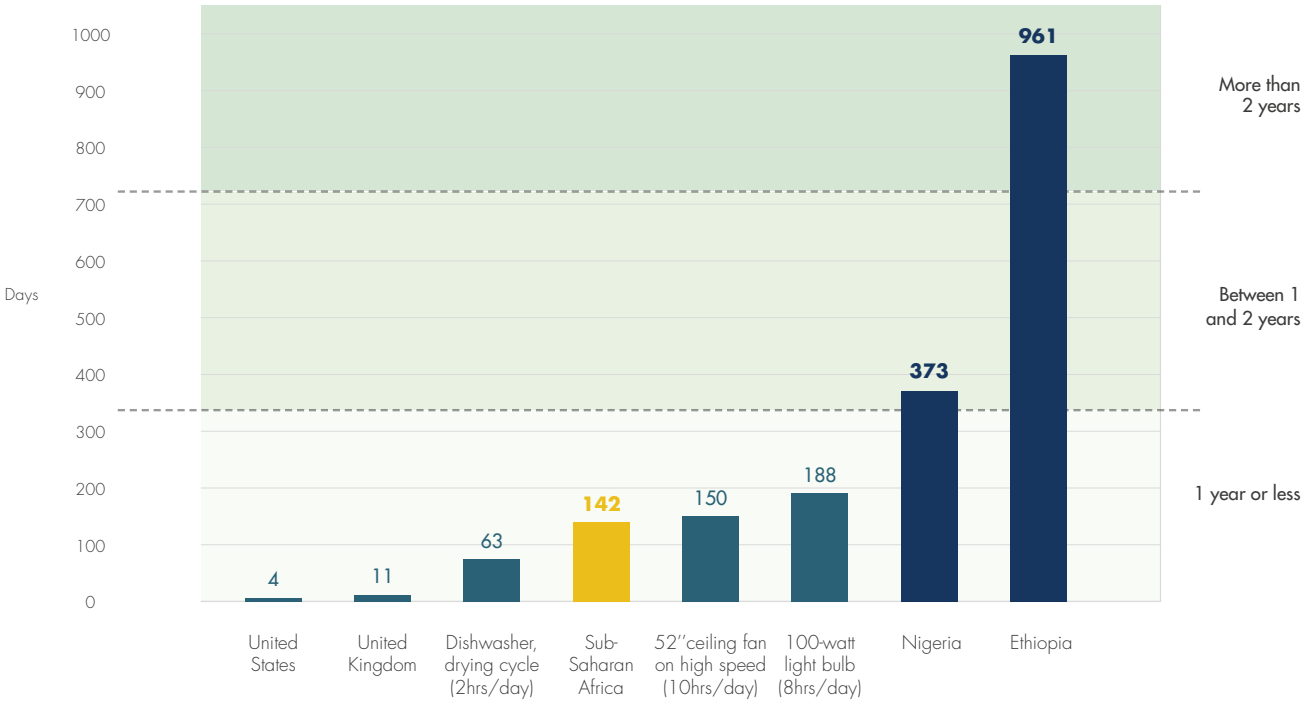
Data source: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Consumption.

Measured on a global scale, electricity **consumption** in Sub-Saharan Africa excluding South Africa is pitifully low, averaging around 162 kilowatt hours (kWh) per capita a year **(Figure 5 and Figure 6)**. This is the lowest level of consumption for any region. One-third of the region's population lives in countries where annual electricity use averages less than 100 kWh each. The global average consumption figure is 2,800kWh, rising to 5,700kWh in the European Union and 12,200kWh in the United States. Electricity consumption for Spain exceeds that of the whole of Sub-Saharan Africa (excluding South Africa) **(See infographic: Worlds apart).**

To put the figures in a different context, 595 million Africans live in countries where electricity availability per person is sufficient to only light a single 100-watt light bulb continuously for less than two months **(Figure 7)**. It takes the average Tanzanian around eight years to consume as much electricity as an American uses in one month.

When American households switch on to watch the Super Bowl, the annual finale of the football season, they consume 10 times the electricity used over the course of a year by the more than 1 million people living in Juba, capital city of South Sudan.

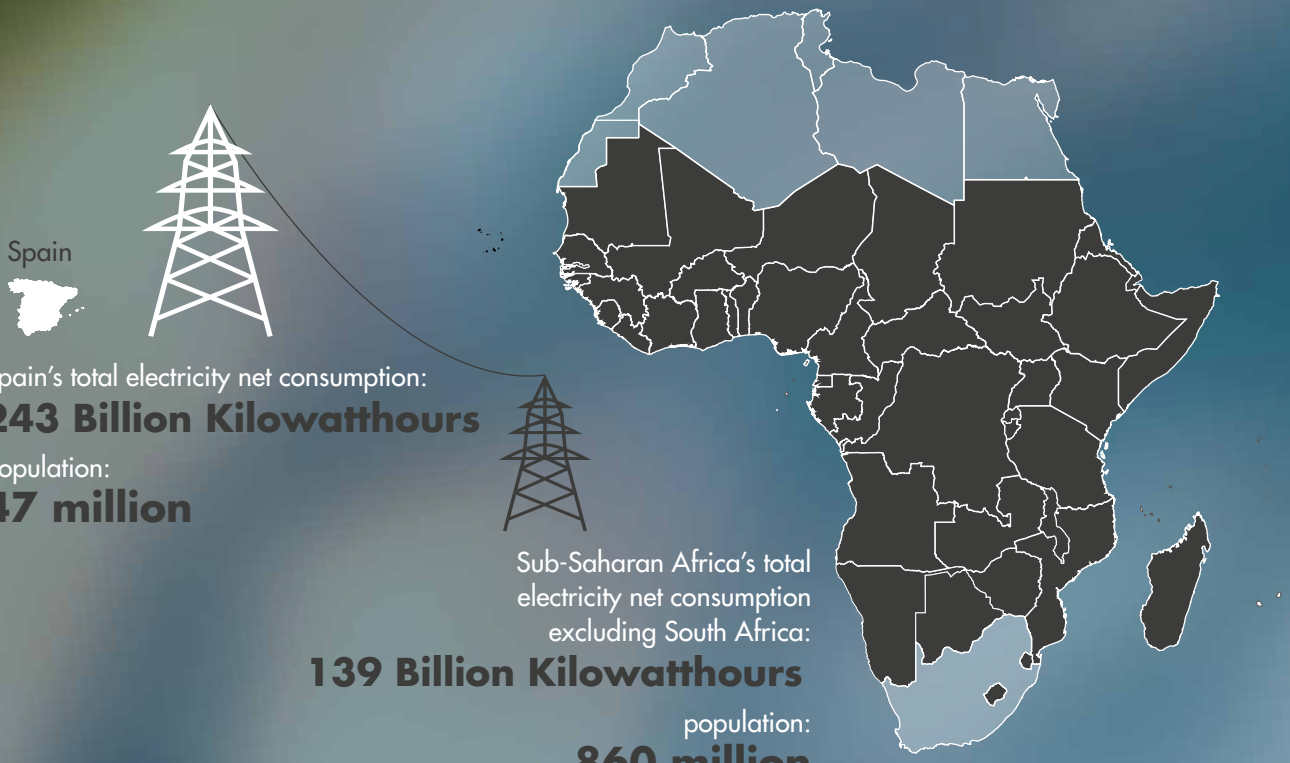
FIGURE 6 HOW LONG DOES IT TAKE? TIME REQUIRED TO USE 150kWh OF ELECTRICITY (PER CAPITA ANNUAL AVERAGE FOR SUB-SAHARAN AFRICA VERSUS SELECTED COUNTRIES AND APPLIANCES, 2012)



Data sources: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Consumption. The World Bank Group. (2012). World Development Indicators: Population.

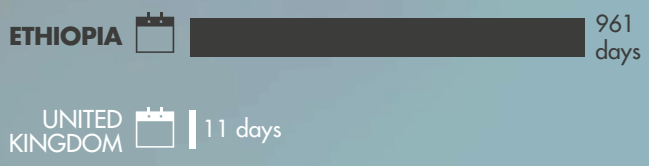
WORLDS APART

Viewed from Africa, energy use patterns in rich countries represent another universe

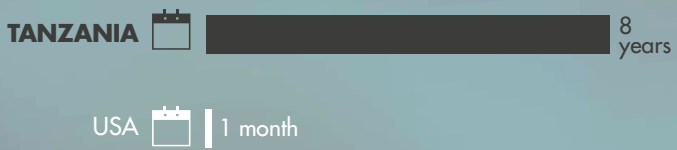


A kettle boiled twice a day by a family in Britain uses five times as much electricity as a Malian uses per year

An Ethiopian takes 87 times longer to consume 150kWh than someone in the United Kingdom



A Tanzanian takes 8 years to consume as much electricity as an American consumes in one month



A freezer in the United States consumes 10 times more electricity than a Liberian, in one year

Range of time

Ethiopia, with a population of 94 million, consumes one-third of the electricity supplied to the 600,000 residents of Washington D.C. Greater London consumes more electricity than any country in Africa other than South Africa.

By international standards much of Africa's energy infrastructure is dilapidated, reflecting several decades of under-investment. According to the IEA, the average efficiency of Sub-Saharan Africa's gas-fired power plants is around 38 per cent.[10] Similarly, most of Africa's coal-fired power plants employ sub-critical technologies, rather than the super-critical technologies that could generate far more electricity from the same amount of fuel. Recent super-critical coal-fired power plants built in China generate on average 30 per cent more electricity than those operating in Africa.

Economic growth has intensified pressure on Africa's creaking energy infrastructure. One symptom of that pressure is a boom in leasing of emergency power. Unable to meet base-load demand through the grid, governments are turning to high-cost energy providers using technologies designed to meet emergency needs.

Low levels of power generation are both a symptom and a cause of wider development challenges. In part, Africa's limited power generation is the product of low average incomes. But it is also a contributory factor in keeping incomes low. In that context, the widening energy gap between Africa and other regions is a matter of concern. There is a very real sense in which today's inequalities in energy are tomorrow's inequalities in economic growth, international trade and investment.

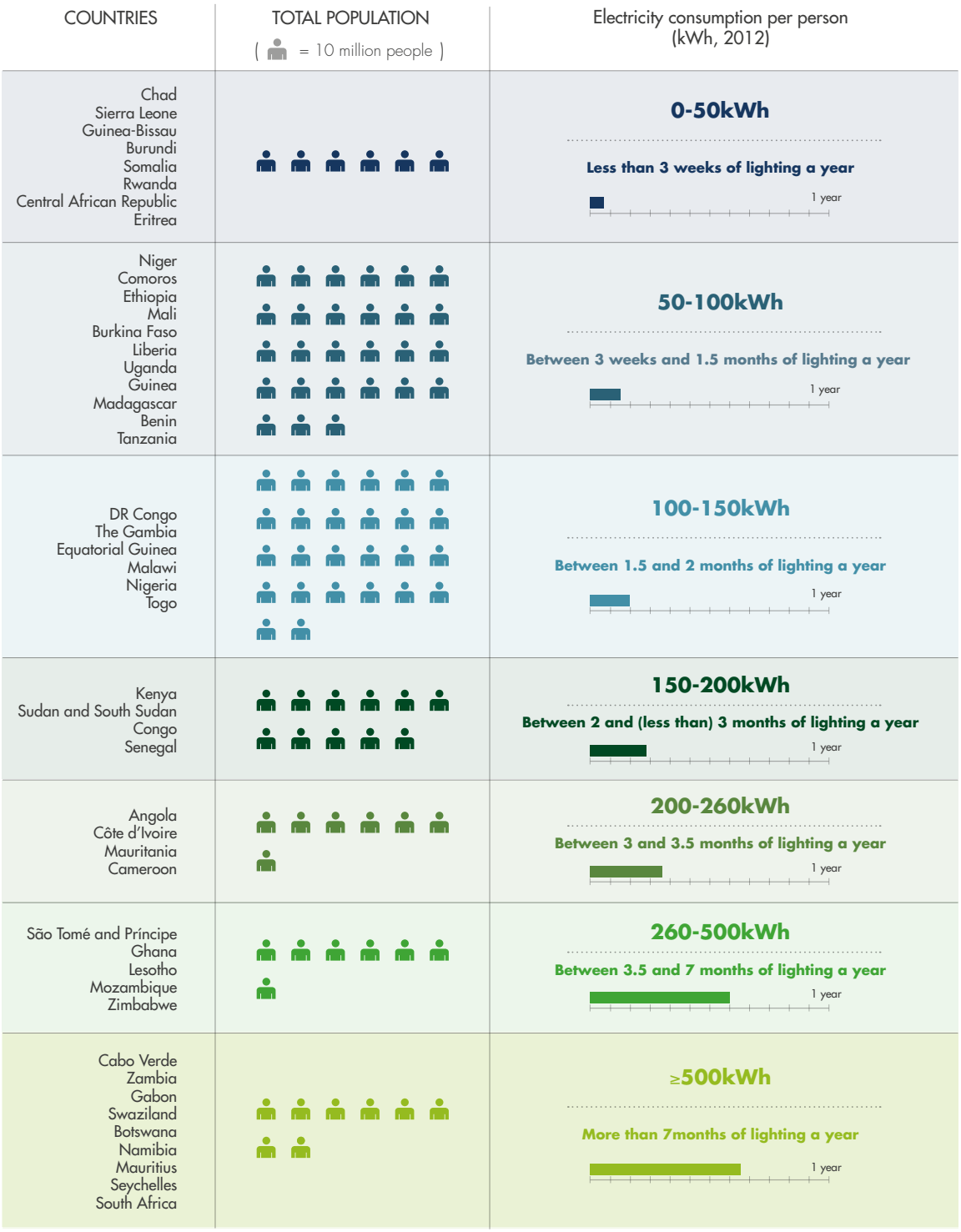
Access to electricity and clean cooking facilities is low and unequal

Data on power generation and electricity use highlight the gap between Africa and the rest of the world. But they do not capture the underlying inequalities in **access** to energy. Average consumption figures understate the full extent of Africa's energy poverty for a simple reason: most Africans do not enjoy access either to electricity or to non-polluting cooking facilities. On the current trajectory, the region is set to account for a rising share of the world's people who do not have access to modern energy **(See infographic: Africa's energy gap - The costs of the divide).**

Sub-Saharan Africa has the world's lowest coverage rates for modern energy. Two in every three people, around 621 million in total, have no access to electricity. In the Democratic Republic of the Congo, Liberia, Malawi and Sierra Leone, fewer than one in 10 people have access to electricity. There are just 10 countries in Sub-Saharan Africa with electricity access rates above 40 per cent **(Figure 8)**. Another 17 countries have electricity access rates of 20 per cent or less. There are around 20 countries in the region with 10 million or more people lacking access to electricity **(Figure 9)**. Electrification rates are half the level in Asia.[11]

There is a striking contrast in many countries between energy potential and electricity access. In Nigeria, a global oil-exporting superpower, 93 million people lack electricity.

FIGURE 7 THE AFRICAN LIGHTING LEAGUE TABLE: MONTHS OF LIGHTING THAT COULD BE PROVIDED AT AVERAGE ANNUAL CONSUMPTION BY COUNTRY IN SUB-SAHARAN AFRICA



A 100 watt light bulb that is on for an hour consumes 100 watt hours or 0.1kWh.
For one day (24 hours), it consumes 2.4kWh.
For one week (168 hours), it consumes 16.8kWh.
For one month (30 days, 720 hours), it consumes 72kWh.
For one year (365 days and 8,760 hours), it consumes 876kWh.

Data sources: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Consumption. The World Bank Group. (2012). World Development Indicators: Population.

AFRICA'S ENERGY GAP: THE COSTS OF THE DIVIDE

621 MILLION

Africans do not have access to electricity

of SSA's energy is consumed by South Africa

89 BILLION

US dollars of petroleum exported by Nigeria in 2013

93 MILLION

Nigerians lack access to electricity

4/5

OF THE POPULATION (727 MILLION) rely on solid biomass, mainly fuelwood and charcoal, for cooking

600,000

AFRICANS ARE KILLED EVERY YEAR by air pollution caused by the use of solid biomass for cooking

In 9 African countries, more than

OF PRIMARY SCHOOLS HAVE NO ELECTRICITY

In Africa, the poorest households spend

MORE PER UNIT OF ENERGY THAN THE WEALTHIEST HOUSEHOLDS with a connection to the grid

On current trends, it will take Africa until

2080

TO ACHIEVE UNIVERSAL ACCESS TO ELECTRICITY

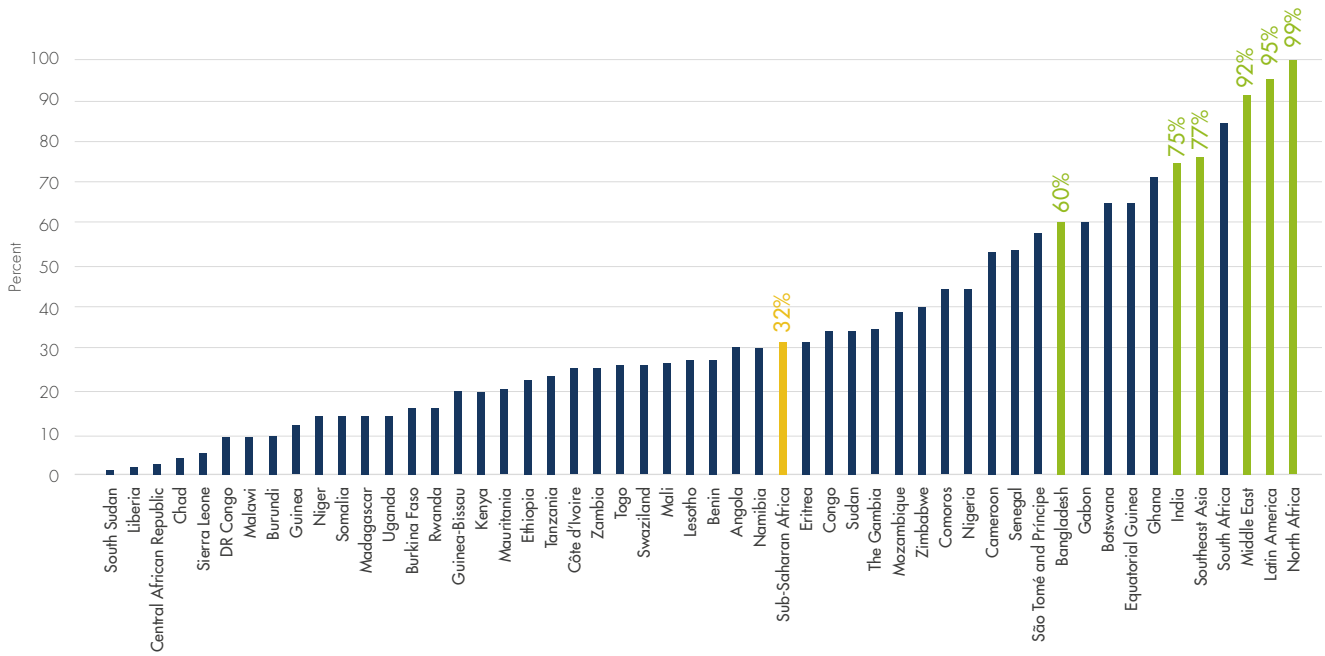
Emerging energy-exporting countries such as Kenya, Tanzania and Uganda each have over 30 million people without electricity. The Democratic Republic of the Congo could meet much of the entire region's demand for electricity through hydropower generation – but 60 million people in the country lack access to electricity.

Sub-Saharan Africa's restricted access to energy cannot be attributed solely to low incomes; policy choices and political leadership are critically important in shaping access to modern energy. Per capita income in Bangladesh is one-fifth of the level in Angola, for example, but rural Bangladeshis are eight times more likely to have access to electricity than their Angolan counterparts. Nigeria has higher levels of average income than Vietnam. But Vietnam has achieved near-universal access to electricity in rural areas, while two-thirds of rural Nigerians have no access to electricity.

Clean, non-polluting cooking facilities are vital to reduce Africa's death toll from household air pollution but access to these is even more restricted than access to electricity. Almost four in five people in Sub-Saharan Africa – 727 million – rely for cooking on solid biomass, mainly fuel wood and charcoal.

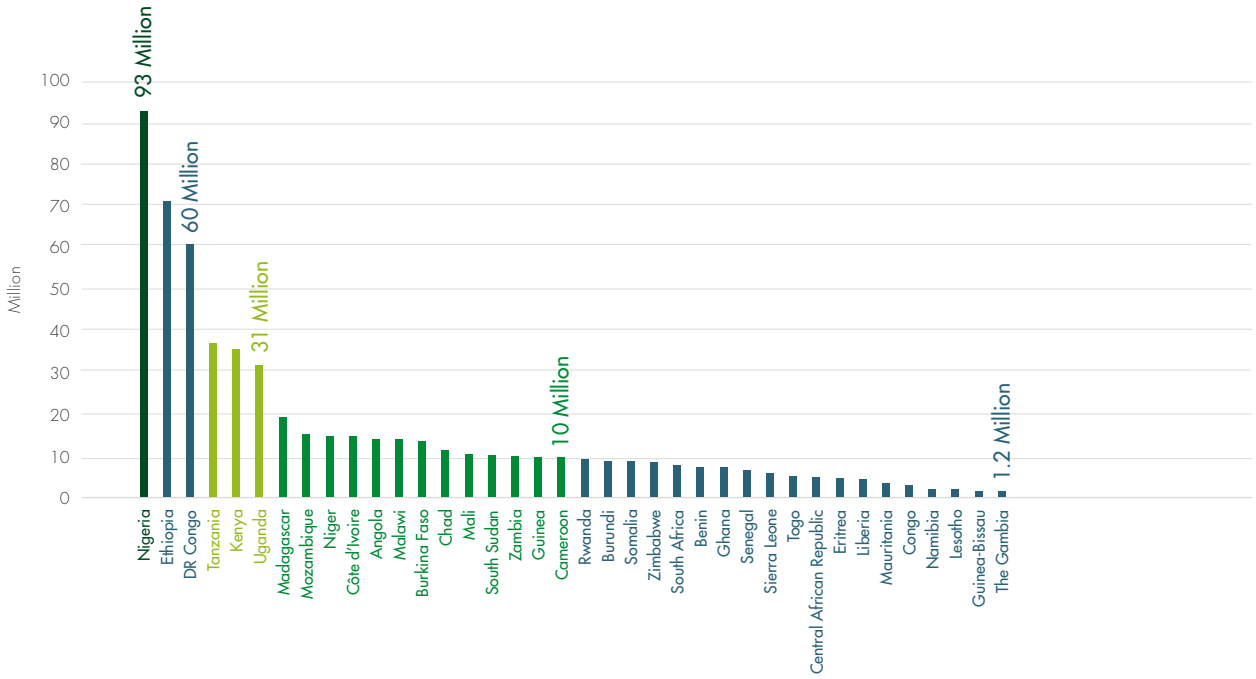
The profile of biomass use varies across countries. In 42 countries, more than half of the population uses biomass **(Figure 10)**. Patterns of biomass use vary across

FIGURE 8 AFRICA UNCONNECTED (ACCESS TO ELECTRICITY BY COUNTRY, 2012)



Data source: International Energy Agency. (2014). World Energy Outlook: Electricity Access database.

FIGURE 9 THE MISSING MILLIONS (POPULATION WITHOUT ACCESS TO ELECTRICITY, 2012)



Data source: International Energy Agency. (2014). World Energy Outlook: Electricity Access database.

urban and rural areas. Over 90 per cent of rural households in Mali, Mozambique and Tanzania rely on firewood and straw for cooking. Urban households have more diverse sources of fuel. While firewood and straw figure prominently, charcoal and kerosene are also widely used.

What are Africa's prospects for achieving the target of universal access to modern energy by 2030? On a "business-as-usual" trajectory, they are non-existent. Population growth exceeds the rate at which access to electricity and clean cooking facilities is increasing. In both areas Africa's share of the global deficit is rising.

According to IEA scenarios, Sub-Saharan Africa is the only region in which the absolute number of people without access to modern energy is set to rise, by 45 million for electricity and 184 million for clean cooking stoves. With other regions on a far more positive trajectory, by 2030 Africa's share of the world's population without electricity will rise from 47.6 per cent to 66.6 per cent; and the share without clean cooking facilities will rise from 26.3 per cent to 34.8 per cent **(Figure 11)**.

On current trends, it will take Africa until 2080 to achieve universal access to electricity. Universal access to clean cooking facilities would occur in around 150 years, sometime after the middle of the 22nd century.

Sub-Saharan Africa is the only region in which the absolute number of people without access to modern energy is set to rise.

FIGURE 10 LIVING WITHOUT MODERN ENERGY: HOUSEHOLD FUEL USE PATTERNS (SELECTED COUNTRIES)

Data source: The Demographic Health Survey Program. (2007 and after). STATcompiler: Type of cooking fuel.

People in rural areas will make up a bigger proportion of the population who do not have access to modern energy sources. On the IEA scenario, by 2030 rural Africans will account for two thirds of the global deficit in access to electricity and a third of the population without access to clean cooking stoves.

Fortunately, current trends do not dictate the destiny of countries. The IEA scenarios highlight the failure of current public policies, financial allocations, and business models to serve the needs of the most disadvantaged people, especially those living in rural areas. There are alternatives to these policies. The 2030 target is within reach, but only if governments and the private sector create an enabling environment that serves the interest of the poor.

FIGURE 11 THE RISING TIDE OF DISADVANTAGE: THE NUMBER OF AFRICANS LACKING ACCESS TO MODERN ENERGY IS RISING

Data source: International Energy Agency. (2013). Energy access projections to 2030.

The overarching condition for delivering on the energy for all commitment is to strengthen the focus on inequality. Wealthy urban Africans and large commercial farmers are not the ones who are getting left behind.

Across much of Africa, there is an energy fault-line running between rural and urban areas. The overwhelming bulk of the region's electricity grid is concentrated in urban areas, while the vast majority of the population living without electricity, around 80 per cent of the total, live in rural areas. The gap is illustrated in (Figure 12).

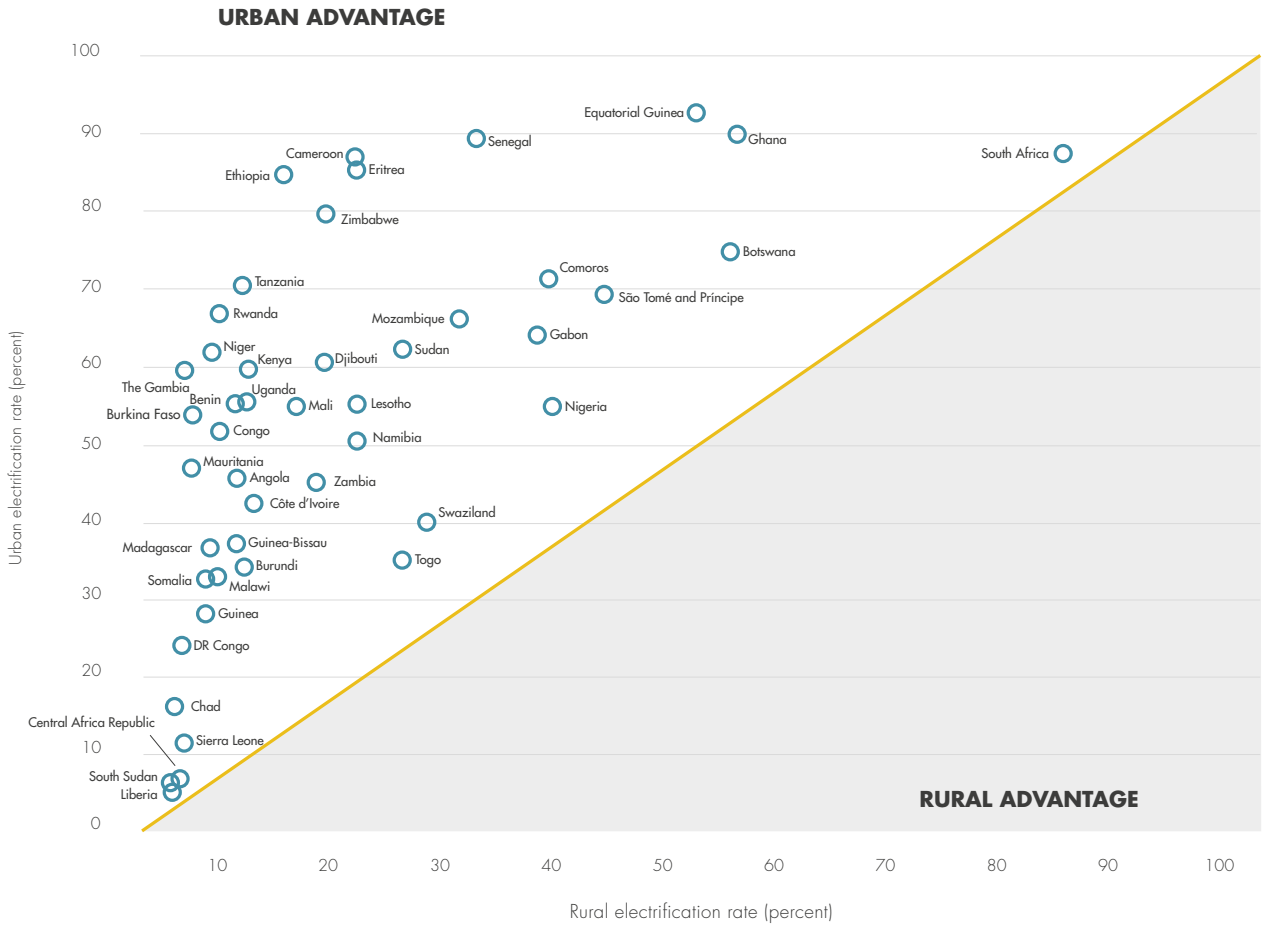
While urban coverage rates are low in countries such as Malawi and Burundi, they are still three times higher in urban than in rural areas. In countries with higher levels of coverage, such as Tanzania and Kenya, urban populations are five times more likely to have access to energy.

Across much of Africa, there is an energy fault-line running between rural and urban areas.

Urban-rural divides are reinforced by wider disparities **(Figure 13)**. Coverage rates in Kenya range from 90 per cent in Nairobi to less than 10 per cent in northern and western areas.

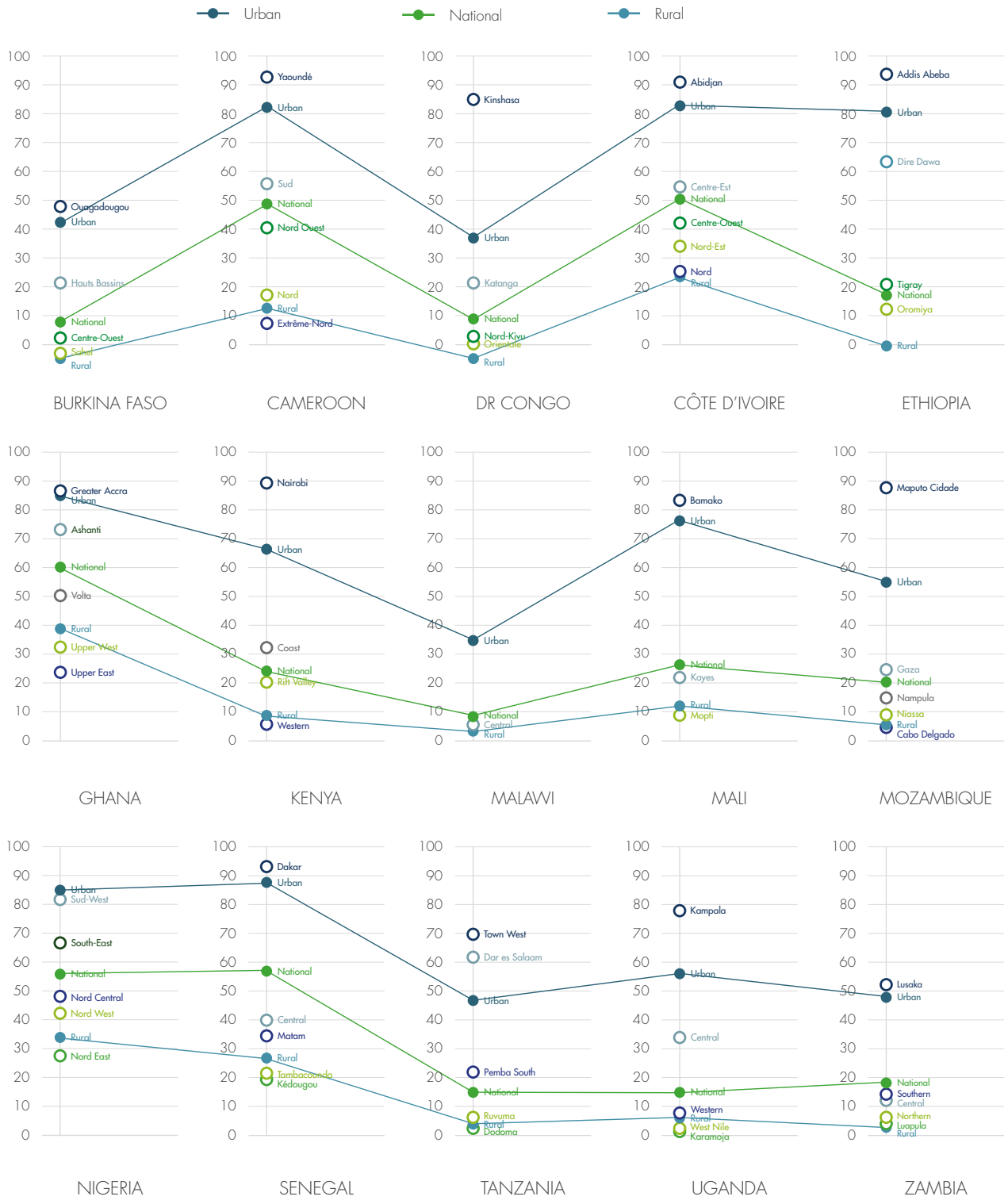
While the urban advantage is a feature of Africa's energy profile, the advantage is partial. Electricity provision is heavily skewed towards high-income groups and areas. Among the poorest 40 per cent of the population, coverage rates are well below 10 per cent. Connection to the grid typically exceeds 80 per cent for the wealthiest one-fifth of households. Residents of informal settlements have particularly low coverage rates, in part because of household poverty; and partly because they often lack the formal property titles needed to secure connections.[12]

FIGURE 12 AFRICA'S GRID GAP: RURAL POPULATIONS HAVE BEEN LEFT BEHIND (2012)



Data source: International Energy Agency. (2014). World Energy Outlook: Electricity access database.

FIGURE 13 CONNECTION TO ELECTRICITY IS HIGHLY UNEQUAL (ACCESS LEVELS FOR SELECTED COUNTRIES AND LOCATIONS)



Data source: The Demographic Health Survey Program. (2007 and after). STATcompiler: The Household has electricity.

Lack of modern energy is holding back development

The consequences of energy deficits have yet to register with sufficient force on the policy agendas of Africa governments. The same is true of the wider international community. Energy did not figure in the Millennium Development Goals, for example. While that omission has been partially corrected in the post-2015 Sustainable Development Goals, there is an abiding sense in which power generation is seen as a peripheral concern, in contrast to priorities in areas such as education, health, nutrition, water and sanitation.

It is difficult to think of a more misplaced perception. Without universal access to energy services of adequate quality and quantity, countries cannot sustain dynamic growth, build more inclusive societies and accelerate progress towards eradicating poverty. Productive uses of energy are particularly important to economic growth and job creation. Energy services directly affect incomes, poverty and other dimensions of human development, including health and education.[13] Expanded energy provision is associated with rising incomes, increased life expectancy and enhanced social well-being.

This association can be illustrated by reference to comparison across countries. Countries that generate less than 1,000kWh electricity per capita are heavily concentrated in the low-income segment of national wealth distribution. Only a handful of countries with electricity consumption of less than 2,000kWh have reached middle-income status. Countries in Sub-Saharan Africa are heavily concentrated in the low-income and low-energy segment of the global distribution **(Figure 14)**.

Looking beyond wealth to social well-being, as measured by the Human Development Index (HDI), underscores the importance of energy. The index is a composite indicator of health, education and living standards. Sub-Saharan Africa overwhelmingly dominates a group of countries that combine low levels of energy consumption with low human development **(Figure 15)**.

One word of caution is in order. Association is not causation. The relationships charted in Figures 14 and 15 operate in both directions. As countries get richer they are better able to expand the supply of energy, which in turn fuels further growth. However the strength of the association is striking. Failure to expand energy provision from the low levels now evident in Africa can only perpetuate low incomes and poor human development outcomes.

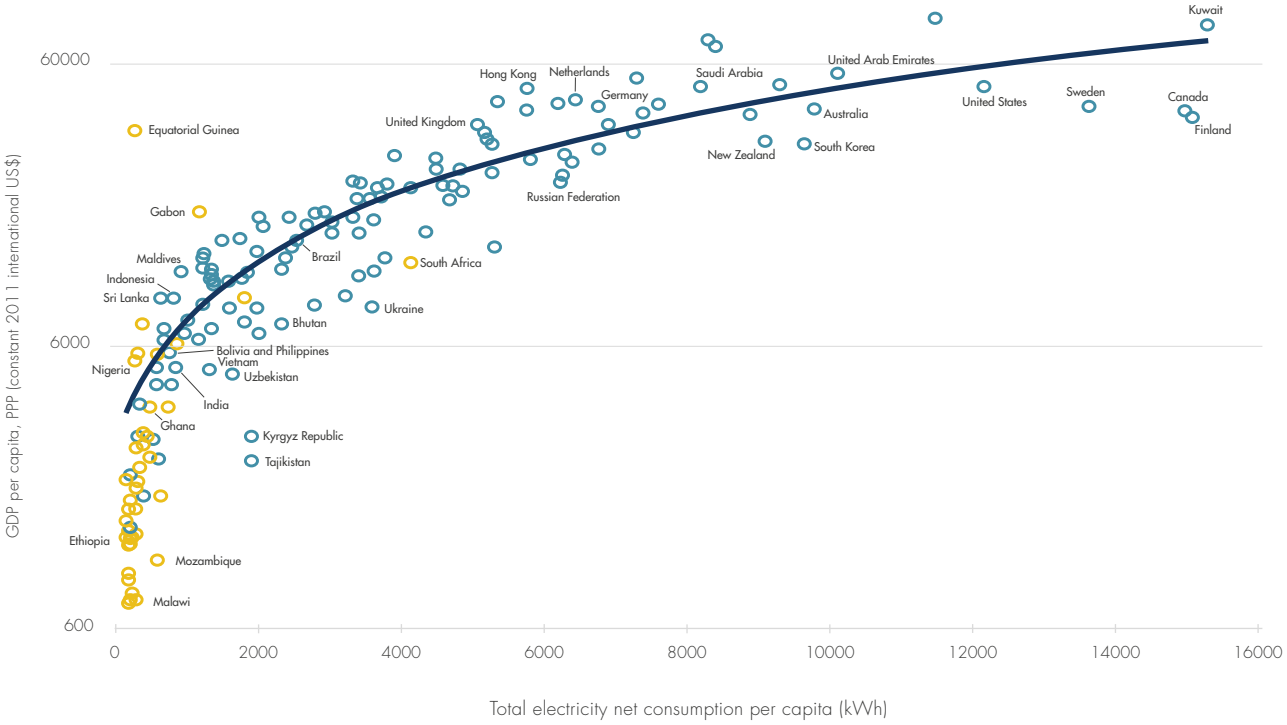
This observation has a direct relevance for the Sustainable Development Goals. In the absence of accelerated progress towards universal access to energy at far higher levels of provision, none of these targets will be attained in Africa.

Companies pay a high price – and economic growth suffers

Energy powers machines that save time and increase productivity. Access to affordable and reliable energy can help companies penetrate new markets, enable farmers to diversify their income sources and support agro-processing industries that link agricultural producers to national, regional and global markets.

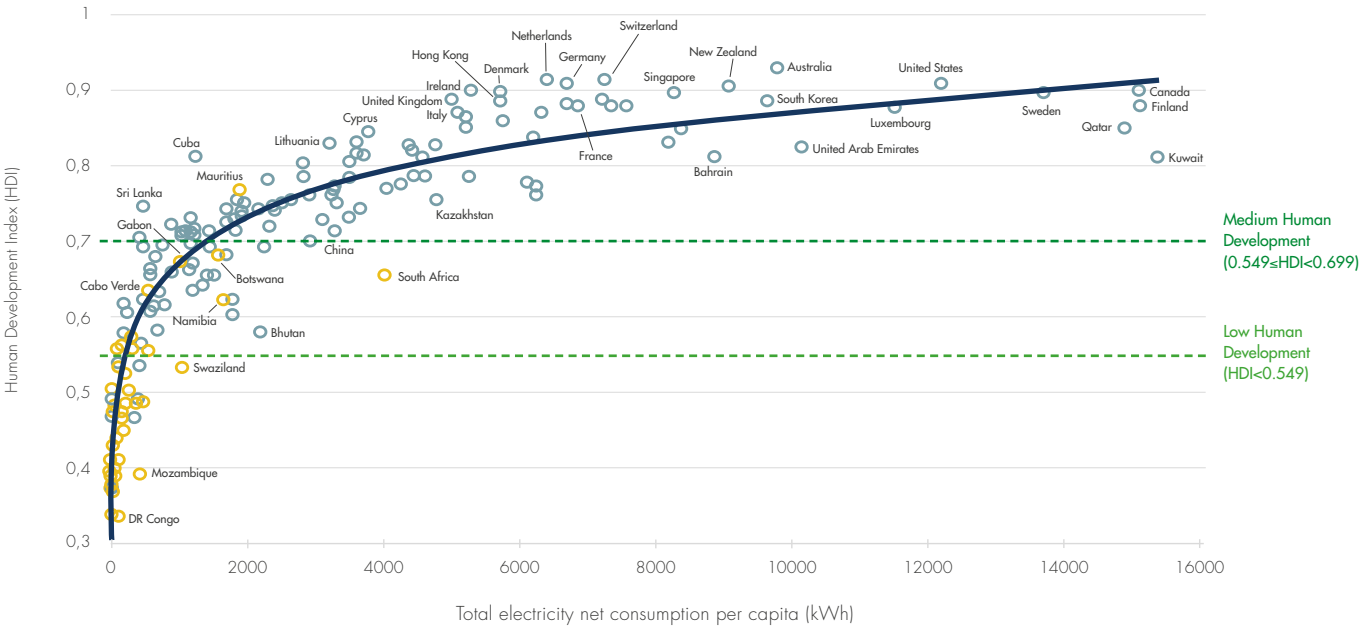
Unfortunately, firms operating in Africa are served by some of the world's highest-cost and least reliable electricity providers. The average price of electric power in Sub-Saharan Africa is far higher than in other developing regions.

FIGURE 14 HAND-IN-HAND: HIGHER INCOMES ARE ASSOCIATED WITH HIGHER LEVELS OF ENERGY CONSUMPTION...



Data sources: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Consumption.
The World Bank Group. (2012). World Development Indicators: GDP Per Capita, PPP.

FIGURE 15 ...AND SO ARE HIGHER LEVELS OF HUMAN DEVELOPMENT



Data sources: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Consumption.
United Nations Development Programme. (2012). Human Development Index.

In addition, higher charges are imposed on firms than on households, an arrangement which is designed to cross-subsidize the consumption of high-income urban households. In many countries, small and medium-sized enterprises (SMEs) bear the brunt of this cross-subsidization because high-voltage, large-scale commercial users often secure concessions from utilities.

Tariff charges tell only part of the story. Power-generation capacity falls far short of demand and supplies are unreliable. Every enterprise in Africa has to plan for regular power outages. Frequent power cuts result in losses estimated at 6 per cent of turnover for large firms and as much as 16 per cent for enterprises in the informal sector.[14]

Unreliable power supply has created a buoyant market in diesel-powered generators. Around 40 per cent of businesses in Tanzania and Ethiopia operate their own generators, rising to over 50 per cent in Kenya.[15] In Nigeria, around four in every five SMEs install their own generators.[16] On average, electricity provided through diesel-fuelled back-up generators costs four times as much as power from grid.[17] Diesel fuel is a significant cost for enterprises across Africa, even in less energy-intensive sectors such as finance and banking. According to McKinsey, diesel fuel represents around 60 per cent of operator network costs for mobile-phone operators.[18]

High cost and unreliable supply add to the cost of doing business in Africa, with damaging consequences for economic growth, investment and tax revenues. The World Bank has estimated the losses at 2-4 per cent of GDP.[19] Lack of reliable and cost-effective electricity is among the top constraints to expansion in the manufacturing sector in nearly every Sub-Saharan country.[20] Small and medium enterprises account for most of the job creation but face particularly severe problems, with around half citing the high cost and unreliability of supply as a barrier to enterprise development.

Lack of electricity reinforces the poverty trap

Restricted access to electricity has direct and damaging consequences for household poverty. Africa's poor typically pay higher unit costs for energy than the rich. This is partly because the rich are subsidized, but also because the poor use inefficient energy sources including batteries, candles, and charcoal.If the poor could use more efficient energy sources they could reduce the share of income that they spend on energy and free up resources for other priority areas. It could also reduce the amount of time that women and girls spend collecting firewood and cooking.

Households across Africa, including very poor households, spend a significant share of their income on energy. Data from 30 countries showed that the average share of household spending directed to energy was 13 per cent.[21] The poorest households typically spend a larger share of their income on energy than richer households. In Uganda, the poorest one-fifth allocated 16 per cent of their income to energy, three times the share of their richest counterparts.

Women and girls spend a lot of time collecting firewood and cooking with inefficient stoves. Factoring in the costs of this unpaid labour greatly inflates the economic costs that come with Africa's energy deficits. Estimates by the World Bank put the losses for 2010 at US$38 billion or 3 per cent of GDP.[22]

Denied access to electricity, households are forced to turn to other sources of energy. **(Figure 16)** provides a snapshot of how Africa's poorest households light their homes. One survey found that rural households were on average spending around US$57 a year (2008 prices) on lighting alone.[23] Kerosene is the most common source of lighting but it is also one of the least efficient. On a unit-of-energy equivalent basis, kerosene is 150 times more expensive than even the least efficient incandescent bulb.[24]

Some of Africa's poorest households are bearing the brunt of the losses associated with energy inefficiency. Consider the case of rural Ethiopia, where more than 85 per cent of households rely on fuel-based sources for light, principally kerosene supplemented by dry-cell batteries. On average, these households spend US$2 a month to secure three hours lighting a day. Scaled up to the national level, total annual spending based on retail prices is around US$331 million. Halving these costs would release funds for investment in education, health and other priorities.[25]

Most poor households cannot afford access to the grid. The region's utilities charge connection fees relative to household income that are among the highest in the world. Charges range from over US$50 in Ethiopia to US$200 in Uganda and US$300-400 in Tanzania and Kenya (**Figure 17** expressed as a percentage of monthly income).

Moreover, the connection fee does not take into account either the additional associated charges such as value-added tax (VAT), security deposits and inspection fees or the cost-escalation associated with distance from grid connection points.

FIGURE 16 HOUSEHOLD LIGHTING: DEVICES AND FUEL SOURCES (PERCENT)

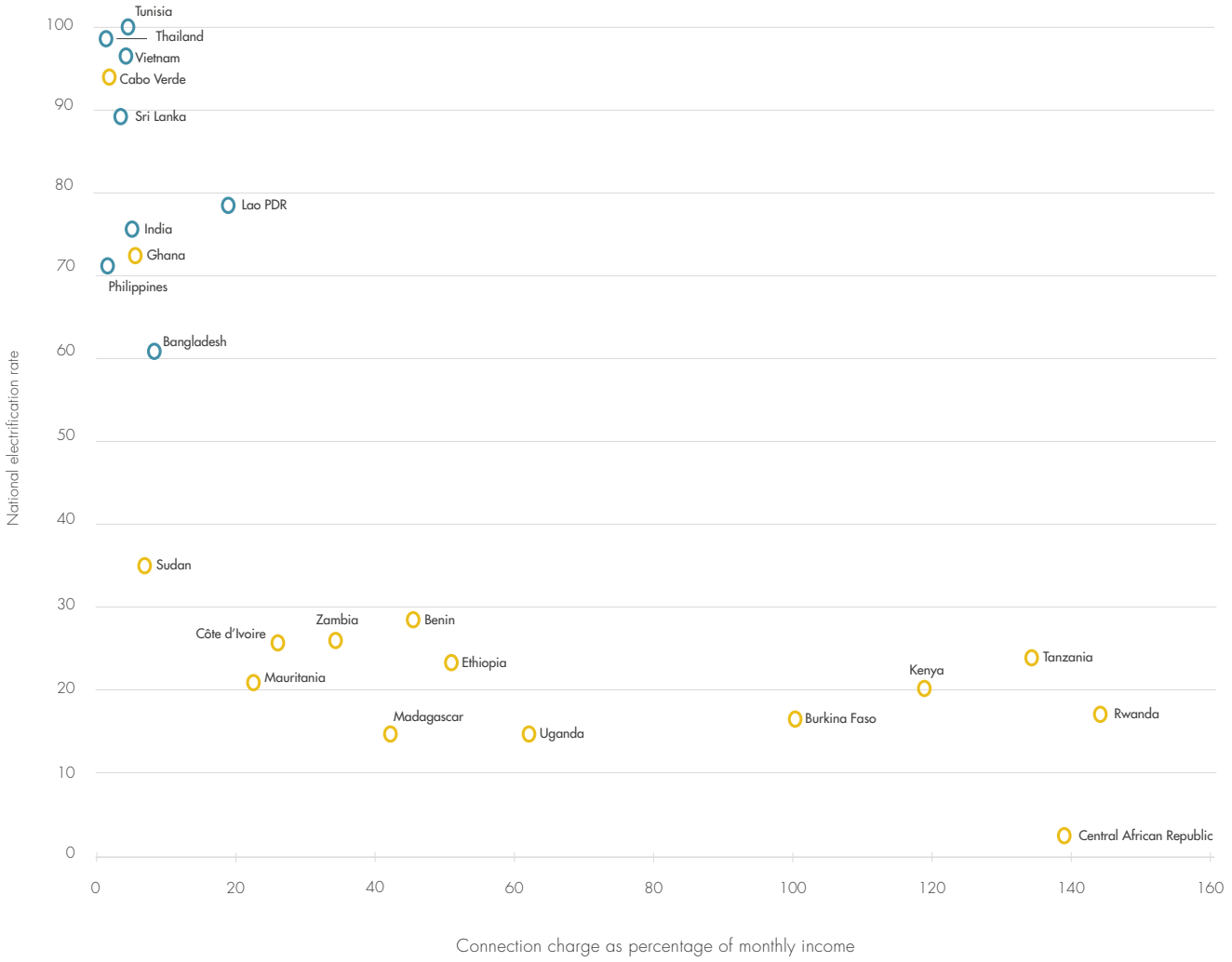
Devices	Ethiopia	Ghana	Kenya	Tanzania	Zambia
Kerosene lamp with no cover	69	5	30	30	8
Kerosene lamp with cover	14	72	67	60	6
Firelight /moonlight	11			7	5
Torch	10	12	10	8	3
Light bulb in socket or lamp	8	6		10	6
Candles		18	5	19	79
Lantern (battery or solar)		4			

Data source: The World Bank Group. (2015). Lighting Africa.

In Tanzania, increasing the distance from an existing power-distribution line from less than 30 metres to 70 metres would increase the connection charge from US$297 to US$871.[26]

Utilities around the world lower the connection barrier by reducing up-front costs through subsidies and low-cost credit, or by incorporating connection costs into tariffs that are paid over the long-term. Unfortunately, the most common practice in Africa is to require up-front payment in full, effectively excluding all but the wealthiest households. This is a "lose-lose" scenario: utilities lose customers and poor households lose access to affordable energy.

FIGURE 17 THE ELECTRICITY COST BARRIER: ACCESS TO ELECTRICITY FALLS AS CONNECTION CHARGES RISE



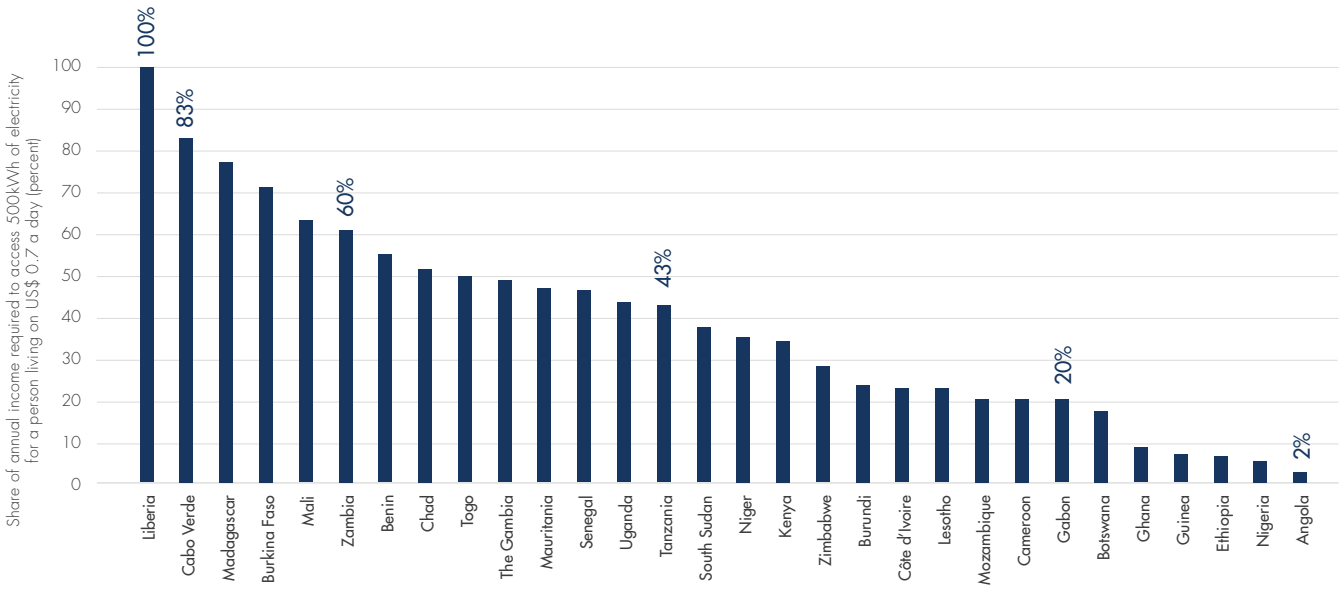
Data source: Golumbeanu, R and Barnes, D. (2013). Connection Charges and Electricity Access in Sub-Saharan Africa. World Bank, Washington, DC.

Even if poor households could secure access to the grid, many would struggle to afford tariff costs. The IEA has identified that urban households need a minimum energy provision of 500kWh of electricity.[27] Using the lowest cost tariff for each country, **Figure 18** expresses the cost of purchasing 500kWh of electricity from utilities as a share of average income, around US$0.74 a day, of the 46 per cent of Africans who live on less than US$1.25 a day.

The cost of meeting the threshold exceeded 40 per cent of income in around half of the 30 countries covered, rising to 60 per cent in Zambia and 100 per cent in Liberia.

Even with more progressive charging structures, national and regional electricity grids will not reach all Africans by 2030. Urbanization provides opportunities to expand provision for low-income households because of the economies of scale that come with more dense concentrations of people. Rural electrification can also extend the reach of grids. However, off-grid solutions will be required for more remote areas and some of the poorest households. Renewable energy sources and innovative business models are creating new opportunities for an energy breakthrough in this area.

FIGURE 18 MANY OF AFRICA'S POOREST HOUSEHOLDS WOULD BE UNABLE TO AFFORD A BASIC ELECTRICITY SUPPLY (THE COST OF 500kWh OF ELECTRICITY AS A SHARE OF INCOME FOR THE POOREST HOUSEHOLDS)



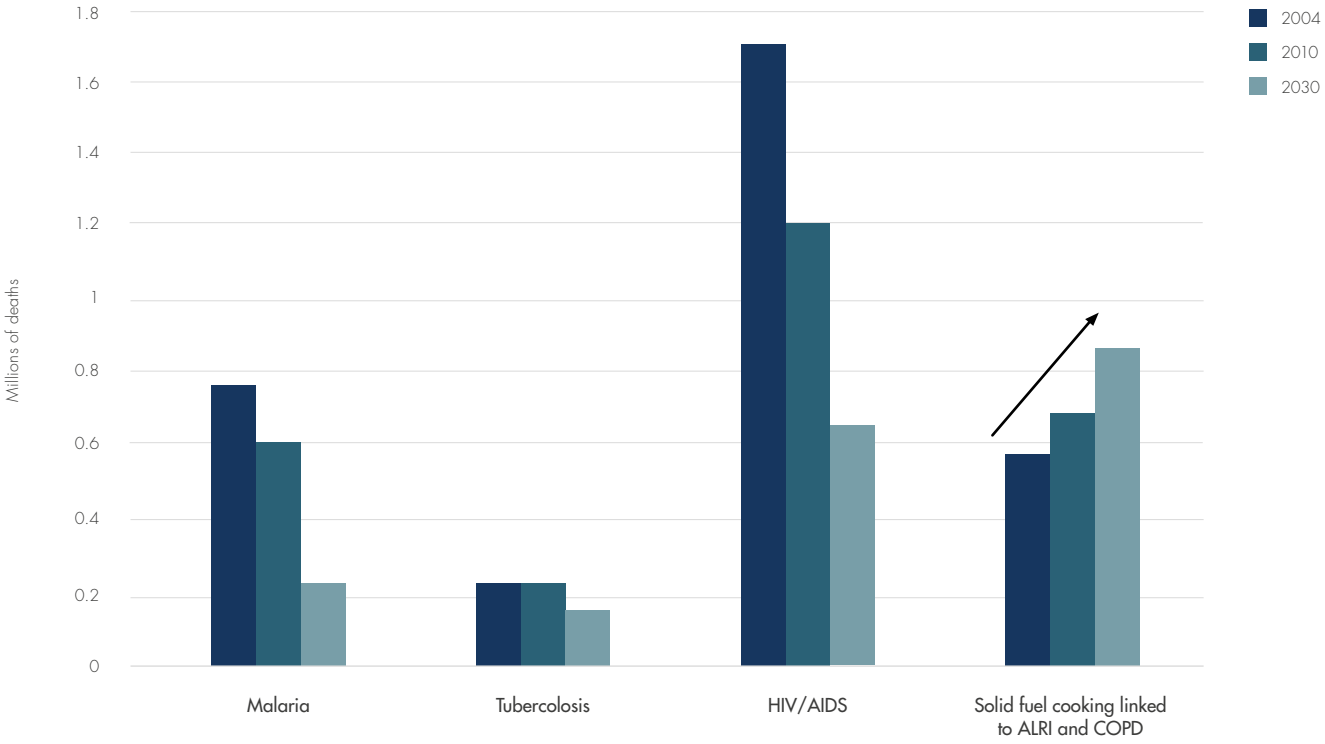
Data source: Overseas Development Institute and Africa Progress Panel research (2015).

Indoor air pollution is a hidden killer

Energy deficits harm Africans' health by undermining health services. They also contribute to one of Africa's most virulent but least visible epidemics, death and illness from the use of biomass fuels such as firewood and charcoal, a major source of household air pollution (HAP) **(Figure 19)**. Women and children are the primary victims.

These fuels are often smoky and typically used on open fires in poorly ventilated homes, exposing people to carbon monoxide, toxic particulate matter and formaldehyde. Similarly, smoky unvented wicks in simple lamps that burn kerosene and in candles can result in substantial black carbon smoke emissions. Women and children face higher levels of exposure because of the time they spend cooking and inside the home.[28] The poor suffer most: the less expensive fuel options they use are typically less efficient and produce more smoke, elevating the health risks. Simple homes built with mud, thatch, and animal skins rarely have a chimney and if there is a chimney it is usually a simple vent with no flue to draw air.

FIGURE 19 AFRICA'S HIDDEN KILLER: DEATHS CAUSED BY HOUSEHOLD AIR POLLUTION FROM SOLID BIOMASS COMPARED WITH OTHER RISK FACTORS



Data source: The World Bank Group. (2012). State of the Clean Cooking Energy Sector in Sub-Saharan Africa.

The global human costs of HAP have been systematically underestimated. Recent research has revealed far stronger relationships between biomass-related pollution and respiratory tract infections, strokes, ischaemic heart disease, lung cancer and obstructive pulmonary diseases.[29]

Africa is on the front line of the HAP epidemic. The World Health Organization estimates that 600,000 Africans die each year as a result of it. Almost half are children under 5 years old, with acute respiratory tract infection the primary cause of fatality. If governments in Africa and the wider international community are serious about their commitment to ending avoidable deaths of children, then clean cooking facilities must be seen as a much higher priority. Put differently, achieving universal access to clean cooking stoves, allied to wider measures, could save 300,000 young lives a year.

Apart from saving lives, reducing the use of biomass by 50 per cent would save 60-190 million tonnes of CO_2- equivalent emissions, as production and use of solid fuels for cooking consumes over 300 million tonnes of wood annually in Sub-Saharan Africa.[30] These wide-ranging benefits point to a compelling case for strengthened international cooperation on the development and marketing of affordable clean-cooking stoves.

Unequal access to energy reinforces disparities in health and education

Restricted access to modern energy services undermines both health and education. When health systems are unable to provide preventive and curative services, people who are already vulnerable face heightened risks. And when shortages of electricity hamper schooling, children lose a chance to gain the education they need to escape poverty and build secure livelihoods.

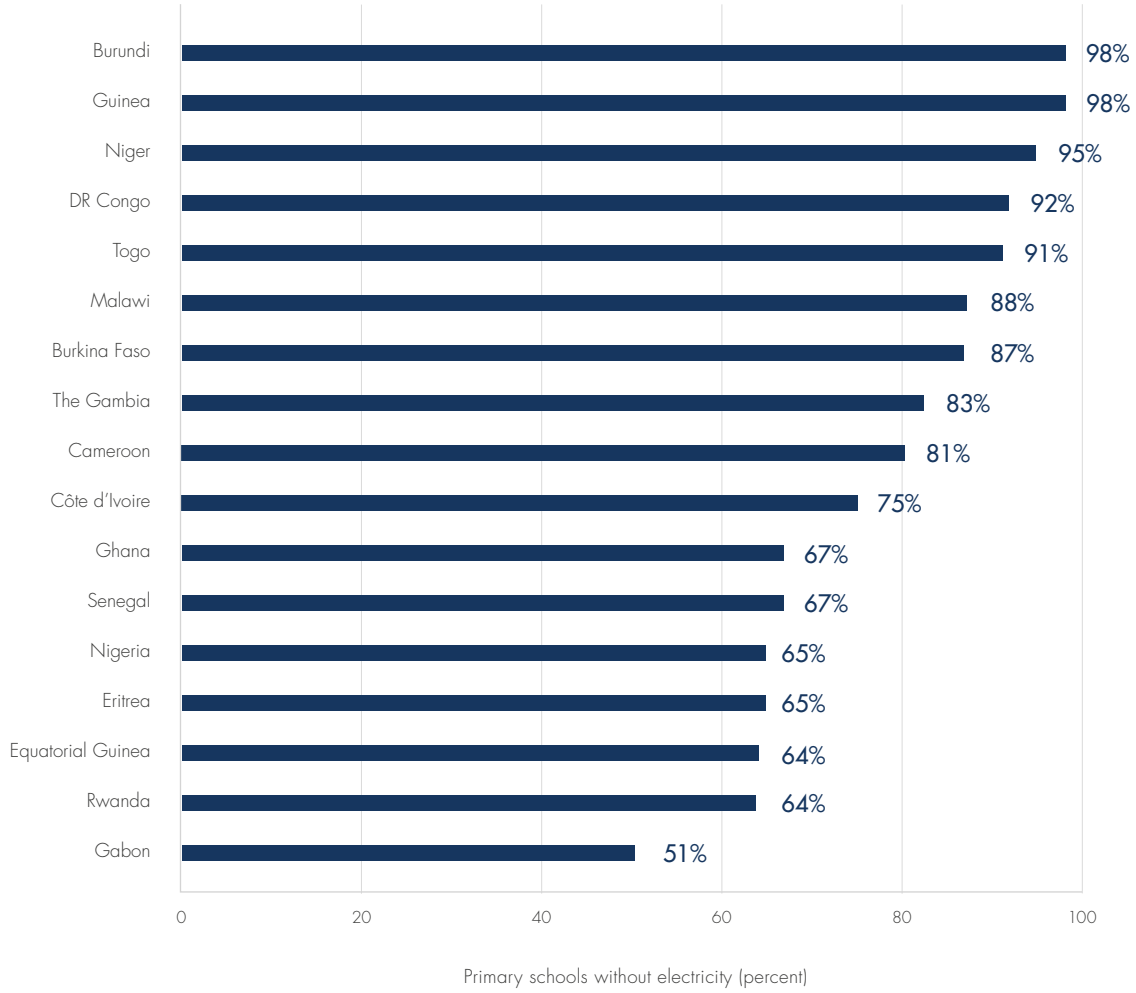
Health systems depend heavily on reliable electricity for refrigeration for vaccines and other medicines, sterilization, many medical instruments, lighting and the functioning of operating theatres. Yet around one-quarter of health facilities reviewed in one of the most comprehensive surveys available for Sub-Saharan Africa, covering 11 countries, reported no access to electricity.[31]

Energy deficits may also be holding back progress in child health. Some 60 per cent of the fridges used to store vaccines in Africa lack access to a reliable source of energy, leading to high levels of wastage and higher delivery costs.[32] In a region with around 105 million children who have not been fully vaccinated, such energy shortfalls can cost lives.

Energy poverty leads to educational disadvantage through many routes. While there has been much attention to the real potential for new learning technologies in education, there has been less recognition of some familiar energy-related problems. Improved access to modern energy can mean more time for attending school and lower risks of school dropout, particularly for school-age girls who can spend less time collecting firewood. Providing electricity to schools can open new doors to learning for boys and girls through information technologies.

Lighting at home enables children to keep up with homework. Research shows improved access to modern energy may boost school attendance.[33] Most of Africa's schoolchildren attend classes without access to electricity. In Burundi, Guinea, Niger, the Democratic Republic of Congo and Togo over 90 per cent of primary schools lack access to electricity **(Figure 20)**.[34]

FIGURE 20 LIGHTS OUT FOR EDUCATION: THE SHARE OF PRIMARY SCHOOLS WITHOUT ACCESS TO ELECTRICITY IN SELECTED COUNTRIES (2012)



Data source: UNESCO. (2012). School and Teaching Resources in Sub-Saharan Africa.

Unsustainable firewood and charcoal use is damaging the environment

The way energy is produced, distributed and consumed has a strong bearing on poverty and on environmental resources. Reliance on biomass such as firewood and charcoal without sustainable agro-forestry management can lead directly to land degradation and deforestation, damaging ecosystems that play a vital role for vulnerable populations. Biomass use links Africa to the global climate change debate, and we will return to this issue in Part II of this report.

Solid biomass accounts for over two-thirds of Africa's total energy consumption, higher than for any other region. Cooking is the primary end use for biomass. Of the estimated 280 million tonnes of oil equivalent solid biomass currently used in Sub-Saharan Africa, 90 per cent is used as cooking fuel.[35]

Depletion and degradation of forestry resources is one by-product of dependence on biomass. In contrast to Latin America and much of Asia, where timber and logging activities account for over 70 per cent of forest degradation, in Sub-Saharan Africa the main drivers of forest degradation are fuel wood collection and charcoal production, with livestock grazing in forests playing a supplementary role. Deforestation significantly increases the time that needs to be allocated for firewood collection, trapping women in a cycle of rising labour demand and environmental degradation.[36]

The rapid growth of cities such as Addis Ababa, Dar es Salaam, Lusaka and Nairobi has gone hand-in-hand with the growth of markets for charcoal, which is the cooking fuel of choice for the urban poor, and deforestation.[37]

Efforts to regulate the charcoal trade have met with limited success. Bans on production and trade of charcoal have increased the costs, fuelled corruption and, in some cases, hurt poor households.[38] The "win-win" scenario would see the market regulated to promote conservation through demand management (in the form of taxes on the charcoal trade, higher prices for wood and restrictions on cutting timber in some zones) while creating incentives for more efficient charcoal kilns. Increased productivity could have the twin effect of keeping down prices for poor urban households while limiting pressure on forestry resources.

Power utilities and energy subsidies impose a heavy fiscal burden

As well as lost opportunities for human development and ecological degradation, Africa's energy systems lead to fiscal costs that have indirect – but profoundly damaging – consequences for development. Misplaced policies are diverting scarce budgetary resources towards highly inefficient practices, reducing the finance available for investment, including universal access to energy.[39]

Much of the waste can be tracked through Africa's power utilities, which are the target of considerable public disquiet. The frequent power outages associated with the former Power Holding Company of Nigeria (PHCN) had earned the company the unwelcome nickname "Please Have Candles Nearby".[40] The Electricity Company of Ghana, the 'state-owned utility distributor, is the focus of its own public protest movement.[41] Tanzania's state-owned energy provider TANESCO is at the centre of corruption allegations. Meanwhile, power utilities continue to accumulate large debts, diverting public finance from more productive purposes.

Much of the waste can be tracked through Africa's power utilities, which are the target of considerable public disquiet.

Behind the endless stream of bad news stories associated with power utilities are some long-running systemic failures. Power utilities in Africa charge high tariffs but have been unable to cover their costs and generate a surplus to finance maintenance and new investment. On one estimate, Africa is losing US$8.2 billion annually through power-sector inefficiencies associated with poor cost-recovery, the underpricing of electricity, distribution losses and other factors.[42]

Part of the problem can be traced to under-investment in operations and maintenance. Transmission and distribution losses average 18 per cent for utilities in Sub-Saharan Africa, which is double the global average and well above the levels reported for other developing regions. Uncollected revenue is another loss. The end result is that revenues typically fail to cover costs, let alone generate a surplus for investment. In Zambia, Nigeria, Tanzania and Niger, revenues cover only 40-50 per cent of historic production costs.[43]

Reliance on emergency power adds to the vicious circle. Utilities experiencing power shortages typically enter into short-term contractual arrangements with emergency power providers who install new capacity, usually in the form of oil-fired generators. The leasing terms are often onerous – and utilities have to meet the cost of oil imports. Generating electricity through emergency power provision typically doubles the cost of electricity.

One recent example of the costs of under-investment and weak governance in the energy sector comes from Ghana. Rising demand for electricity and supply-side constraints associated with inadequate water levels in the country's three hydropower plants, frequent breakdown of equipment and transmission losses have led to frequent outages. The government has responded by purchasing a fleet of emergency power barges from General Electric and other suppliers, including Turkish firm Karadeniz Energy Group (KEG), which will rent two floating power plants to produce 450MW of electricity for the nation's electricity grid. The 10-year contract with KEG will cost Ghana US$1.2 billion and requires the government to create a US$100 million escrow account as a guarantee against non-payment for electricity by the state utility distributor, Electricity Company of Ghana. The terms of the agreement have generated political concerns in Ghana, with critics claiming that the government has secured an unfavourable deal. It is clear that emergency barges generate power at exceptionally high cost.

Another example is Tanzania. In 2011, Aggreko, one of the world's largest suppliers of emergency power, secured a US$37 million contract with the Tanzanian state utility, TANESCO, to establish two 50MW diesel power plants in response to hydropower shortages.[44] Both plants are still in operation. In total, the company is supply 1,000MW of power across 17 countries. What starts as an emergency response invariably becomes a permanent facility for delivering high-cost base-load power. Industry estimates suggest that the rental market for generators is growing at 13 per cent a year, from a 2013 base of US$1.8 billion. Africa's demand for imported generators has created a fast-growing market for companies in China, France and the United Kingdom.[45]

Power-sector utilities constitute a major fiscal burden for many countries. In 2010, Sub-Saharan Africa's energy utilities were operating with deficits estimated at 1.4 per cent of regional GDP, some US$11.7 billion.[46] This represented five times the level of publicly financed investment in the energy sector. Utility deficits are so large in some

countries as to compromise fiscal stability. In Tanzania, a combination of reliance on emergency power-generation, inefficiency and outright corruption left TANESCO, the state energy provider, with debts so large that they have compromised the country's entire budget **(Box 2)**. The direct 2015 budget costs of Senegal's state provider SENELEC are estimated at 2.8 per cent of GDP, which is more than the country spends on primary education.[47] In Burkina Faso losses associated with the state-owned electricity company (SONABEL) and fuel importer (SONABHY) absorbed 10 per cent of the 2013 budget, diverting expenditure from priorities.[48] The government has regularly supported debt forgiveness and the recapitalization of both companies.

Subsidies for electricity utilities represent a transfer from public funds to the small minority connected to the grid and to the suppliers of the utilities. Almost the entire benefit is captured by the wealthiest 20 per cent of the population.

Fiscal transfers to utilities also have wider ramifications. When governments take on utility debts, they typically finance them through private-sector banks. This is often lucrative business for the banks concerned but it prevents the banking system from directing savings towards financing productive investment.[49] It also sends negative signals to potential investors. In effect, government debt financing for utilities crowds out private investment.

In addition to financing loss-making utilities, many governments subsidize kerosene. According to the International Monetary Fund (IMF), the average subsidy applied to kerosene and other oil-based products amounted to 45 per cent of its market price in 2013, or US$10 billion.[50]

The overall effect of subsidizing consumption of fossil fuels is to distort energy pricing, incentivize overconsumption, deter investment in renewable energy, create unsustainable fiscal costs and lock households and energy systems into inefficient fuel-use patterns that perpetuate the underlying energy crisis.[51]

Energy subsidies have deep political roots, but reform is possible. Countries such as Ghana, Niger and Kenya have adjusted policies to bring domestic prices into closer alignment with international markets.[52] Several important lessons have emerged from the reform experience. In Ghana, the government carried out a detailed review of the distribution of benefits from subsidies and communicated the evidence to the public. It introduced new measures aimed at using savings from reducing subsidies to counteract harmful effects on the welfare of the poor, including reducing fees for education and increased spending on health. In Nigeria, reforms stalled in part because little advance effort was made to prepare the ground or to compensate the poor. The country's experience illustrated a wider concern: although the country's fuel subsidies are ill targeted, removing them can incur substantial individual costs for poor people.

Low oil prices have helped create a renewed impetus towards reforming subsidies on fossil fuels. Towards the end of 2014, Indonesia's new president, Joko Widodo, introduced legislation virtually eliminating the fossil-fuel subsidies that had been set to absorb 10 per cent of budget spending. The savings have been earmarked for social-protection programmes and infrastructure investment. India is also cutting subsidies. Both governments rightly see transfers for fossil-fuel subsidies as a source of inefficiency and inequality. Political leadership is needed to navigate subsidy elimination and effective communication of the potential benefits can help to mobilize a constituency for reform.

BOX 2 INEFFICIENCY, CORRUPTION AND EMERGENCY POWER PROVISION IN TANZANIA

Tanzania's state energy provider TANESCO has accumulated debts that are so large as to compromise the county's entire budget, forcing government to undertake painful fiscal adjustments. In 2012, transfers from the national budget to cover losses amounted to 0.3 per cent of GDP. Non-payment of bills to power providers and other suppliers amounted to another 1 per cent of GDP, undermining incentives for private investment in the process. TANESCO's operations contributed to one of Africa's largest current account deficits and a deteriorating fiscal deficit, which reached 6.8 per cent of GDP in 2012/2013.

Rising demand and under-investment in maintenance and operations has exacerbated power shortages. Outages are especially common during the dry season as the water levels fall in reservoirs serving hydropower stations. Reliance on emergency power provision has reinforced underlying economic problems. In 2013, TANESCO was spending twice as much on emergency provision as it was receiving in revenue, adding to an already large operating deficit. The company was forced to borrow US$250 million on commercial terms with a government guarantee. It also received a direct budget transfer of US$220 million, financed by the World Bank and the African Development Bank.

The most recent episode involves allegations over the irregular withdrawal of US$124m from an escrow account jointly held by TANESCO and Power Tanzania Ltd. (IPTL), a company formed under a public-private partnership agreement. A Parliamentary Public Accounts Committee has raised concerns over the acquisition of IPTL from a Malaysian company by a company called Pan Africa Power Solutions, through a British Virgin Islands connection and linkages to a businessman prominent in Kenya.

The parliamentary committee has raised concerns over transfers from the escrow account into off-shore funds. Payments include over US$70 million to one of Tanzania's richest men. While several senior political figures have been forced to resign, the committee's investigations have run into a web of offshore accounts with unknown beneficial ownership structures. Tanzania's Revenue Authority (TRA) has called for Interpol to investigate.

Whatever the precise circumstances and scale of illicit payments, the diversion of resources from an energy system unable to provide reliable power or to reach 7.2 million Tanzanians has been considerable. Ironically, the parliamentary session during which the report was presented was disrupted by a power outage.[53]

In the case of Sub-Saharan African, the potential benefits are very significant. Redirecting the US$21 billion of energy subsidies which currently enhances the welfare of the wealthy into energy infrastructure, access to electricity and social protection could unlock major gains. According to the IEA, the costs of achieving universal energy access for Sub-Saharan Africa are around US$20 billion per year.

Fixing Africa's under-performing utilities is another urgent priority. By selling electricity to a favoured middle class at prices that are less than the cost of production, utilities have been unable to generate the revenues needed for investment in operations, maintenance and new infrastructure. Transmission losses, a by-product of under-investment in maintenance, raise the costs of generation and diminish revenues. Failure to collect fees is endemic.

Utilities need to generate an operational surplus in order to finance investment and cut subsidies, which implies price levels sufficient to generate a margin. But in countries with very low levels of average income, price increases can render electricity unaffordable.

Getting the balance right requires market pricing balanced with a strong commitment to equity which is supported through regulation and public finance.

Part of the challenge is political. All too often utilities are viewed less as a mechanism for delivering affordable energy for all than as sites of political patronage and rent-seeking. Changing utility practices often implies a commitment to changing power relationships and the politicization of utilities.

Market failures are undermining opportunities for investment and poverty reduction

Viewed from an investment perspective, replacing existing fuels with modern energy represents a widely neglected market opportunity. Access to modern energy systems could cut household costs, with benefits for expenditure and investment in other areas.

In Sub-Saharan Africa, 692 million people live on less than US$2.50 a day, 60 per cent of them on less than US$1.25 a day. Assuming an average of five people per household and an average monthly household expenditure of US$6 on energy, this represents an annual market of US$10 billion **(Figure 21)**.

The market does not serve the poor well. Translated into equivalent cost terms, Africa's poorest households are spending around US$10/kWh on lighting, or around 20 times the amount spent by high-income households with a connection to the grid.[54] By comparison, the national average cost for electricity per kilowatt-hour in the United States and is US$0.12 and in the United Kingdom US$0.15.[55] A rural woman in northern Nigeria spends around 60 to 80 times more per unit of energy consumed than a resident of Manhattan or London. The same woman also spends some 30 times more than the residents of high-income households with grid connections in gated communities in Lagos.

Reducing energy costs would help break the poverty trap

Cutting the cost of energy could generate significant benefits for poor households. Basic lighting can be provided through low-cost renewable technologies at prices as low as US$1-2/kWh, implying cost reductions of 80-90 per cent.[56]

Similar savings are available for clean-cooking stove technologies. Just halving costs would save US$5 billion for people living below US$2.50, or US$36 per household. Plausible price reductions of 80 per cent would raise these figures to US$8 billion overall, US$58 per household. Such savings could release income for investment in productive activities, health and education, while at the same time increasing demand for electricity.

It is not feasible to derive poverty-reduction effects from these figures as more detailed household survey evidence would be required to identify the distribution of benefits. However, there is considerable potential for energy savings to be converted into reduced poverty. Cutting energy costs by the levels indicated in our exercise could lift 16-26 million people out of poverty.

FIGURE 21 THE COSTS OF ENERGY AND POTENTIAL SAVINGS (HOUSEHOLDS ≥ US$1.25)

Poverty line	Population (million) living below the poverty line	Number of households (million)*	Total expenditure for lighting and cooking (billion US$/year)**	Savings (billion US$/year) from reducing the costs	
				With 50 percent reduction	With 80 percent reduction
≥1.25US$	416	83	6	3	4.8
Between 1.25 and 2.50US$	276	55	4	2	3.2
≥2.50US$	692	138	10	5	8
Total	1,384	276	20	10	16

* Assumption: Each household has five members
** Example: (83 million households X 6US$/month X 12 months) = 6 billion US$

Data sources: The World Bank Group. (2011). PovcalNet. Modi, V. (2004). Energy Services for the Millennium Development goals.

Viewed from a different perspective, current expenditure patterns represent a market opportunity **(See infographic: Africa's billion dollar energy market)**. Flexible renewable technologies, especially solar photovoltaic (PV) cells, have the potential to deliver energy at lower unit costs than those now paid by poor households. Moreover, cutting costs would unlock demand.

Providing households with a first step on the modern energy ladder through reasonable access to electricity charged at US$1-2/kWh could increase electricity consumption fourfold.[57] Investors stand to gain from providing the energy sources that could substitute for biomass and other products, and households stand to gain from lower prices.

An obvious question that arises is: "Why has the market not delivered change?" There is no easy answer. Part of the problem is that poor households are unable to afford the upfront capital costs of the technologies that could lower prices and generate savings over the long run. This is a classic market failure that can be corrected through new business models and more effective public policies. Another constraint is the difficulty faced by firms in securing credit and equity for investments geared towards markets characterized by limited purchasing power. Here, too, public policy and international cooperation can make a difference, as we show in Part III.

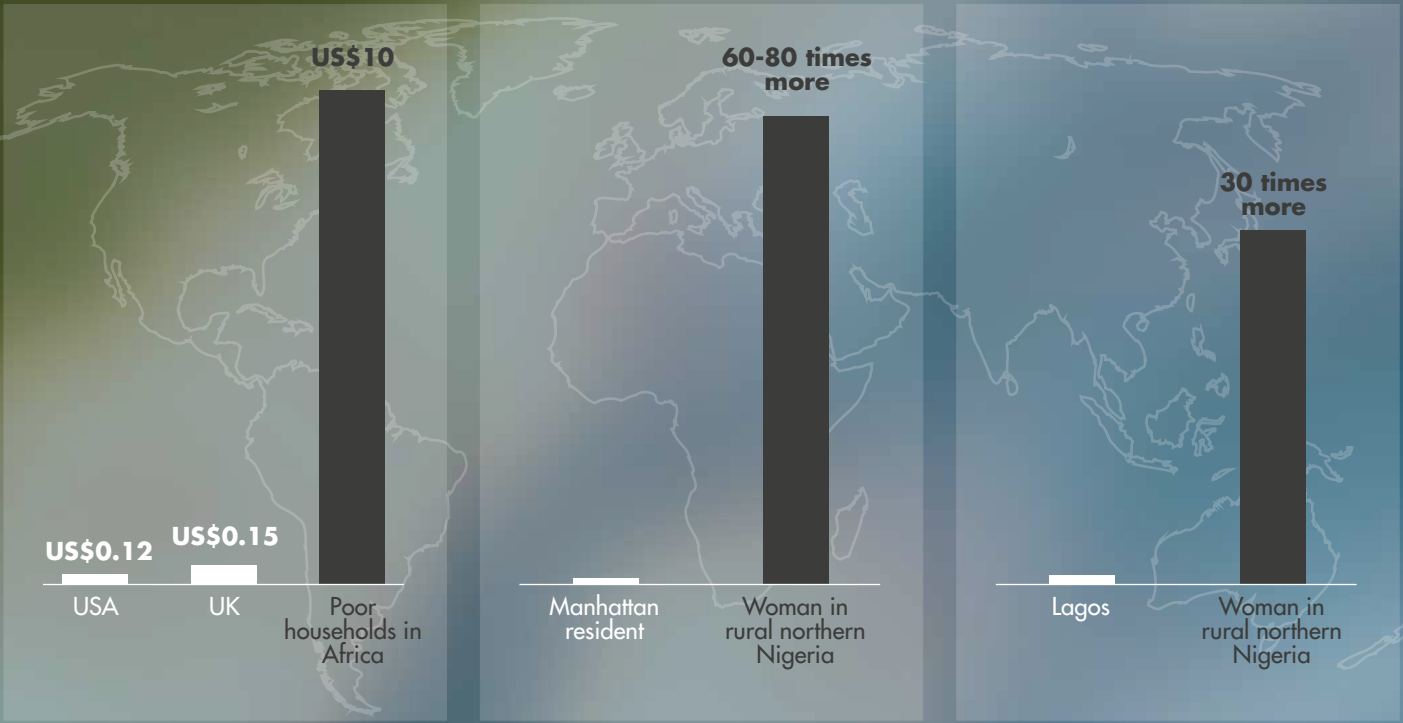
Financing energy for all will take a step change in investment

Energy systems in Africa are chronically under-financed. About three-quarters of government spending is allocated to operations and maintenance, leaving little scope for investment in an expanded, more efficient and more equitable energy system. Investment constraints also hold back opportunities for Africa to benefit from the wave of innovation in renewable technology.

AFRICA'S BILLION DOLLAR ENERGY MARKET

Reducing prices, increasing access, empowering households

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



US$10 billion

The amount spent on energy by Africans living on less than US$2.50 a day

The size of the energy market points to significant opportunities for investment and household savings

Reducing energy costs

by investing in modern energy could

CREATE INVESTMENT OPPORTUNITIES

INCREASE HOUSEHOLD SAVINGS

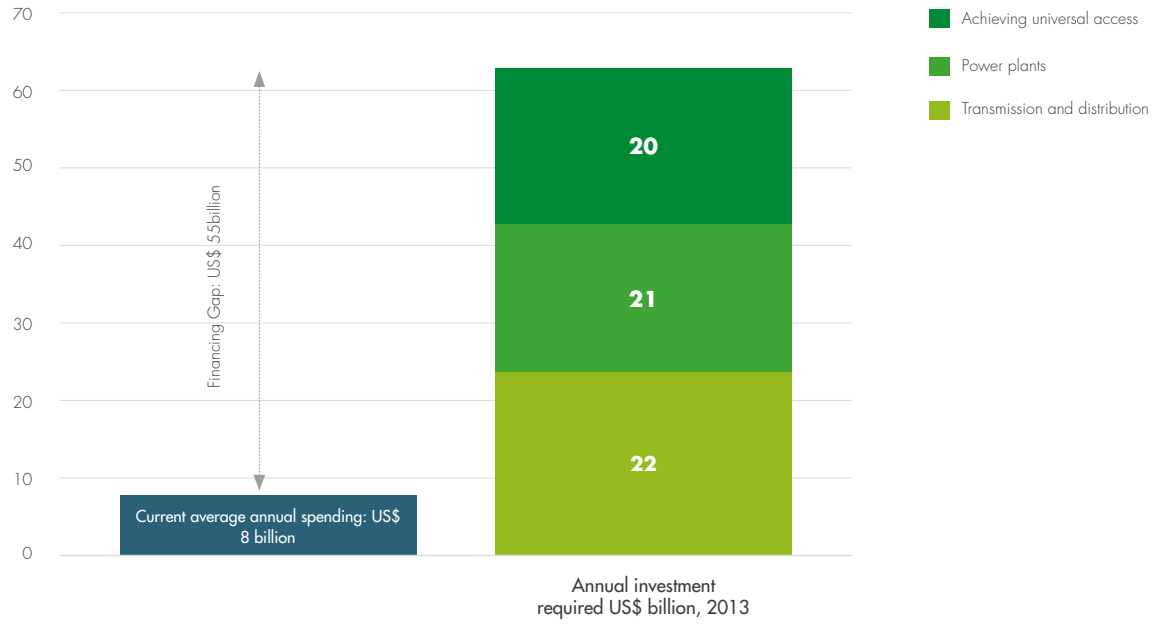
REDUCE POVERTY

How big is the investment gap that has to be closed if Africa is to transform its energy system? We can address the question by referring to IEA scenarios. These scenarios, which we discuss in further detail below, are conservative. They assume a three- to fourfold increase in power by 2040, taking into account investment in power plants and transmission and distribution systems.

The IEA scenarios include some provision for expanding access but not for universal access. We therefore supplement the investment costs included in the scenario by making provision for the US$20 billion per annum that the IEA estimates is required between 2015 and 2030 to achieve energy for all.[58]

Current spending on investment is around US$8 billion a year, or some 0.49 per cent of GDP. Public financing accounts for around half of overall investment and Chinese investment, public–private partnerships and concessional development finance cover the rest. Covering the costs of investment in plant, transmission and distribution would require an additional US$35 billion annually. Adding the full costs of universal access would take another US$20 billion. The total investment gap of about US$55 billion a year represents around 3.35 per cent of GDP **(Figure 22)**. This figure does not take into account spending on operations and maintenance.

FIGURE 22 AFRICA'S ENERGY FINANCING GAP: AVERAGE ANNUAL COST OF UNIVERSAL ACCESS PLUS INCREASED POWER GENERATION



Notes: The estimates are based on an outcome mid-way between the IEA's New Policy and Africa Century scenarios

Data source: Derived from current investments and IEA scenario data.

OPPORTUNITY AFRICA
The region's vast untapped energy potential

Africa's energy systems stand at a crossroads. For countries across the region, this is a moment of great opportunity. Two-thirds of the energy infrastructure that should be in place by 2030 has yet to be built. Demand for energy is set to surge, fuelled by economic growth, demographic change and urbanization. Cities could emerge as hubs of innovation. As concerns over climate change spur innovation that is driving down costs for low-carbon energy, Africa could seize the opportunity to leapfrog into a new era of power generation. No region has more abundant or less utilized renewable energy potential. Decentralized power generation and distribution systems are opening up new possibilities for reaching populations currently bypassed by national grids **(See infographic: Opportunities)**.[59]

But such positive outcomes are not guaranteed. Power-generation capacity could fail to keep pace with demand, creating an increasingly restrictive energy bottleneck. The energy gap between Africa and other developing regions could widen, with damaging consequences for Africa's place in increasingly interdependent and competitive global trading systems. Energy planning in Africa has suffered from a backward-looking conservatism that could leave the region on the sidelines of the global low-carbon energy revolution. Even if power generation increases, there is a danger that large numbers of people will be left behind, especially in rural areas and urban informal settlements.

The stakes could hardly be higher. Transformation of Africa's energy systems would transform prospects for inclusive growth that reduces poverty and accelerates progress in improving people's lives. Perpetuating the limited and unequal access to small amounts of power that characterizes much of Africa today is a prescription for inequality and restricted opportunity.

There are two fundamental requirements for changing this picture. First, the quantity of power generation has to undergo a step increase. Current scenarios for the region developed by the IEA and others lack ambition and are not aligned with developments in Africa. Second, far more attention has to be paid to the most disadvantaged. Too many energy plans focus on generating more gigawatts, with insufficient regard to equity and access to electricity. This is inconsistent with the commitment to deliver energy for all by 2030. Devolved power generation, coupled with more flexible approaches to grid development, could bring electricity to every household in Africa. However, success will require strong political leadership to overhaul the governance of power utilities.

"Access to electricity is fundamental to opportunity in this age. It's the light that children study by, the energy that allows an idea to be transformed into a real business. It's the lifeline for families to meet their most basic needs, and it's the connection that's needed to plug Africa into the grid of the global economy."

Barack Obama
President of the United States of America

OPPORTUNITIES

A powerful current is sweeping across Africa's energy systems

The untapped potential of Africa's primary energy resources (excluding South Africa) is estimated to be

260 times the current grid-based capacity

1. URBANISATION

2. POPULATION GROWTH

3. ECONOMIC GROWTH

4. ELECTRIFICATION

are driving an increase in **energy demand**

Burkina Faso, Ethiopia, Ghana, Kenya, Mauritania and South Africa **are at the forefront of renewable energy innovations**

The renewable advantage: speed and decentralisation

Africa can ride the wave of new technologies and innovation to enter a new era of power generation

Africa has a late-comer advantage

adopt, adapt and innovate

Governments are setting a higher bar for ambition – and some are delivering →

Rwanda expanded electricity access by **160 percent** between 2008 and 2011 →

Ethiopia is set to achieve **zero net emission status by 2027.** No developed country has matched this level of ambition

Africa can lead the world on climate-resilient, low-carbon development - a triple-win for

1. CLIMATE

2. POVERTY REDUCTION

3. ECONOMIC GROWTH

Prices for renewable technologies are falling and are now competitive with fossil fuels →

→ Africa's governments can lay the foundations for a low-carbon future. In some countries, fossil fuels – including coal – will continue to figure in the energy mix

International development finance can unlock significant private investment to spur a renewables revolution

Regional cooperation is deepening:

Only **5 per cent** of electricity is traded across African borders so the potential is huge

The AU is backing a **US$22 billion** project to develop a pan-African electricity highway by 2020

In West Africa, the AfDB is supporting a project that will increase access to low-cost electricity for **24 million people**

Energy demand is rising and set to surge

Energy systems across Sub-Saharan Africa are struggling to cope with rising demand for power generation. That struggle is set to intensify. Four powerful drivers of demand are evident:

- **Economic growth:** Each percentage point in GDP growth in developing countries tends to be accompanied by growth in energy demand of 1.2-2.3 per cent.[60] Africa has been an exception to the rule. Sustained economic growth at 4-5 per cent would change this picture, generating demand for electricity among companies and an emerging middle class.

- **Population growth [61]:** Between 2015 and 2040, the population of Sub-Saharan Africa is expected to increase by 755 million, or 81 per cent. Electricity generation will have to almost double by 2040 simply to maintain per capita provision. Similarly, access rates will have to increase by more than population growth to achieve energy for all.

- **Urbanization:** By 2050 around one half of Africans will live in cities, compared with just over one-third today – an increase in the urban population of 800 million people **(Box 3)**. The implications for energy provision are far-reaching. Today, urban consumers in Africa use on average three times more electricity than their rural counterparts. Urbanization also lowers the cost of connectivity. The cost of connecting a new household to the grid typically ranges from US$500 in high-density urban areas to US$1,500 for sparsely populated areas that are far from the grid.[62]

- **Electrification rates:** As more households and firms are connected to the grid, demand for energy will rise. The rate of increase will be determined by price, the degree to which firms replace generator-fired power with grid-based power and consumption levels among newly connected households and companies.

BOX 3 AFRICA'S URBAN FUTURE – RISKS AND OPPORTUNITIES

Sub-Saharan Africa is home to some of the world's fastest-growing cities **(Figure 23)**. Unplanned urbanization on the current model will lead to cities marked by high levels of pollution, restricted access to services and rising greenhouse gas emissions. There is an alternative that will benefit Africa and the world.

Research carried out for this report tracked urbanization and the economic prospects of Sub-Saharan Africa's 69 largest cities across 35 countries. The results show:

- Half of the world's fastest-growing cities are in Sub-Saharan Africa; 13 cities will double their population between 2012 and 2030; and Lagos will be home to 25 million by 2030.
- The GDP of the 69 African cities is set to increase by US$750 billion, or 167 per cent, by 2030, based on "business as usual" economic growth. While these cities currently represent less than a fifth of the population, they already generate 36 per cent of GDP.
- The number of low-income cities is set to decrease from 15 to 4 between 2012 and 2030.

Across the world, urbanization has created hubs of innovation, vibrant new markets and productivity gains. But the "urban dividend" is not automatic.

Africa's urbanization has been a largely unplanned consequence of rural poverty. The rise of a new high-income elite has deepened already pronounced social divides. The sprawling slum of Kibera in Nairobi, for example, is separated from the homes of Kenya's super-rich by a single road. Urban sprawl is pushing settlements into agricultural areas and onto increasingly precarious sites susceptible to flooding.

Cities built in this fashion haemorrhage economic opportunities and amplify social and environmental stress. Lacking access to modern energy, poor households resort to burning charcoal. Emissions of soot, traffic fumes and smoke have created dangerously high levels of particulate matter, which is linked to premature death, asthma, heart attacks and respiratory diseases.

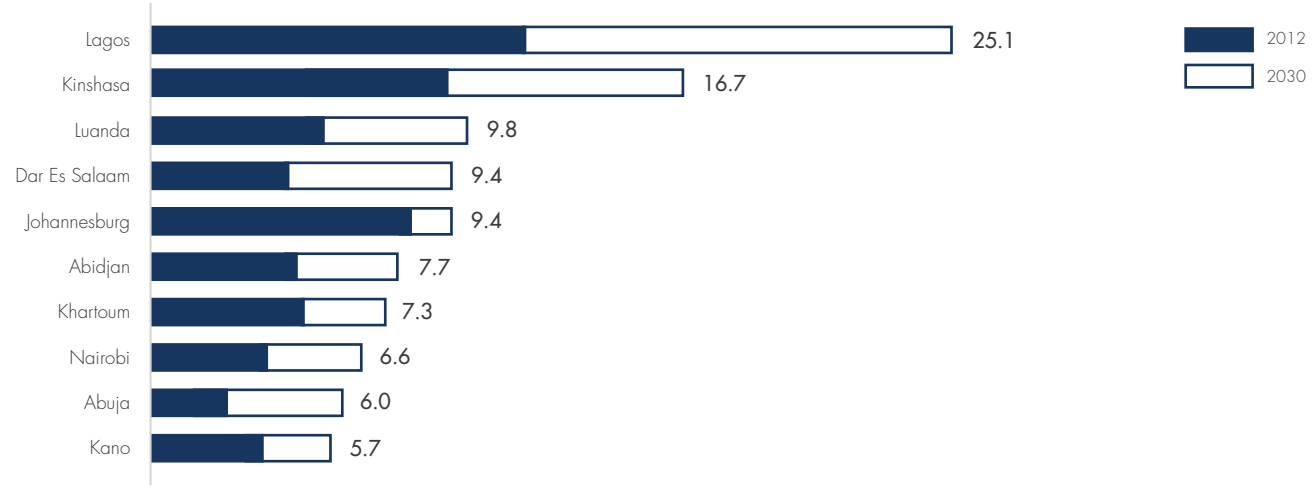
Road-traffic problems reinforce the costs of pollution. Sub-Saharan Africa has the world's lowest levels of car ownership, but the highest levels of road death (322 road deaths per 100,000 cars) and some of the world's most congested cities. One study in Lagos estimated that commuters lost 3 billion hours annually to congestion and that a 20 per cent reduction in congestion would save US$1 billion every year.

There is an alternative. City authorities can work with utilities and the private sector to expand access to affordable electricity. Renewable-energy technologies offer opportunities to leapfrog grid-based systems through solar and wind power.

Similarly, Africa's urban transport crisis could become an economic opportunity if managed in the right way. Cities such as Lagos and Abuja in Nigeria and Addis Ababa in Ethiopia have developed bus rapid transit and light rail systems, modelled on best international practices. Some governments are also responding to the emerging crisis of air pollution. The five member states of the East African Community have committed to a shared target for lowering sulphur emissions in fuel.

Other opportunities can be created by allowing entrepreneurs access to the urban waste-stream and by devolving sanitation services to communities. Compact, cohesive and connected African cities could bring benefits in terms of economic growth, jobs and less pollution, while reducing transport-related emissions.[63]

FIGURE 23 AFRICA'S EXPANDING CITIES (PROJECTED POPULATION GROWTH TO 2030)



Data source: Godfrey, N and Zhao, X. (2015). The Contribution of African Cities to the Economy and Climate: Population, economic growth, and carbon emission dynamics.

Mainstream scenarios fall far short of the ambition needed

Scenarios developed by the IEA and others provide an insight into some of the energy challenges facing policymakers in Africa, as well as the potential costs of meeting higher levels of demand.

The results of these exercises are instructive. As illustrated previously, the two core scenarios of the IEA, the new policies scenario and the more ambitious African century case, envisage a substantial increase in power but neither achieves universal access. IEA's demand modelling suggests that electricity generation will need to increase by a factor of four to six by 2040. Over the next 15 years, under these scenarios, electricity generation would increase from 440TWh in 2012 to between 974TWh and 1124TWh by 2030. A scenario developed by McKinsey is also within this range. The unifying conclusion is that power generation will increase by around 4 per cent a year.

Measured against the record of the past 15 years, a 4 per cent annual increase in electricity generation would mark a step increase.

Viewed against a higher level of ambition, the projected increases look less impressive. In the IEA's standard scenario, per capita electricity availability for Sub-Saharan Africa, excluding South Africa, would amount to around 830kWh in 2040. This is well below the level in India today and around one-third the current level in Thailand. To raise the entire region of Sub-Saharan Africa to the average current per capita electricity access of South Africa would require a 33-fold increase in installed capacity.[64] One recent study has shown that even a less ambitious 10-fold increase would require a 13 per cent per annum average growth rate.[65]

Many people could be left behind

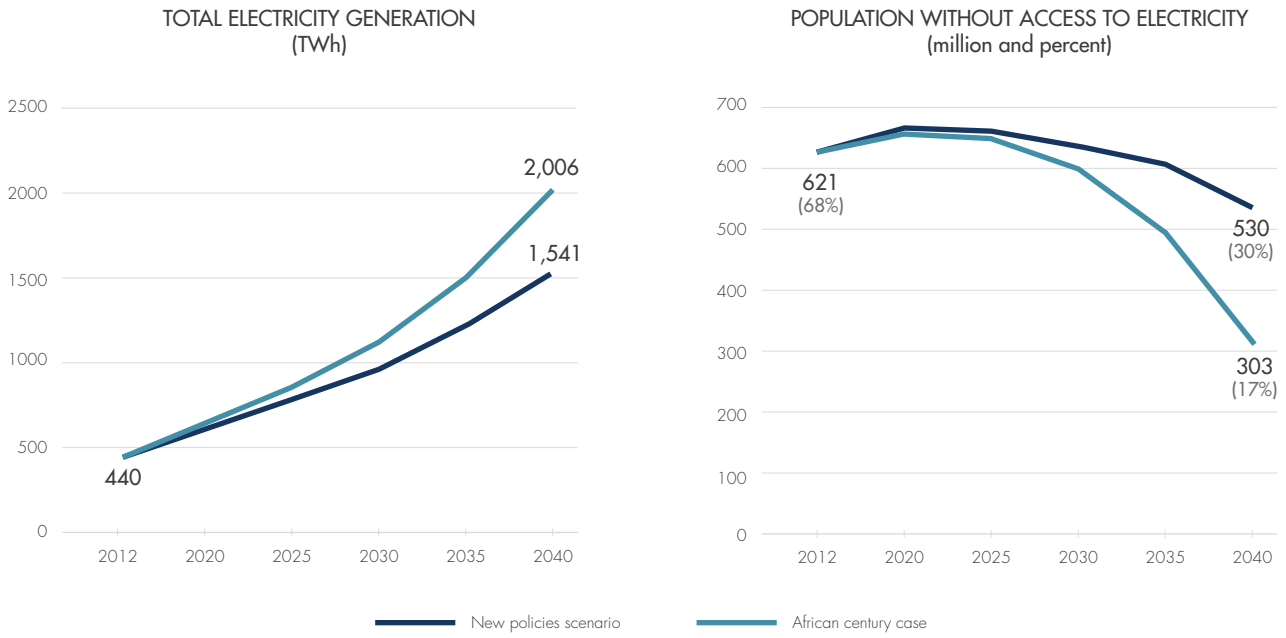
The standard energy scenarios also serve to highlight concerns over equity. Even with a fourfold increase in power generation, millions of Africans would literally be left in the dark.

Universal access to electricity does not imply high levels of consumption. The IEA provides an initial threshold for energy access in rural areas at 250kWh for rural households and 500kWh for urban households, assuming a five-person household. At this level, access is sufficient to power a couple of light bulbs for a few hours a day, charge a mobile phone and, in urban areas, perhaps run a fan. The IEA thresholds equate to 50-100 kWh per person annually, or around 0.5 per cent of consumption in the United States and 5 per cent of average consumption in Latin America. These are hardly ambitious targets.

Yet neither the IEA nor the McKinsey scenarios anticipate universal access to energy by 2040, let alone by the 2030 target date envisaged under the Sustainable Development Goals **(Figure 24)**. The IEA scenarios would leave between 595 million and 635 million people without access in 2030, or between 43 per cent and 46 per cent of the region's population. The McKinsey scenario envisages 70-80 per cent access by 2040.[66]

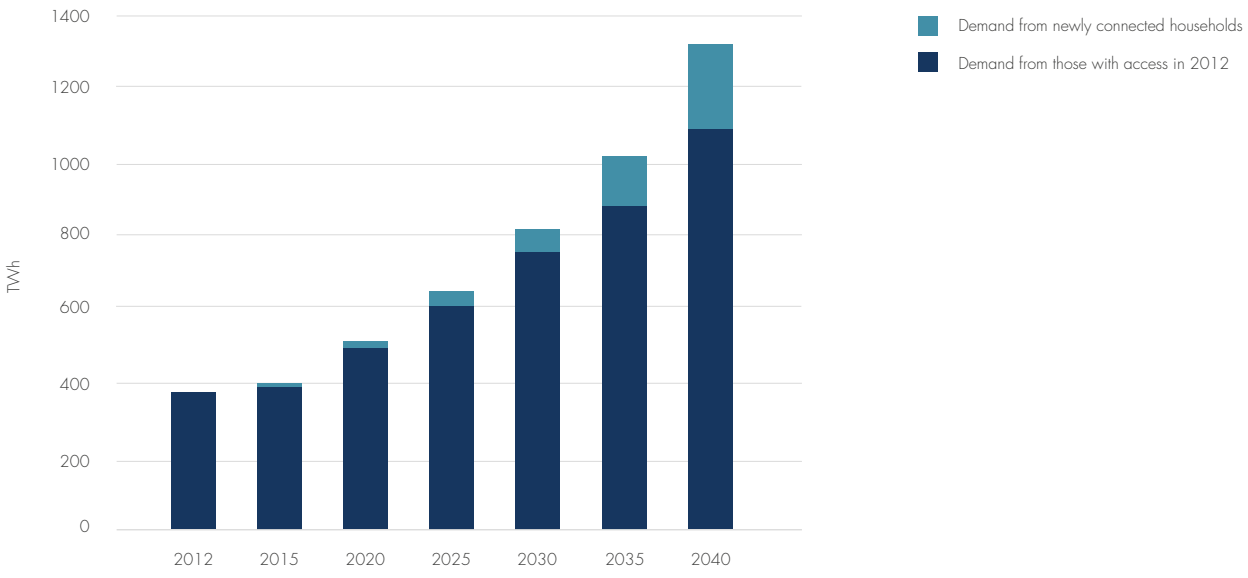
These numbers imply that populations now without access will account for a very small share of the additional electricity consumption. If these scenarios become reality, the direct benefits of connectivity will trickle down at a desperately slow pace **(Figure 25)**.

FIGURE 24 IEA SCENARIOS WOULD GENERATE MORE POWER: BUT DO LITTLE TO INCREASE ACCESS



Data source: International Energy Agency. (2014). Africa Energy Outlook: A focus on energy prospects in Sub-Saharan Africa.

FIGURE 25 MORE POWER, UNEQUALLY SHARED (PROJECTED ELECTRICITY DEMAND BY SOURCE, IEA SCENARIO, 2012-2040)



Data source: Derived from IEA scenario data.

Policymakers need to raise the bar for ambition

The projected access figures for 2030 raise important questions for policy makers. The IEA is one of the world's most influential bodies in energy policy and its *Africa Energy Outlook* is rightly seen as an authoritative source of data and analysis.[67] Yet the core scenarios developed by the agency question not just the region's capacity to make an energy transformation, but also the credibility of international commitments to achieve energy for all by 2030.

While recognizing the evidence that can be marshalled to support the claim, the Africa Progress Panel rejects the conclusion. Financing, political will and effort are not fixed parameters; they can be changed through strong political leadership and effective international cooperation. Africa cannot afford a level of ambition that leaves the region without the power needed to support economic growth, and millions of the region's citizens without access to even the most basic level of electricity.

If more ambitious goals are to be achieved, policymakers have to abandon the traditional incremental approaches and assumptions that underpin the IEA scenarios and focus on transformational change in two areas. First, overall power generation needs to increase at least 10-fold by 2040 if Africa's energy systems are to support the growth in agriculture, manufacturing and services needed to create jobs and raise living standards. Second, if governments are serious about the 2030 commitment of "energy for all", they must adopt the strategies needed to extend provision through the grid and beyond the grid. This is an area in which technological choice matters. Households lacking access to electricity cannot afford to wait 15-20 years until large-scale, capital-intensive projects come on stream. The speed of deployment matters and new technologies are dramatically increasing the speed at which initial access can be provided.

There is no shortage of evidence to demonstrate what is possible. Brazil, China and Indonesia have achieved rapid electrification over short time periods.[68] Vietnam went from levels of access below those now prevailing in Africa to universal provision in around 15 years **(Box 4)**. The country expanded electricity consumption fivefold between 2000 and 2013. Bangladesh has increased electricity consumption by a factor of four over the same period.

In each case, the transition to universal modern energy access was based on a transformation in ambition, allied to the adoption of new technological systems, institutional reform and finance. Equity has figured prominently, as poor households and rural areas were accorded a high priority.[69]

Given the pace of technological change, past experience may not provide a guide to future options. Electrification has tended to progress slowly at access rates below 20 per cent, accelerate between 20 per cent and 80 per cent, and then slow down as energy systems are extended into more remote and poorer areas.[70] With the emergence of new renewable technologies that can deliver affordable decentralized power to households, both the take-off and the "last mile" could see accelerated progress.

Several African countries are already in the early stages of what may be an energy transformation. In some cases the starting point is a very low level of access and per capita provision. Even so, countries as diverse as Ethiopia, Kenya, Rwanda and South Africa are pushing back the boundaries of what appears possible.

BOX 4 LESSONS FROM VIETNAM'S DRIVE TOWARDS UNIVERSAL ACCESS

The experience of Vietnam cautions against adopting a low level of ambition in transforming energy systems. In 1990, only 14 per cent of the population had access to electricity. Today, Vietnam nearly has universal coverage. Electricity production rose by a factor of ten between 1990 and 2010. Fossil fuels have increased their share in the primary energy mix but renewable energy provision increased fivefold.

Whether measured in terms of power generation, access or average consumption, Vietnam has attained indicators for electricity far in excess of those that would be predicted on the basis of the country's income levels. The extension of the transmission and distribution grid played a critical role in facilitating Vietnam's transition to energy for all. Public investments in the 1990s created a network of high-voltage and medium-voltage transmission lines, including a national North-South line, allowing power produced by major hydropower projects to be transmitted across the country.

Universal access to electricity has been attained at relatively low levels of consumption. Most households in the poorest 40 per cent consume less than 100kWh. However, the poorest households also benefit indirectly from the electricity utilized by small enterprises for agro-processing.

What are the factors behind Vietnam's success? Beyond sustained political leadership, three factors stand out:

The development of a central grid and a decentralized system
Despite the presence in the 1990s of a state electricity monopoly, reforms allowed local communes and groups of households to play a role in distribution through the purchase of electricity. By 2010, local distribution utilities (LDUs) were operating in almost two thirds of the country's 9,087 communes.

Pragmatic market reform with strong regulation
Vietnam has undertaken far-reaching energy-sector reforms, which are moving the country towards the creation of competitive generation and wholesale markets where sellers (power plants) and buyers (distributors and large consumers) will operate in a competitive power pool. Average tariffs are set and collected at levels sufficient to generate a profit for reinvestment and maintenance.

Financing provisions
Targets for electrification have been linked to finance. Public investment has dominated the drive towards universal access and expanded power generation. Community-level contributions have also played a key role, accounting for around one-third of overall financing. Aid played an important role in financing energy infrastructure, but had a residual role in rural electrification.[71]

Africa's energy assets – vast but under-exploited

Sub-Saharan Africa may be starved of electricity, but the region is extraordinarily rich in energy assets. Measured in terms of technical potential, the power-generation capacity of gas, coal and hydropower resources vastly exceeds existing levels of power generation. Adding solar and wind power to the mix dramatically increases the potential.

Exploiting that potential requires finance, technology and institutional capabilities that are missing in many countries. Moreover, energy planners are making decisions in a fast-moving environment. Received wisdom is dissolving in the face of an extraordinary wave of innovation in low-carbon technologies. Concern over climate change will strengthen that wave, with potentially revolutionary consequences.

Received wisdom is dissolving in the face of an extraordinary wave of innovation in low-carbon technologies. Concern over climate change will strengthen that wave, with potentially revolutionary consequences.

There is no roadmap to guide the decisions that African governments have to make. Every government has to determine what constitutes a judicious mix of energy sources in the light of its natural resources, financial and technological capabilities, and where the country is starting from. But no government can afford to ignore the emerging opportunities associated with low-carbon technologies.

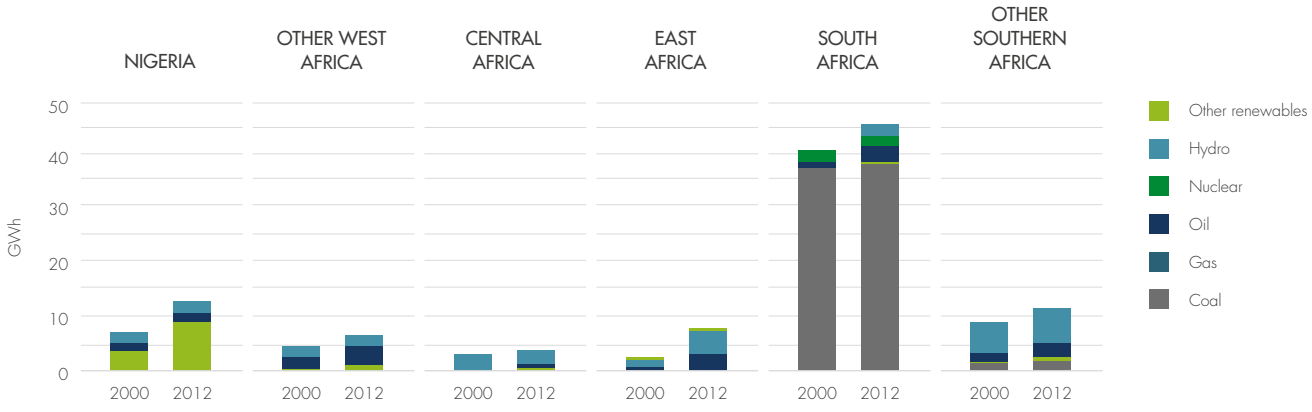
The starting point – small grids dominated by hydro-power and coal

Regional energy figures for Sub-Saharan Africa are distorted by the size of South Africa's grid. Coal is the dominant primary energy resource for the region, accounting for 45 per cent of total electricity supply. However, hydropower is by some distance the main source of energy for most countries. Taking South Africa out of the equation, hydropower accounts for around 70 per cent of power generation.

Figure 26 provides a subregional snapshot of grid-based capacity. To summarize a complex picture:

- **Southern Africa:** The 46GW grid in South Africa is dominated by coal. The remaining three-quarters of the population accounts for one-fifth of installed capacity, with hydro-power and oil dominating. South Africa is one of the world's major coal producers and exporters.
- **West Africa:** Around half of the subregion's 20GW grid is gas-fired, with oil accounting for another one-third of capacity and hydropower for 20 per cent. The high share of oil results in average costs of generation more than double the costs for southern Africa.
- **East Africa:** Total grid capacity has tripled since 2000 as a number of major hydropower projects have come on stream, including the Merowe dam in Sudan and Ethiopia's Beles II and Gilgel Gibe II dams. Hydropower accounts for around half of grid capacity, with oil-fired generation accounting for over 40 per cent of the remainder.
- **Central Africa:** The subregion has the most limited grid capacity of 4GW and the growth of that capacity has been very slow. Hydropower dominates, accounting for around two-thirds of output.

FIGURE 26 BEHIND THE BIG PICTURE: FRAMING ENERGY SOURCES BY SUB-REGION (GWh, 2000 AND 2012)



Data source: International Energy Agency. (2014). Africa Energy Outlook: A focus on energy prospects in Sub-Saharan Africa.

One of the standout features of the current primary-energy mix is the limited role of renewable energy other than hydropower. There has been a marked increase in generation of geothermal energy in East Africa over the past decade and generation is increasing using both solar photovoltaic and wind-power technologies. However, renewable-energy sources currently represent around 1 per cent of total grid-based capacity.

Regional trade in energy is weakly developed. Sub-Saharan Africa has four operating power pools but all are operating well below optimal levels.[72] Less than 8 percent of power crosses the region's borders, despite the capacity needs of many countries. The southern African power pool is the most developed and electricity exchanges from Cahora Bassa in Mozambique to South Africa dominate trade within the subregion. In central and eastern Africa, less than 1 percent of power crosses international borders. The West African gas pipeline, first mooted in the mid-1980s, is a case study in failed regionalism.[73]

Primary energy potential – a snapshot of the inventory

Measuring energy potential is inherently difficult. Even so, Africa has rich primary-energy resources in the form of reserves of fossil fuel and resources for hydro, solar and wind power. Tapping into even a fraction of the technical potential would transform the region's energy systems. Estimates developed by McKinsey put the untapped potential at 1.2TW, excluding solar power. To put this number in context, it represents 26 times the current grid-based capacity (excluding South Africa). Adding solar potential to the equation would multiply the potential by a factor of 10.

Africa currently utilises a fraction of the region's technical **hydropower** potential. Overall potential capacity has been estimated at 1,844TWh a year, three times the current total electricity consumption for the entire region.[74] The untapped potential for large rivers is mainly concentrated in the Upper Nile and the Congo.

The Democratic Republic of the Congo alone accounts for around half of the region's technically exploitable hydropower potential. The Grand Inga project **(Box 5)** could add around 44GW to Africa's grid. While large hydro-projects capture the headlines, small-scale hydropower plants represent very large potential. Sub-Saharan Africa currently has 588 small plants in operation with an average size of less than 10MW.[75]

Hydropower will remain the primary source of non-fossil fuel energy. Major investments have been put in place. The Grand Ethiopian Renaissance Dam (GERD), now being built in the Benishangul-Gumuz region near the border with Sudan, will be one of the world's largest dams. Five other major hydro-projects with a capacity in excess of 1GW are under development, two in Ethiopia, two in Angola and one in Mozambique. The Niger, Orange and Senegal river systems have large potential for hydropower.

Realizing that potential creates development challenges that go beyond power generation. The up-front costs of designing and constructing big dams are very high; investment in GERD absorbs around 10 per cent of Ethiopia's budget. Harnessing water for energy can mean a loss of river irrigation for smallholder farmers. Impacts on local people can be very severe, especially in communities subject to forced displacement. Few governments have put in place the mechanisms needed to protect human rights and provide adequate compensation. Large dams also have social, environmental and economic consequences for downstream countries.

BOX 5 THE GRAND INGA – A TRANSFORMATIVE BUT DELAYED PROJECT

Nothing better illustrates the gulf between Africa's power potential and current provision than the Grand Inga project. This envisages the construction of the world's largest hydropower complex in the west of the Democratic Republic of Congo. If constructed, the 44GW plant would double the electricity production capacity of Africa in one stroke. Grand Inga could generate more power than the Three Gorges Dam in China, making it the world's largest infrastructure project.

Over the decades many plans for the development of Grand Inga have been drawn up and consigned to the dustbin. Two dams, Inga 1 and Inga 2, were built more than 30 years ago. Utilization rates are desperately low, however, because of poor maintenance, under-investment and political instability. Rehabilitation is underway, although repeatedly delayed by financing constraints and governance concerns.

Strengthened governance in the Democratic Republic of the Congo is one condition for development to proceed. Another is prior agreement on a cross-border network of transmission lines, cooperation between utilities, and critically a financially viable buyer to make the project bankable. Grand Inga can only work with the development of a regional grid. The AfDB continues to play a crucial role in the development of Inga III.[76]

Sub-Saharan Africa has abundant reserves of **coal** and **oil**. At current production levels, coal reserves are sufficient to meet demand for around 141 years. Most of the reserves are concentrated in South Africa. However, Mozambique has the potential to emerge as a major producer, with estimated reserves of 25 billion tonnes. Recoverable resources of oil are placed at around 65 billion barrels, enough for another century of production at current levels. New discoveries are expanding the reserve levels. Sub-Saharan Africa has accounted for around 60 per cent of new oil discoveries since 2000, with traditional West African countries being joined by new suppliers. The Jubilee field in Ghana and the Kingfisher field in Uganda have raised prospects of wider discoveries, with intensive exploration under way in Kenya's Rift Valley and Ethiopia's Ogaden Basin. Madagascar has emerged as a potentially significant producer of unconventional oil.

Natural gas has emerged as a regional energy game-changer. West Africa dominates production, with Nigeria's exports having quadrupled since 2000. But the major news story is in East Africa. Ten years ago, neither Mozambique nor Tanzania would have figured among the major gas producers of Sub-Saharan Africa. Today they account for about half of gas-fired power potential.[77] Mozambique's estimated reserves are the fourth largest in the world. Only a small group of countries – Cameroon, Côte d'Ivoire, Nigeria, South Africa and Tanzania – currently use their gas resources for domestic consumption. This could change. McKinsey estimates a regional potential of about 400GW of gas-generated power to 2040 and Mozambique, Nigeria and Tanzania account for 60 per cent of the total. Ongoing exploration is likely to produce further discoveries of natural gas, partly because exploration in Sub-Saharan Africa remains underdeveloped by comparison with the rest of the world.

Non-hydro renewable energy capacity is extraordinarily rich:

- **Geothermal** capacity is estimated at 7GW to 15GW, with a concentration in East Africa. The Rift Valley's very large geothermal potential is already being exploited by Kenya and developed by Ethiopia. In Kenya, geothermal's contribution to the national energy mix is now over 50 per cent.

- **Solar power** is Africa's most abundant but least utilized source of energy generation. Potential capacity has been placed as high as 10 terawatts (TW).[78] Most of the region enjoys more than 300 days of bright sunlight and irradiance levels twice the average for Germany, where a thriving solar industry has developed. Estimates of prospective solar photovoltaic (PV) electricity supply by 2030 range from 15GW to 62GW.[79]

- **Wind-power deployment** is limited but the potential is large. Technical potential has been put at 1,300GW.[80] Several countries have zones with wind speed and reliability meeting high-efficiency standards, including the Rift Valley, South Africa, Chad and Mauritania, where technical capacity has been estimated at four times annual energy consumption in terms of oil equivalence. Kenya is developing utility-scale wind-power generation in the Turkana region. Angola, Mozambique, Namibia, Tanzania and South Africa have potentially large offshore resources.[81]

Technological choices – and energy future scenarios

For policymakers concerned to convert potential into real energy, mapping resources is just one part of a complex equation. Solar irradiation only becomes a viable source of modern energy when it is harnessed to technology. Fossil fuels such as gas and coal have to be transported and transformed into thermal energy through combustion. The critical considerations facing governments are the locations of primary energy resources and the costs of putting in place the infrastructure, technology and finance needed to exploit those resources.

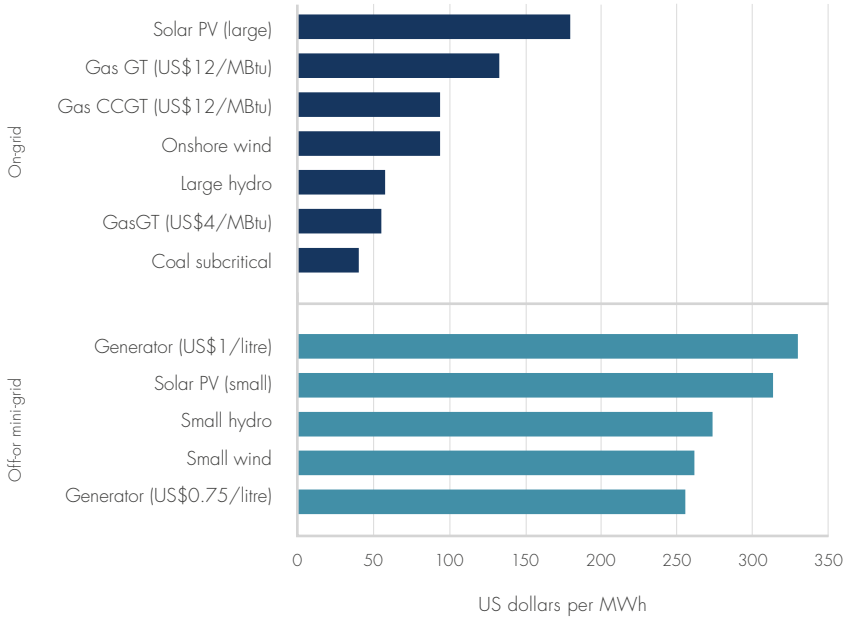
The IEA has estimated costs for power generation across a range of technological options. These costs are expressed in comparable – or "levelized" – terms. In the case of on-grid provision, coal has a distinctive cost advantage in the IEA estimates, with solar PV at the top end of the "levelized" cost range.[82] Solar PV and other renewable options, including small hydro- and small wind power, are more competitive than diesel generators in off-grid or mini-grid applications **(Figure 27)**.

The scenarios outlined earlier are acutely sensitive to assumptions about future costs and technological change. Both the IEA **(Figure 28)** and the McKinsey scenarios anticipate that the expansion of power generation will be associated with a shift in the energy mix and that the share of coal will shrink and the shares of renewable energy and natural gas will rise:

- Coal accounts for 23-27 per cent of the regional electricity mix by 2030 according to the IEA scenarios and 21 per cent under the McKinsey scenario.

- Gas-fired power dominates the 2040 electricity mix predicted by McKinsey, accounting for 40-50 per cent of capacity; the IEA scenarios point to a share of around one-quarter.

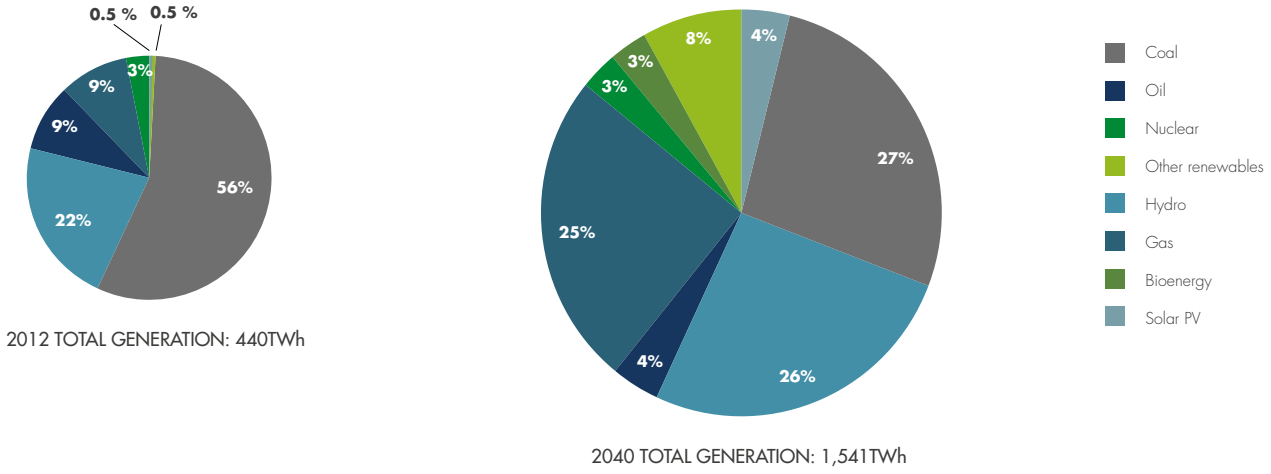
FIGURE 27 ELECTRICITY COSTS VARY FOR ON-GRID AND OFF-GRID SOURCES: INDICATIVE LEVELISED COSTS FOR SUB-SAHARAN AFRICA (2012)



Notes: Costs are indicative and figures for specific projects could vary significantly, depending on their detailed design. GT = gas turbine; CCGT = combined-cycle gas turbine; MBtu = million British thermal units.

Data source: International Energy Agency. (2014). Africa Energy Outlook: A focus on energy prospects in Sub-Saharan Africa.

FIGURE 28 AFRICA'S ENERGY PROFILE IS SET TO CHANGE, WITH THE SHARE OF COAL SHRINKING: ELECTRICITY GENERATION BY FUEL IN SUB-SAHARAN AFRICA IN THE NEW POLICIES SCENARIO (2012 AND 2040)



Data source: International Energy Agency. (2014). Africa Energy Outlook: A focus on energy prospects in Sub-Saharan Africa.

- Under the McKinsey scenario, solar would comprise 17 per cent of capacity by 2040, but not take off until 2030. In the IEA scenarios, solar represents just 4 per cent of 2040 capacity.

- The IEA scenarios envisage hydropower accounting for between one-quarter and one-third of 2040 capacity, compared with 11 per cent in the McKinsey scenario.

We cite these comparisons to illustrate two points that should figure prominently in the calculations of policymakers. First, the broad direction is away from coal and towards natural gas, hydropower and other renewables. Projections by McKinsey point to solar as the lowest or second-lowest source of energy by 2030, pointing to a strong case for investment in this area.[83] Second, the marked variations between the scenarios illustrate the uncertainties associated with the underlying price trends and technological change. Any scenario using today's costs may be overtaken by events.

The challenge for African policymakers is to devise investment strategies that deliver early results while recognizing that decisions taken today will shape mid-century energy infrastructures. Global climate-change imperatives point to a compelling case for avoiding "high-carbon lock-in" through building carbon-intensive energy systems that will undermine international efforts to contain global warming. More immediately, the economics of energy provision are moving strongly in a direction that favours the development of a low-carbon infrastructure. The Global Commission on the Economy and Climate concluded: "Renewable energy sources have emerged with stunning and unexpected speed as large-scale, and increasingly economically viable, alternatives to fossil fuels."[84] Even without climate-change considerations, Africa cannot afford to miss out on the opportunity of low-carbon energy.

Key sources of renewable energy have gone from being prohibitively expensive to being cost-competitive in less than a decade. Wind and solar, in particular, are increasingly competitive with energy systems based on fossil fuels. The results are reflected in the global demand patterns. In 2013, renewable energy sources excluding hydropower accounted for 44 per cent of new installed capacity worldwide, creating significant benefits for climate change.[85]

Regional, weighted average costs of generating electricity from biomass, geothermal sources, hydropower and onshore wind are all now in the range of, or even lower than, estimated costs of fossil fuel-fired electricity generation costs. Solar PV-generation costs also increasingly fall within that range.

The pace of change is accelerating. Technological development, in-country learning and capacity development continue to drive down costs. Real prices for solar PV power have fallen by half since 2010.[86] The most competitive utility-scale solar PV projects are now regularly delivering electricity for just US$0.08 per kilowatt-hour (kWh), which is well below the average level (US$0.14 per kWh) for Sub-Saharan Africa.[87]

This backdrop does not provide policymakers in Africa with a roadmap to guide the choice between renewable and fossil-fuel energy sources. Despite the convergence in costs of renewable technologies, there are wide variations not only within each country but also between countries. It would be folly to interpret current cost data as evidence to support a "renewables only" approach.

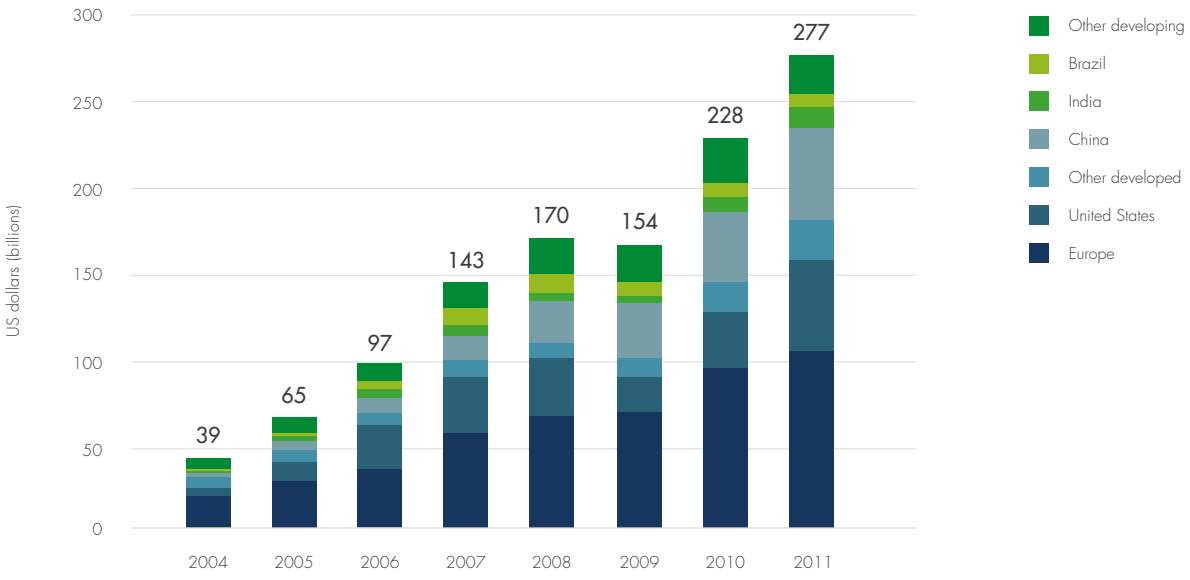
By the same token, Africa cannot afford to turn a blind-eye to the renewables opportunity. Solar energy in particular provides a vast untapped source of energy and solar PV technologies are increasingly cost-effective off-grid as well as on the grid. Fast-growing emerging markets including India and China are using wind and solar power to diversify their energy mixes and reduce reliance on coal-fired power generation. In recent government tenders in Brazil, wind-power out-competes fossil-fuel alternatives **(Figure 29)**.[88]

Experience in Sub-Saharan Africa itself is also informative. From hydro-power in Ethiopia to geothermal in Kenya, and solar power in Ghana, recent years have seen a surge of investments in renewable power generation.

In South Africa, coal overwhelmingly dominates power generation and energy investment, but in 2013, the state provider Eskom contracted for wind power at prices 17 per cent below those projected for the country's two massive new coal-fired power plants.[89] South Africa's recent experience in renewable energy sources has implications for the continent. Its Renewable Energy Independent Power Producer Procurement (REIPPP) programme has successfully channelled substantial private-sector expertise and investment into grid-connected renewable energy at highly competitive prices. To date, 64 projects have been awarded to the private sector under the REIPPP.

From hydro-power in Ethiopia to geothermal in Kenya, and solar power in Ghana, recent years have seen a surge of investments in renewable power generation.

FIGURE 29 THE RISING TIDE OF RENEWABLE ENERGY INVESTMENT BY MAJOR COUNTRIES (US$ BILLION, 2004-2011)



Data source: Sustainable Energy For All. (2013). Global Tracking Framework.

These projects will generate 3,922MW of renewable power – and the first projects are already online. Private-sector investment has totalled US$14 billion. Prices have dropped over the three bidding phases with average solar PV tariffs decreasing by 68 per cent and wind by 42 per cent, in nominal terms.

There are compelling grounds for African governments to put in place the policies and investments needed to launch a low-carbon energy take-off. Recent scenarios developed by the International Renewable Energy Agency (IRENA) suggest that by 2030 renewable energy sources (including hydropower) could reach a 50 per cent share of Sub-Saharan Africa's electricity mix.[90] That projection is highly plausible, provided that governments put in place the policies needed to promote investment in renewable sources, build technological capacity and expand regional trade in energy.

There is more to the energy-investment calculus than simple price comparisons. Factoring in the environmental and health impacts of fossil fuels – especially coal – changes the relative price equation. The ongoing public-health crises in Chinese and Indian cities highlight that coal-fired power generation carries very high costs in terms of health financing, days lost through sickness and premature death. This is a future that African policymakers should seek to avoid.

Fossil fuels will remain an important part of the fuel mix

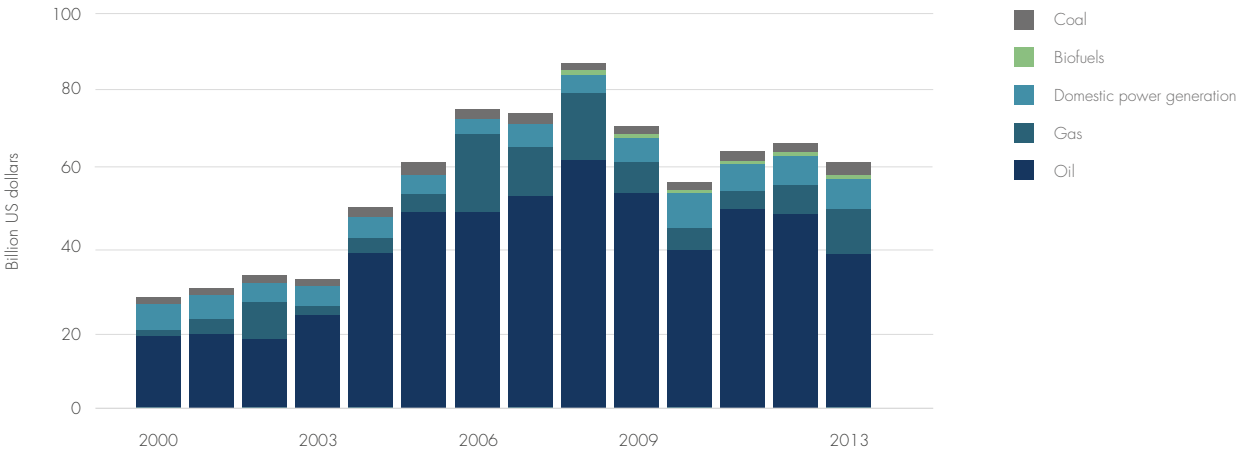
Africa cannot afford to stand on the sidelines of the low-carbon energy revolution. Nor can it embark on a "green energy" agenda that jeopardizes prospects for achieving the increased power generation and access needed to sustain inclusive growth, reduce poverty and create jobs. The pace and sequencing of decarbonization has to take into account countries' starting points and the policy choices available, along with considerations of fairness and equity related to climate justice.

Fossil-fuel reserves provide Africa with the foreign exchange and revenue streams needed to finance imports of energy technology and public investment. They also provide primary energy resources for domestic energy consumption. Far too much of the investment activity in the energy sector has been geared towards exploration, extraction and export and too little towards domestic energy needs **(Figure 30)**. For every US$1 invested in power generation in 2012, another US$5 was invested in export activity, principally in oil.

Natural gas has a vital role to play in meeting Sub-Saharan Africa's rising demand for energy. It can be utilized as a fuel for combined-cycle power plants. It offers an alternative to biomass in cooking and to gasoline or diesel in transport. Natural gas can also be used to produce nitrogenous fertilizers, substituting domestic production for imports. Putting in place the facilities to gather and process gas, and developing the gas networks, markets and pricing strategies needed for cost-effective exploitation, are major tasks for African governments. Nigeria's Gas Master Plan envisages the development of an ambitious integrated US$15-20 billion investment in gas processing, petrochemicals, fertilizer production and a gas-fired power plant. Mozambique and Tanzania have also developed strategies aimed at rebalancing gas production by expanding the domestic sector **(Box 6)**.

The pace and sequencing of decarbonisation has to take into account countries' starting points and the policy choices available, along with considerations of fairness and equity related to climate justice.

FIGURE 30 MOST OF AFRICA'S ENERGY INVESTMENT IS GEARED TOWARDS EXPLORATION, EXTRACTION AND EXPORT: INVESTMENT IN FUEL AND FOR POWER GENERATION (US$ BILLION, 2000-2013)



Data source: International Energy Agency. (2014). Africa Energy Outlook: A focus on energy prospects in Sub-Saharan Africa.

Modelling exercises have captured the great potential associated with natural gas. Developing a regional gas grid in eastern and southern Africa could bring gas to 263 major urban areas across eight countries: Burundi, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania and Uganda. The headline costs are large, at US$57 billion. But the costs could be spread over several years and this infrastructure would benefit 185 million people in urban areas. In addition to power, gas would also allow cleaner cooking and cleaner fuel for public transport vehicles. The wider benefits of power and industry would reach up to 600 million people in eastern and southern Africa.[91]

One cautionary note has to be sounded on natural gas. Developing a gas infrastructure is highly capital-intensive and building infrastructure from scratch takes time. Estimates by the IMF place the cost of building the infrastructure for Mozambique's gas at US$40 billion (or 2.7 times the GDP of 2012). Moreover, even if the project is developed early and the finance is in place, it would take until 2035 to develop the full infrastructure.

Falling oil prices have generated a wide-ranging international debate over future market prospects. As noted earlier, oil-fired power generation figures with some prominence in the energy mix of many countries. However, these countries should avoid premature investments in expanded capacity. Oil-fired power generation has been expensive in Sub-Saharan Africa and countries that invested in plant capacity during the last era of low oil prices have faced high import bills and high energy costs. Moreover, gambling on a continuation of low prices in a volatile market may provide unwise.

BOX 6 SHIFTING PRIORITIES IN TANZANIA – A STRONGER EMPHASIS ON DOMESTIC MARKETS

With power demand rising by over 10 per cent a year and perennial electricity shortages acting as a brake on growth, Tanzania is reorienting its natural gas priorities. There is a growing emphasis on developing the country's huge natural gas reserves in the Ruvuma Basin to supply local industry and create jobs at home.

While foreign investors and several donor governments have been unsympathetic to the policy shift, there has been some initial success. The Songas gas-to-power project now provides Tanzania with around one-fifth of its grid-based electricity, reducing dependence on imported fuels and seasonal unreliability associated with hydropower. Around 30 industrial companies receive electricity from Songas.

Songas has a 20-year power purchase agreement with the state-owned Tanzania Electric Supply Company (TANESCO), signed in 2004. The electricity is sold for around US$0.055/kWh, which is well below the equivalent costs of electricity generated using imported fuel. Songas has saved Tanzania a reported US$1.8 billion since it began operations.[92]

The share of coal should shrink – and so should Western double standards

The role of coal is diminishing fast, though it will continue to play a significant role under any credible scenario for achieving universal access to energy by 2030. Several countries across the region are scaling-up coal-fired power projects in response to power shortages. Many of these projects involve foreign investors, with part of the planned generation geared towards mining activities. Among the cases at various stages of the project pipeline are:

- In 2013, **Nigeria** entered into a memorandum of understanding with a Chinese energy company to build a US$3.7 billion coal power project that is expected to add 1,200MW of electricity to the national grid.[93]
- In **South Africa**, two of the world's largest super-critical coal-fired power stations are scheduled to enter commission, Medupi and Kusile. Each will generate 4.8GW of electricity.[94]
- By 2023, **Kenya** plans to produce 2.7GW of power from coal, with new power stations planned at Kitui and Lamu.[95]
- **Mozambique** has approved a 25-year concession for the construction of a 600MW coal-fired power plant in Moatize, Tete province.[96]
- **Tanzania** already produces coal from two mines, mainly for power generation. China's Sichuan Hongda signed a US$3 billion deal with Tanzania in 2011 to mine coal and iron ore and to build a coal-fired power plant that is to be completed in 2018/19.[97]
- **Senegal** has signed a contract with locally registered Africa Energy SA company to build a coal-fired power plant with a capacity of at least 300MW by 2017.[98]

International concern over coal focuses on the high carbon content of the energy it generates. On a per unit basis, coal generates roughly twice as much CO_2 as natural gas. Globally, it represented 29 per cent of primary energy supply in 2012 but accounted for 44 per cent of energy-related CO_2 emissions.[99] There are compelling grounds for eliminating coal from energy systems as early as possible.

In the case of Sub-Saharan Africa, the elimination date is likely to be well after 2040. Prohibiting investment in coal before then would limit power generation in countries that do not have readily available and affordable alternatives, and would produce modest benefits for climate change. If current trends continue, the region's share in energy-related CO_2 emissions will increase from 2 per cent to just 3 per cent by 2040.

This should not deflect attention from the global benefits of low-carbon development in Africa. As coal's share of the region's primary energy mix reduces, the carbon intensity of Africa's power generation is declining. With the aggressive promotion of renewables, it would decline more rapidly. On one estimate, increasing installed grid capacity of renewables by 24 per cent through to 2040 would reduce CO_2 emissions from 625 megatonnes (Mt) to 495 Mt a year – a 21 per cent reduction. However, this would increase the capital cost of power generation by around US$108 billion. Given the investment constraints faced by governments in Africa, such figures point to a compelling case for international cooperation to expand the choices available to energy planners through incentives rather than penalties.

Some questions certainly have to be asked about approaches to fossil fuels in international cooperation. There has been a long-running battle within multilateral development banks between mainly European and North American advocates of a move away from supporting fossil-fuel energy investments, and middle-income and low-income countries seeking investment for power infrastructure. The former group have a discernible upper hand. The World Bank Group has adopted guidelines allowing for coal investment only in rare circumstances.[100] The US Overseas Private Investment Corporation, which backstops companies investing in developing countries, is effectively prohibited from investing in energy projects involving fossil fuels.[101] Aid agencies such Britain's Department for International Development (DFID) and other EU donors provide no support for coal-fired power development.

It is striking that there has been little debate over whether limiting development finance for fossil fuels, including coal, in the name of cutting greenhouse gas emissions might hamper efforts to achieve universal access to energy for all.

Viewed from a Sub-Saharan African perspective, it is difficult to avoid being struck by some marked double standards. Coal-fired generation occupies an important share in the energy mix of countries such as Germany, the United Kingdom and the United States, where it has a far greater share than in most countries of Sub-Saharan Africa. Yet the same countries are able to use their shareholder domination of the World Bank to limit support to Africa. One perverse side-effect is to leave African governments without the finance that might enable them to invest in more efficient coal-fired power plants with lower emissions.

The most obvious alternative to coal or natural gas in most countries is large-scale hydropower. Yet here too there are financing constraints. Concern over the displacement of populations has prompted most Western donors to shun support for dams. The perception in Africa is that the preference of the donor community would be for the region to embrace solar power and wind-power on a scale and at a pace of change that no rich country would consider. The frustration has been powerfully captured by **Donald Kaberuka**, the President of the African Development Bank:

"It is hypocritical for Western governments who have funded their industrialization using fossil fuels, providing their citizens with enough power, to say to African countries, 'You cannot develop dams, you cannot develop coal, just rely on these very expensive renewables'… To every single African country, from South Africa to the north, the biggest impediment to economic growth is energy, and we don't have this kind of luxury of making this kind of choice."

Double standards aside, there are compelling grounds for African governments to review their investment plans for coal. International evidence strongly suggests that the competitive position of coal-fired power generation is deteriorating.[102] Unlike renewable energy and gas-fired generation, the costs of coal-fired electricity generation are not falling. If the Paris climate-change summit produces an agreement, it is likely that countries will impose taxes on CO_2 emissions and the pace of technological change in coal will slow relative to low-carbon technologies.

Several emerging markets are already adjusting their priorities. Chinese government policy is aimed at reducing the share of coal in the energy mix and investment in renewable energy is growing. Coal accounted for around half of new electricity generation in 2013 – down from 85 per cent a decade earlier.[103] One-fifth of all global investment in renewable energy in 2011 took place in China.[104]

Evidence from within Africa also provides a cautionary tale for coal enthusiasts. Coal-fired power-plant projects are subject to notorious delays and cost overruns. The experience of the Medupi and Kiseli plants in South Africa is instructive. The plants have brought large capital outlays and are set to produce high-cost electricity several years later than scheduled.

Moreover, an abundance of reserves should not be confused with commercial capacity. One of the major constraints in Sub-Saharan Africa's coal development, both for domestic consumption and export, is a lack of infrastructure. This was illustrated in January 2013 when Rio Tinto Zinc announced a US$3 billion write-down of its coal-mining investment in Mozambique, citing the slow pace of infrastructure development.[105]

Gas-turbine power generation may be a viable alternative to coal in many countries. Several developed countries are using natural gas as a potential "bridge technology" in the transition to a lower-carbon economy.[106] For Africa, investments in natural gas development could dislodge the preference for coal as the default new option for new power supply. The flexibility of gas in electricity generation makes it a potentially important enabler of higher levels of penetration of variable renewable energy sources.

Energy for all – the grid and beyond

Increased power generation is a necessary condition for delivering on the commitment of universal energy for all – but it is not a sufficient condition. As the IEA and McKinsey scenarios discussed earlier graphically illustrate, expanded power generation can go hand-in-hand with limited gains in access. An important question for policymakers is how to extend opportunities for access to affordable energy while increasing overall consumption of electricity.

Large-scale electricity generating plants will continue to dominate the energy landscape in Sub-Saharan Africa. These plants permit economies of scale, but they require transmission and distribution networks to connect customers. The cost of transmission rises with distance. Reaching remote rural areas in Tanzania, for example, can cost US$2,300 per household, almost five times the connection costs in urban areas.[107] Connecting to the "last mile" can be even more costly.

It can often also take 7-10 years (or more) between the initial investment decision for a large plant and the time it starts generating power. If the aim is to deliver energy for all by 2030, then large, capital-intensive plants will not achieve the goal.

Energy strategies aimed at reaching populations without access to electricity have to consider a range of options. One option is to extend the grid or to connect populations to the existing grid. Another option is to develop mini-grids. These might comprise a single generator and low-voltage distribution network, often serving a single community or small town. The generator might be powered by diesel, solar PV, a small-scale hydropower scheme or by a combination of sources. Mini-grids are not connected to the national grid, though they can be designed to facilitate future connectivity, and they may be owned by a private business, a utility or a community. A third option is the deployment of stand-alone decentralized systems in the form of a generator or solar home system that can be adopted by individual households.

The IEA estimates that around half of the population who currently lack access to electricity would be best served by grid extension.[108] The Joint Research Council puts the figure lower, estimating that around 70 per cent of rural populations who now lack access could be supplied through mini-grid and off-grid systems.[109] In practice, detailed energy-sector mapping is required to identify the most cost-effective route to delivery. One such exercise in Senegal found that 20 per cent to 50 per cent of the unconnected rural population could be most efficiently reached through investments in grid extension.[110]

Providing people with electricity as their first step on the energy ladder can transform households and the energy requirements are modest. Using the IEA's threshold consumption figures, the additional electricity generation required for universal access in rural areas is 35TWh by 2030 – a 4 per cent increase over the IEA's baseline projection. Mini-grids and stand-alone systems would together supply just under half of this total.

Renewable energy markets across much of Africa are being transformed from below. Unconnected, low-income households are increasingly tapping into new decentralized technologies, especially in solar, to secure entry-level lighting. New business models are emerging to support this development.

As we highlighted above, consumers and investors stand to gain from substituting biomass and kerosene with modern energy.

There is also an international interest. In the IEA scenario, diesel generators would generate 12,520GWh of electricity a year to 2030. One corollary of that output would be 12,520 kilotonnes of CO_2. These emissions could be diminished or altogether avoided through the expansion of renewable energy, underscoring the case for international cooperation to secure complementary gains in access to energy and the global benefits that come with lower greenhouse gas emissions.

"We lit up Africa, the formerly dark continent, using hydro, solar, wind, geothermal energy, in addition to fossil fuels."

Nkosazana Dlamini-Zuma, Chair of the African Union

AFRICA'S ENERGY TRANSFORMATION
The rising tide of reform, investment and innovation

After decades of neglect, energy policy is starting to move centre-stage in Africa. Governments are adopting more ambitious targets for power generation, backed in some cases by far-reaching reforms of their energy sectors. Private investors, domestic and foreign, are seizing new market opportunities. Beyond the national grid, smaller firms are responding to the demand of poor households for basic lighting, heating and cooking. International cooperation is also gathering momentum. The United Nations programme Sustainable Energy for All has put Africa's energy crisis firmly on the post-2015 development agenda.

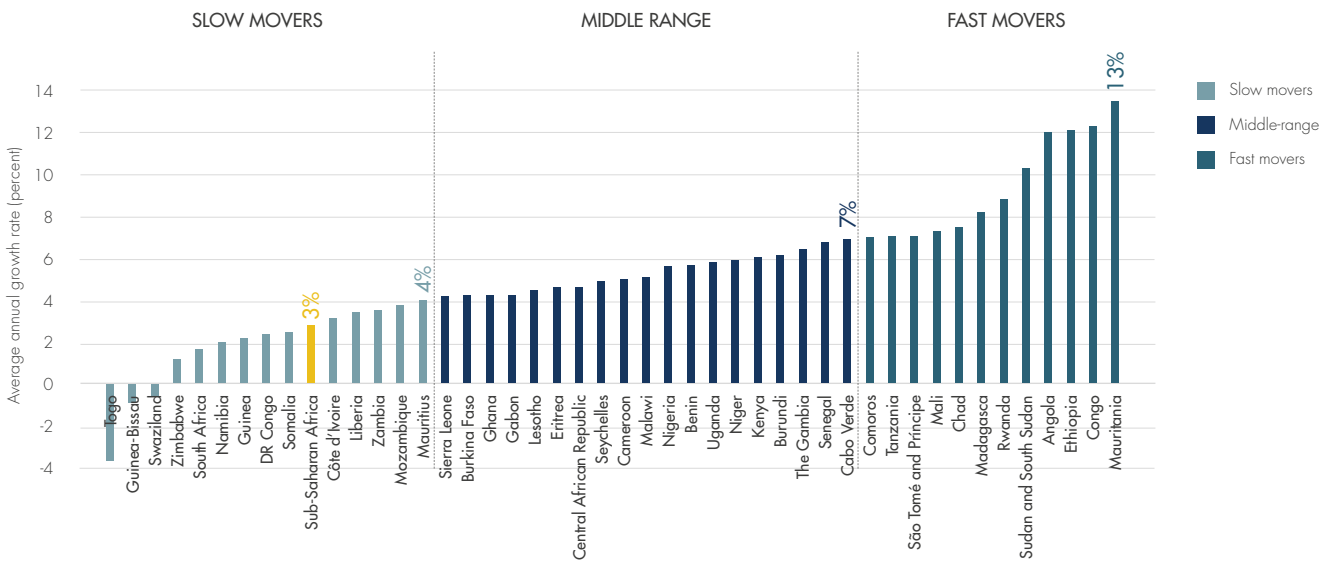
This section of the report provides a snapshot of developments that are transforming the African energy environment. It highlights a rising level of ambition across the region and the emergence of innovative new business models. Many of the gains that have been registered are fragile. Even so, there is a growing recognition among governments that ordinary people are frustrated by the failings of current energy systems, and that an economic transformation will have to be supported by an energy transformation.

Governments are setting a higher bar for ambition – and some are delivering

Scenarios developed by the IEA and McKinsey envisage a fourfold increase in power generation over the next 25 years. These scenarios are being overtaken by events on the ground. Many governments in Africa are setting their sights far higher.

The disappointing regional record on energy over the past 15 years of high economic growth obscures some extraordinary advances. There are 12 countries in which net electricity generation has been increasing by 7 per cent a year or more since 2000; another 19 are meeting or exceeding the 4 per cent per annum growth levels projected in the IEA and McKinsey scenarios **(Figure 31).** Many countries continue to register limited gains, in some cases because there is an inevitable lag between investment and delivery; in others because the investments have yet to be put in place. Yet the strong performance of some countries provides a powerful example for others.

FIGURE 31 BEHIND THE AVERAGE: SOME COUNTRIES ARE INCREASING ELECTRICITY NET GENERATION (AVERAGE ANNUAL GROWTH RATE FOR TOTAL ELECTRICITY NET GENERATION, 2000-2012)



Data source: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Electricity Net Generation.

BOX 7 RWANDA'S ENERGY TRANSFORMATION

Rwanda has put in place ambitious plans to increase power-generation and expand access to electricity. Sustained engagement by the country's leaders and reform of the electricity utility has opened the door to wide-ranging investment opportunities.

Current plans envisage that 70 per cent of the population will have access to electricity by the end of 2017, up from 12 per cent in 2012. Over the same period, the strategy aims at increasing electricity generation from about 100MW to 1,160MW. The increase would come from a range of sources. Hydropower will be the main technology, but solar PV, geothermal, biogas and peat will also be used as new sources of energy.

Total investment requirements for 2013-2017 are estimated at US$4.2 billion, or US$845 million a year under a proposed accelerated plan. Public financing will cover around 40 per cent of the cost. However, the financial viability of the strategy depends on public-private partnerships.[111]

The scale and pace of change has been insufficiently recognized. Starting from an extremely low base, Rwanda expanded electricity access by 160 per cent in just three years between 2008 and 2011 **(Box 7)**. Current plans are scaling up both access and power-generation capacity. Mauritania, a little-known success story, is one of the strongest performers in the region. Power generation has increased threefold since 2000.

The experience of Ethiopia is even more telling **(Box 8)**. Net power generation increased from 1.3 billion kWh to 6.6 billion kWh between 2000 and 2012. The country is now set to emerge as a major regional exporter of electricity. Rapid energy-sector development is one leg of an ambitious strategy to achieve middle-income status by 2025. The other leg is a Climate-Resilient Green Economy (CRGE) initiative that aims to build resilience against harmful climate-change effects nationally while demonstrating leadership globally. On a business-as-usual pathway, greenhouse gas emissions would more than double, from 150 million tonnes carbon dioxide equivalent ($MtCO_2e$) today to 400 $MtCO_2e$ in 2030. On a per capita basis, the emissions would remain tiny at less than 3 tonnes per capita (the current level in the United States is 17 tonnes).

BOX 8 ETHIOPIA – AN EMERGING ENERGY EXPORTER

As one of the world's highest-growth economies, Ethiopia has seen demand for electricity rise sharply. Increased investment has expanded net electricity generation fivefold. Even so, power shortages continue to hold back economic growth and grid coverage is limited, with just 15-20 per cent of rural Ethiopians having access to electricity.

Ethiopia's Growth and Transformation Programme (2010-2015) and its successor (2015-2020) is changing this picture. The strategy aims at another fivefold increase in power generation, from 2GW to 10GW, with a doubling of grid connection from 2 million to 4 million households and 75 per cent of villages connected to the grid.

Large-scale public investments in hydropower have underpinned the strategy, including the Gilgel Gibe 3 dam and the Grand Ethiopian Renaissance Dam, a 6GW hydropower project.

The World Bank forecasts that Ethiopian electricity sales will rise from 4GW in 2011 to 17GW in 2020. By 2030, the aim is to export at least 5,000MW, up from just 223MW now. Total investment requirements are estimated at around US$2 billion annually, which is double current levels. The World Bank and the African Development Bank (AfDB) are financing a transmission line capable of transporting 2GW of electricity from Ethiopia to Kenya.

Ethiopia is also investing heavily in non-hydro renewable development. New public-private partnerships are emerging. US-Icelandic company Reykjavik Geothermal has signed a US$4 billion agreement to build a 1GW geothermal plant by the beginning of the next decade. One of the region's largest wind-farm projects, the 120MW Adama project, is under development through a US$290 million French investment. The emphasis on renewable energy will lead to the abatement of 250 $MtCO_2e$ by 2030, which is a decrease in greenhouse gas emissions of up to 64 per cent compared with a business-as-usual model.[112]

However, the government has adopted around 60 initiatives aimed at keeping overall emissions at today's level, while achieving zero-net-emission status by 2027 through forestation, land conservation and carbon-neutral transport policies.[113] No developed country has matched this level of ambition.

Africa's new energy strategies far exceed the goals identified in the IEA's baseline scenarios. The Africa Progress Panel has reviewed the energy plans of around 30 countries. Most aim well beyond doubling capacity by 2020. Nigeria is targeting an increase in generating capacity to 40GW in the early 2020s, from 8.6GW today.[114] Kenya's Vision 2030 strategy envisages installed capacity of 15GW by 2030, which is a sevenfold increase over current levels.[115] Tanzania's Big Results Now initiative, supported through Power Africa, aims at efficiency gains and investments that will double capacity over 2012 levels to 2GW by the end of 2016.[116]

Some countries are setting a high level of ambition from a low base. Liberia has one of the world's smallest grids and lowest rates of access to electricity. Less than 5 per cent of the country currently has access and the grid of Monrovia, the capital city, is largely supplied by expensive diesel-based generators. By 2030, the country aims to increase capacity from 23MW to 300MW and have one-third of the country covered by the grid.

The financial landscape is changing

Part of the impetus towards change in the energy sector can be traced to financing. Several governments have stepped up public spending commitments. Energy-sector reforms have unleashed a new wave of private investment, with African business and international equity firms entering public-private partnerships. Development finance institutions are playing an expanded role, and international cooperation has moved into a higher gear. President Barack Obama's Power Africa initiative and cooperation between Africa and the European Union have put energy for all on the global development agenda. Chinese investment has emerged as a game-changer.

Much more capital needs to be mobilized for infrastructure development but the record of recent years points to a new mood towards energy investment. African governments increasingly view energy investments as a vital ingredient of national growth and poverty-reduction strategies. And private investors, for whom African energy infrastructure would once have been a "no-go" zone, are seizing new market opportunities.

Domestic financing is on the rise

International dialogue on energy financing for Africa sometimes overlooks the critical role of domestic financing. Resources mobilized from taxes and utility charges are estimated to account for around 80 per cent of total spending.[117] Official development assistance (ODA) probably accounts for around 6 per cent of total spending and non-ODA external financing around 15 per cent.[118]

Recent estimates put energy sector budget allocations for 2012 at US$12.6 billion, an increase of 28 per cent over 2010. As in other areas, regional financing is dominated by South Africa.[119]

Budget allocations excluding South Africa increased from US$1.6 billion to US$2.1 billion between 2010 and 2012. Yet several countries including Cameroon, Ethiopia, Ghana, Kenya, Mali and Uganda have more than doubled budget allocations.

The figures have to be treated with caution. There is often a large gap between allocations and actual expenditure. Moreover, the overwhelming bulk of public spending, probably around three-quarters, is directed towards operations and maintenance, rather than investment.[120] The dead weight of utility losses severely limits the fiscal capacity of states to finance energy infrastructure. However, budget priorities are shifting in a positive direction.

Recourse to sovereign debt financing is mobilizing new resources. In 2014, African governments issued US$14 billion in sovereign debt and finance for energy infrastructure figured prominently. In December 2014, Ethiopia joined a growing cast of countries drawing on Eurobond markets, with a US$1 billion debut bond.[121] Ethiopia has financed part of the US$4.5 billion in investment required for the Grand Ethiopian Renaissance Dam from domestic taxation, domestic bonds and "diaspora bonds".[122] Kenya has issued around half a dozen infrastructure bonds, most recently raising US$2 billion in Eurobond markets. Some countries, including Kenya, have also issued local-currency bonds for infrastructure projects.[123]

Pension funds are also being harnessed in some countries for energy financing. Ghana's Social Security and National Insurance Trust has taken over a power plant as part of a more active investment strategy. The US$4 billion Botswana Public Officers Pension Fund has taken stakes in energy infrastructure, as has the Nigeria Social Insurance Trust Fund. The scale of pension-fund investment remains limited but illustrates the potential for tapping into a deeper pool of savings.

Does sovereign debt offer a viable alternative to tax-based public financing and private investment? Prudential recourse to international bond markets offers a number of advantages. The cost of borrowing is typically well below domestic market costs. Sovereign debt also provides access to hard currency needed to finance imports of energy technologies.

Sovereign debt does come with risks attached. Countries are borrowing on global bond markets on 5- to 10-year terms, while power projects often take 10 to 20 years or longer to construct and generate revenue streams. Moreover, because revenue streams are in local currency while bonds are serviced in hard currency, the costs of borrowing can escalate sharply with national currency devaluation, as Ghana and Nigeria recently discovered to their cost.[124]

Governments may also face difficulties refinancing bond-related debt as the amortization increases towards the maturity date.[125] Large fiscal deficits, as in Ghana and Zambia, drive up the yields on sovereign bonds and lead in turn to fiscal pressure and current-account deficits. One detailed survey has cautioned that some countries are at risk of a renewed debt crisis.[126]

Ultimately, public investment in energy infrastructure has to be financed through some combination of tax revenues and government debt. One of the greatest barriers to the transformation of the power sector is the low level of tax collection. Even before the upward revision – or "rebasing" – of GDP figures for many countries, revenue-to-GDP ratios across much of Sub-Saharan Africa were very low. With rebasing, it is evident that some governments are fundamentally failing to build credible tax systems. In 2013, Nigeria's revenue-to-GDP ratio stood at just 11 per cent, one of the lowest levels in the world.

One of the greatest barriers to the transformation of the power sector is the low level of tax collection.

Independent power providers are a growing presence

The private sector is increasingly engaged in financing the power sector. Financing for private participation infrastructure (PPI) has been dominated by telecommunications since 2000, but there has been a sharp increase in investment in electricity. Since 2010, the electricity sector has attracted around US$4 billion annually.[127]

Independent power providers (IPPs) have become an increasingly prominent feature of the energy landscape over the past 15 years. There are now 130 IPPs operating across Sub-Saharan Africa.[128] Over 90 per cent of them were started after 2000.[129] Excluding South Africa, cumulative IPP investments amount to an estimated US$8 billion.[130] There is evidence of steady growth in IPP-related power-generation capacity. An additional 977MW of IPP investment reached financial close in 2012 and 2013 bringing the total IPP capacity in Sub-Sahara Africa to 5.8GW – around 6 per cent of total grid capacity. Another 1.1GW reached financial close in 2014.[131]

Domestic policy reforms are opening the door to a new wave of public-private partnerships. Few governments have embraced wholesale liberalization. What has emerged is a "hybrid market" in which incumbent state-owned utilities continue to occupy a key role.[132] IPPs typically operate through power purchase agreements (PPAs) under which utilities and regulators agree to purchase electricity at a pre-determined price.

Regulatory systems have also been strengthened. Around 30 countries have established independent regulators, contributing to improvements in transparency. Some, including Kenya, Ghana and Uganda, have wholly or partially unbundled generation, transmission and distribution, in some cases introducing competition at one or more levels.

One of the most striking examples of reforms comes from a country that has been synonymous with poor governance in the energy sector. Nigeria's liberalization programme is one of the most ambitious and largest to have been introduced in the developing world. At the end of 2010 the National Electric Power Authority was broken up and 17 generating and distribution companies put up for sale in a US$2.5 billion tendering process **(Box 9)**.

South Africa's liberalization experiment is being closely followed by other countries. The renewable energy programme has seen a total of 64 IPP projects awarded to the private sector through competitive tendering. Over 100 different shareholder entities have been involved, almost half of them in more than one project, with investment totalling over US$14 billion. Once on stream, these projects will generate 3,922MW of renewable power. Successive rounds of tendering have attracted a wide variety of domestic and international project developers. Competition has driven down prices without dampening investor interest.

BOX 9 NIGERIA'S ENERGY REFORMS

Constant power outages, inability to expand power generation, restricted access to electricity and corruption have figured prominently on Nigeria's charge sheet. Repeated rounds of reform delivered little – but the picture is changing.

Nigeria's power-sector privatization programme represents Africa's most ambitious attempt to date to mobilize private finance for the energy sector. The process began with the break-up of the inefficient National Electric Power Authority (NEPA). Seventeen state-owned utilities (6 in generation and 11 in distribution) were put up for sale through competitive tender.

Successful bids brought together a diverse group of Nigerian and international investors. The listed Nigerian conglomerate Transcorp and US company Symbion Power offered US$300 million for the 932MW Ugheli power plant. Another consortium of Chinese, Nigerian and British groups secured the 1,020MW Sapele plant.

Forte Oil, a Nigerian company owned by Femi Otedola, together with Shanghai Municipal Electric Power Company and the British Virgin Islands-listed BSG Power, owned by Israeli billionaire Beny Steinmetz, successfully bid US$132m for the Geregu plant.

The involvement of powerful business figures in Nigeria has been an important factor in the political economy of reform. Past efforts at liberalization have been derailed by vested interests, ranging from importers of power generators to incumbents in the power utilities. There are concerns about disclosure of the full beneficial ownership structure of some companies, but the first hurdle of the reform process has been cleared.

Some of the benefits of the privatization programme are already evident. The Ugheli power plant, one of the largest in the country, has already increased power generation. However, the journey ahead is likely to prove challenging. Immediate concerns focus on the financial viability of Nigerian Bulk Electricity Trading (NBET), the agency set up to act as an intermediary between companies involved in generation and distribution companies. On one estimate, simply restoring the capacity of the state utilities could require investment of US$4 billion. Meanwhile, the government estimates that it will require around US$3.5 billion annually in new capital to meet its power generation targets.[133]

New investment partnerships are emerging and business leaders in Africa have played a prominent role. The Presidents of Nigeria, Côte d'Ivoire and Ghana joined influential entrepreneurs Tony Elumelu, Aliko Dangote and other political and economic leaders to establish the African Energy Leaders Group at the World Economic Forum in Davos in 2015, signalling the new direction. The group aims to promote the long-term investments and the investment climate needed to transform Africa's energy sectors.[134]

African governments have mobilized investment for public-private partnerships. IPPs in Ghana, Kenya, Nigeria and Tanzania all include government financing. In total, around one-third of IPPs include equity stakes from African governments.[135]

While IPPs play a valuable role, their contribution is not without problems. There is a widespread public perception in Africa that the terms of power purchase agreements are heavily skewed towards investor interests. That perception is driven partly by a concern that the risk premium demanded by investors is poorly aligned with real market risk, especially when governments themselves are providing guarantees and financing the wider investments (for example, in distribution lines) that generate profits.

BOX 10 MULTIPLE INVESTORS, COMPLEX DEALS – AFRICA'S EMERGING IPPS

One of the most striking features of energy-financing arrangements in Sub-Saharan Africa is their sheer complexity. Investor concerns over foreign exchange risk, political risk and the reliability of contractual agreements all contribute. So too does a tendency to insist on an "Africa risk premium" that may be unrelated to underlying market conditions.

Azura-Edo, Nigeria: The project was the first fully financed private-sector IPP. In the first phase to 2017, a 450MW open-cycle gas turbine power plant will be built by Azura Power near Benin City, in Edo state. Azura is owned by Amaya Capital, a Nigerian company, and American Capital Energy & Infrastructure, a US private equity group. The US$750 million transaction for the first phase comprises US$220 million of equity and US$530 million of debt from a consortium of 15 banks from nine countries.

The Azura project was the first Nigerian power project to benefit from the World Bank's Partial Risk Guarantee structure, with political risk insurance for equity and commercial debt provided through the Multilateral Investment Guarantee Agency (MIGA). The Nigerian federal government has effectively provided a sovereign guarantee. This complements a power purchasing agreement between Azura and the state-owned Nigerian Bulk Electricity Trading Company.

Bujagali, Uganda: The 250MW Bujagali dam project in Uganda was jointly funded by Industrial Promotion Services (IPS), the infrastructure and industrial development arm of the Aga Khan Fund for Economic Development, Sithe Global Power, a company majority owned by Blackstone Capital Partners, and the government of Uganda.2 The plant will be operated by Bujagali Energy Limited (BEL), a company established by the project partners to operate and manage the plant for 30 years, following which it will be transferred to the government of Uganda for a nominal price.

Debt is the principal form of financing. A commercial loan of US$115 million from Standard Chartered and Absa banks is covered by the World Bank political risk guarantee. The rest of the financing came from other multilaterals, such as International Finance Corporation (IFC), the European Investment Bank (EIB) and the African Development Bank (AfDB).

European development finance institutions have been extensively involved, including the French agency Proparco, Germany's Deutsche Investitions- und Entwicklungsgesellschaft (DEG) and KfW Group, and Netherlands Development Finance Company (FMO). MIGA provided an equity investment guarantee for Sithe Global of up to US$115 million for a 20-year period, while the World Bank's International Development Association provided a partial risk guarantee (PRG).

KivuWatt, Rwanda: KivuWatt is developing a 25MW gas-extraction and power-production facility at a cost of around US$128 million. The project sponsor is a private company, Contour Global, which has invested US$35.7 million in equity, with FMO contributing another US$8.9 million. The remaining US$83 million is in the form of borrowing from AfDB's private-sector arm, the Emerging Africa Infrastructure Fund (EAIF), Belgian Investment Company for Developing Countries (BIO), the FMO and the European Financing Partners (EFP). Even though the project is a private power plant, it has been able to attract about 72 per cent of its funding from multilateral and bilateral entities.[136]

Complexity is another problem. Mobilizing finance for energy infrastructure in Africa requires navigation through a maze of instruments, approval processes and risk-management arrangements. The transaction costs represent a major barrier **(Box 10)**. Less fragmented and more standardized approaches coordinated through agencies such as the AfDB could help to cut through the complexity and deliver results earlier.

Private equity investment is an emerging force

Foreign capital flows into Africa have increased sharply, reaching 5 per cent of GDP in 2013.[137] Direct foreign investment dominates the transfers. However, the past five years has also seen a marked increase in private-equity flows, attracted by high dividends in areas including financial services, telecommunications, consumer goods, construction and energy.[138]

Liberalization in the power sector has been a magnet for equity investors. Between 2010 and 2013, there were around 27 private equity investments in energy and natural resources, with an aggregate value of US$1.2 billion.[139]

A new generation of investment funds is emerging. The Carlyle Group, which raised US$591 million on its initial African Fund, is expanding energy infrastructure investments in East Africa. In February 2015, Helios Investment Partners announced closure of a heavily oversubscribed US$1.1 billion Africa-focused fund, part of which will target energy infrastructure.[140] In the same month, Actis launched a US$1.9 billion renewable energy platform, Lekela Power, aimed at funding wind- and solar-power investments over the next three years.[141]

Established groups are also expanding their market presence. Sithe Global, part of the Blackstone Group, one of the world's largest private equity companies in infrastructure, is scaling up Africa operations. During 2014, Blackstone announced a joint project with Dangote Industries, the Nigeria-registered industrial conglomerate led by Aliko Dangote, to invest up to US$5 billion over the next five years in energy infrastructure projects across Sub-Saharan Africa, with a particular emphasis on power, transmission and pipeline projects.[142]

Development finance institutions have added to the momentum behind private equity investment. In 2015 the Norwegian Investment Fund for Developing Countries and the UK's Commonwealth Development Corporation injected US$225 million into Globaleq,[143] one of the largest foreign equity investors and power-sector operators in Africa. Wholly owned by Actis, it has eight separate projects across five countries, including two independent power-generation companies generating 300MW of natural gas-fired power in Cameroon.[144] Another investment fund, the US$250 million ARM-Harith Infrastructure Fund, launched by a partnership of companies in South Africa and Nigeria, in 2013 secured a US$20 million investment from the AfDB. These examples give a sense of the dynamism in private-equity markets.

Private-equity investments in the energy sector do generate very large margins. Shareholders in Uganda's privatized (and now publicly listed) electricity grid, for example, get a reported return of 20 per cent a year in dollars on capital investment. Moreover, government guarantees have effectively reduced the risk of the investment.[145] Equity investors themselves identify Sub-Saharan Africa as a more profitable market than other emerging markets.[146]

Unfortunately, what is good for the private interest of the equity investment community is not necessarily good for the public interest. Private equity investment is not a viable source of finance for long-term operations or long-term infrastructure financing.

Margins of 15-20 per cent translate into energy prices too high to expand access to affordable energy. As a general rule, projects should only be carried out as a public-private partnership (PPP) if they offer better value for money than public-sector provision. African governments should exercise far greater caution and scrutiny over private-sector returns.

International cooperation initiatives are gathering pace – and development finance is rising

Recent years have seen a step increase in international cooperation on energy-sector financing. Power Africa has dominated the headlines. However, the Africa-EU Energy Partnership has also increased support for energy projects. One focal point for international cooperation is the Programme for Infrastructure Development in Africa (PIDA), an African Union initiative that includes 15 major trans-boundary energy projects. Development finance institutions (DFIs) are also playing an expanded role.

The Brookings Institution has documented the changing role of official development finance (ODF). Until recently, ODF was dominated by transport, water and sanitation. Since 2006, however, there has been a sharp increase in energy-related infrastructure spending from US$305 million in 2006 to US$3.5 billion in 2012 (or one-third of ODF infrastructure investment).

Separating headline figures from real delivery of development finance for energy is notoriously difficult. Power Africa has committed US$7 billion over four years, or US$1.4 billion annually, to energy-sector financing. Much of the proposed financing will be channelled through loan guarantees provided by the US Export-Import Bank for projects involving US companies.[147] The Overseas Private Investment Corporation (OPIC), a US government agency, has committed to provide US$1.5 billion to develop energy projects in Africa through equity and risk guarantees. The aim is to generate an additional 10GW of power by using development finance to leverage private finance.

The European Union operates an array of energy-related financing initiatives, ranging from development aid to non-concessional funding. For example, the EU-Africa Infrastructure Trust Fund (ITF) combines loans, grants and risk guarantees for energy projects. An Africa-EU Renewable Energy Programme funds a range of renewable-energy projects.[148]

The political impetus behind US and EU aid has contributed to the shift in energy-sector financing. Some of the results can be seen in new projects. Operating under a Power Africa umbrella, General Electric has committed to bringing 5GW on line in Ghana and Tanzania by providing technology, expertise and capital.[149] European donors have financed a wide range of PIDA projects, including grants through ITF for electricity connections between Côte d'Ivoire, Liberia and Sierra Leone. Another effect of the energy focus has been registered in the activities of the development finance institutions of Germany, the Netherlands, Norway and the United Kingdom.

These DFIs are now part of an elaborate financing architecture, operating alongside the World Bank and the African Development Bank that has played an important role

in supporting IPP financing. With debt financing typically covering around 70 per cent of project costs, DFI guarantees have been critical to credit provision from commercial banks and investment decisions by equity investors.[150] The level of financing provided through DFIs is probably in the range of US$3 - 6 billion in total since 2009 and is only modest relative to energy-sector financing gaps. However, the engagement of the DFIs, the World Bank and AfDB has unlocked private investment that may not otherwise have taken place.

As in other areas, the weaknesses of the development finance architecture have to be recognized. Flows of official development assistance (ODA) and development finance are likely to remain modest in relation to the scale of Sub-Saharan Africa's needs. US and EU development finance transfers for energy average no more than US$2 billion. Total overseas development finance in 2012 was less than US$4 billion. The array of climate investment funds and the Green Climate Fund provide a source of low-carbon finance to support renewable energy investments, but the pool of resources is inadequate – and Africa has been largely bypassed (see Part II).

Opaque reporting systems are another problem. They make it all but impossible to derive real annual financing levels. The capacity of donors and DFIs for "leveraging" or unlocking additional private-sector finance is unclear. Reported ratios of private-to-public finance range from 1:7 for Power Africa to 1:13 for EU energy financing.[151] But there is limited robust, audited evidence to support these figures and the EU's reported ratios appear very high. The bottom line is that current levels of development finance fall very far short of the level required to meet Africa's energy ambitions.

Enter the dragon – the rise of Chinese energy investment

Chinese foreign direct investment (FDI) and other forms of finance in Africa have increased rapidly in recent years. Chinese state and non-state companies are involved in a wide range of export, infrastructure development and domestic market activity. China is now the single largest source of external finance for power-generation investments.

Best estimates put Chinese official finance to Sub-Saharan Africa's energy sector in excess of US$16 billion between 2000 and 2012, which is more than double the financing for IPPs.[152] Some 30 projects have been completed or are under construction, representing 4.7GW of power for 2012-2014 alone.

The majority of Chinese-supported projects have received funding from the Export-Import Bank of China (China Exim Bank), which provides soft loans and export credit on the part of the Chinese government. The 2014 contract to construct the Geba 1 and Geba 2 hydropower developments in Ethiopia was awarded to an Ethiopian company and two Chinese partners, Sinohydro and China Gezhouba Group, with US$582m in finance (80 per cent of the total) provided by Exim Bank.[153] In many cases, Chinese finance is one element in a wider package. For example, the Industrial Commercial Bank of China (ICBC) has agreed to provide US$1.2 billion of the US$2 billion required to construct a 1,000MW coal-fired electricity plant in Kenya.[154]

Large hydropower projects dominate China's energy-financing portfolio in Africa. Engineering and procurement contracts with Chinese contractors account for around 70 per cent of projects. Ethiopia, Nigeria, Sudan, Guinea, Ghana and Cameroon dominate transfers, although about 16 countries receive some form of Chinese finance. In some countries there is an overlap between IPP and Chinese finance. The Chinese

Development Bank provided around 40 per cent of the financing used to underwrite Sunon Asogli, Ghana's second IPP, and is part-financing IPP projects in Zambia.

Chinese development finance for energy infrastructure in Africa has been a source of controversy for traditional aid donors. There are concerns that the finance is motivated by a need to secure access to Africa's natural resources on terms favourable to China and by commercial self-interest. Some aspects of Chinese finance require closer scrutiny. In particular, the practice of securing debts against future exports of raw materials creates commercial risks. Transparency is also a concern.

On the other side of the equation, many African governments welcome the speed at which Chinese finance is disbursed. By contrast with the complex arrangements surrounding IPP projects, Chinese support also has the merit of operating on a "one-shop" model that combines different types of finance with technical support, including early-stage technical development.

Illicit financial flows must be tackled

Additional revenues can be mobilized by reducing losses through illicit financial transfers and narrowing opportunities for tax evasion. In 2012, Sub-Saharan Africa lost US$69 billion in illicit financial flows, principally as a result of trade misinvoicing **(See infographic: Plugging the gaps).**

Five of sub-Saharan Africa's emerging energy powers – Ghana, Kenya, Mozambique, Tanzania and Uganda – collectively lost US$6.3 billion annually between 2002 and 2011 through trade misinvoicing, according to research by Global Financial Integrity. The losses amounted to between 7-13 per cent of total government revenues.

Recent research carried out by Global Witness has raised serious concerns over the allocation of oil concessions in Liberia, with beneficiaries including companies with links to known tax evaders. In Nigeria, global companies such as Royal Dutch Shell and ENI have been investigated for placing investments in companies associated with known money-launderers. Another set of investigations in the Republic of Congo has drawn attention to irregular activities involving major global companies and offshore facilities.

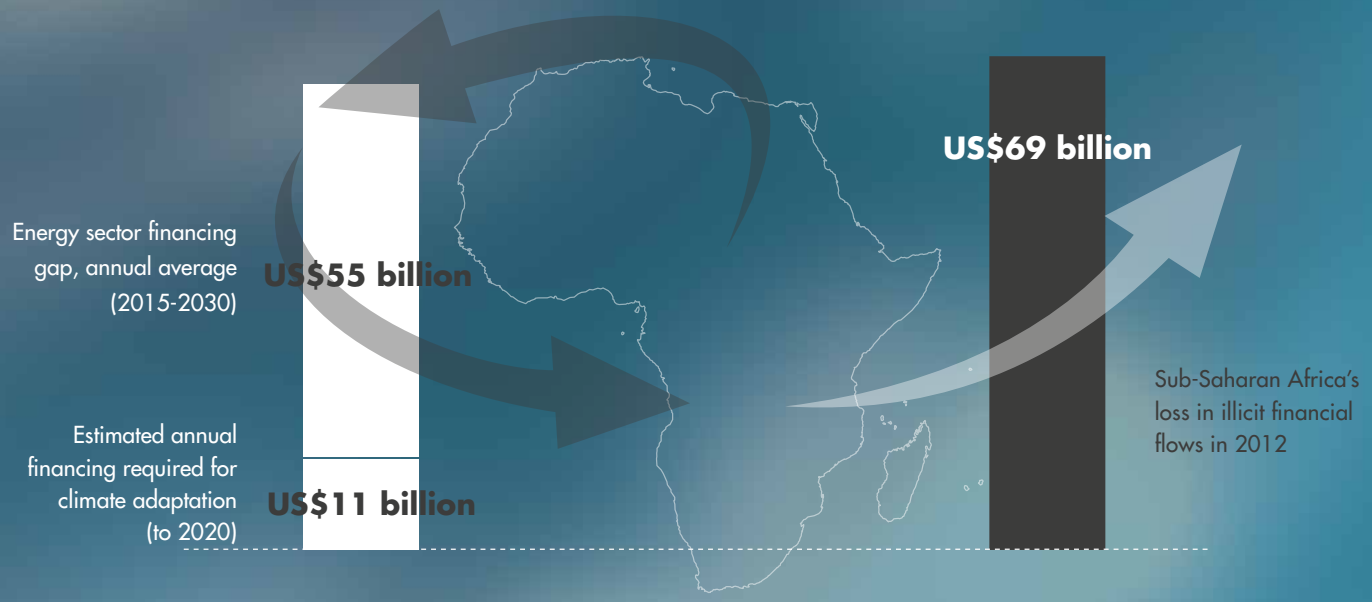
G20 countries must act on past commitments to strengthen tax disclosure requirements, prevent the creation of shell companies, and counteract money-laundering. While the G20/OECD reforms on base erosion and profit shifting are essential, they must be extended more rapidly to benefit African nations. The international community should support African nations to build their capacity both to raise tax domestically and to protect themselves against illicit financial outflows, especially via trade misinvoicing.

A renewables revolution is under way

Renewable energy is at the forefront of the changes sweeping Africa. Hydropower continues to dominate the investment landscape, and this is unlikely to change. Yet many governments have recognized the potential benefits of non-hydro renewable energy.

PLUGGING THE GAPS

Illicit outflows are higher than the financing gap for both energy access and climate adaptation



CUT ILLICIT FINANCIAL FLOWS
and narrow the opportunities for tax evasion

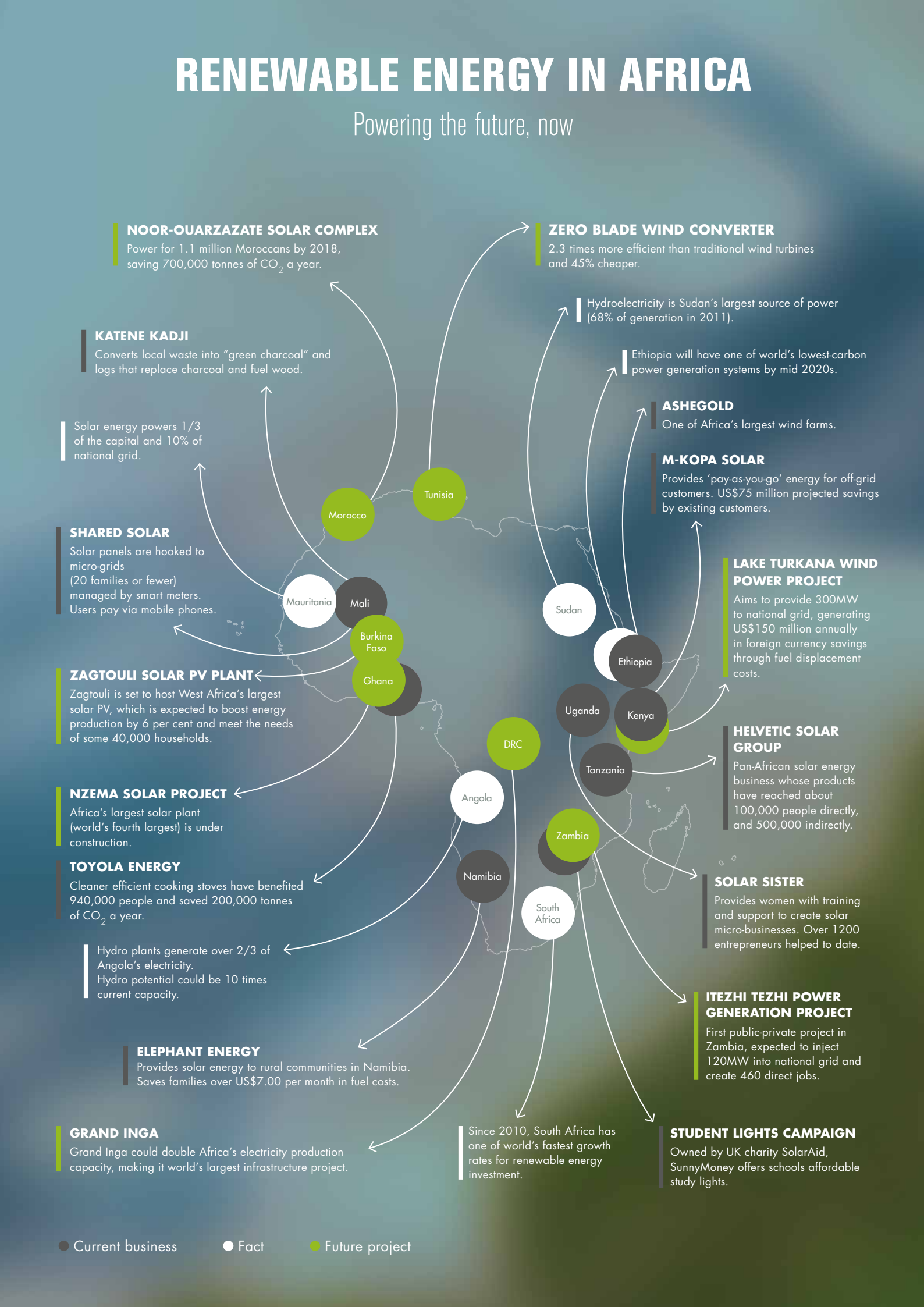
Over half of Sub-Saharan African countries have now conducted detailed renewable energy assessments under the auspices of the IRENA.[155]

The benefits of these sources are even more wide-ranging in the Sub-Saharan African context than in other countries. Non-hydro renewable energy sources can be scaled up far more quickly than traditional thermal energy sources and they can be deployed for on-grid and off-grid electricity supply. Solar, wind and geothermal power generation offer foreign-exchange savings for countries that have to pay hard currency to import energy. Moreover, with renewable technology prices in steep decline, many energy planners are looking to future cost advantages from early investment in renewable sources.

The Sub-Saharan African experience remains a largely hidden chapter in the renewable energy story. Yet the region is registering some of the most remarkable advances in solar, geothermal and wind power. It is not just that renewable power generation is rising fast from a low base. Some African countries are today in the top tier of renewable energy innovators **(See infographic: Renewable energy in Africa)**.

RENEWABLE ENERGY IN AFRICA

Powering the future, now



Other examples include:

- **Nigeria** is rapidly scaling up solar capacity. Agreements signed in 2014 and the first half of 2015 will take the country across the 5GW threshold. SkyPower FAS Energy has signed agreements with the federal government and the Delta State government to develop 3GW of utility-scale solar photovoltaic (PV) projects over the next five years at an estimated cost of US$5 billion.[156] Negotiations to build another 10GW in capacity through a South Korean firm, HQMC, would also see the establishment of Africa's first large-scale solar-panel manufacturing facility.[157]

- **Kenya** is now the world's ninth largest producer of geothermal energy. Current plans envisage the doubling of capacity by the end of 2016 through expansion of the existing Olkaria plant. Kenya is also developing wind power resources. The Turkana Wind Power Project will add 20 per cent to currently installed capacity.

- One of Africa's largest wind farms is located in **Ethiopia**. The 120MW, 84-turbine farm is 780 kilometres north of the capital, Addis Ababa. It was developed to mitigate the impact of falling water levels in the dry season on hydropower stations. In 2013 the government announced the development of a 1GW geothermal plan.

- Since 2010, **South Africa** has registered one of the fastest rates of growth in the world for renewable energy investment. The Renewable Energy Independent Power Producer Procurement (REIPPP) programme contracted for US$14 billion of private-sector investment across 64 projects, ranging from wind farms and solar PV to biogas.

- The world's fourth largest solar facility is under construction in western **Ghana**. The US$400 million Nzema solar project will include 630,000 solar PV modules generating 155MW and adding 6 per cent to Ghana's overall power generation.[158]

- In **Mauritania**, solar energy now powers around one-third of energy use in the capital city, Nouakchott, and 10 per cent of the national grid. Plans are under way to commission a 30MW wind farm, increasing the share of renewable energy in the national energy mix to 45 per cent.

- In **Rwanda**, Ignite Power has developed a template for connecting all households on and beyond the grid **(Box 11)**.

The limits of renewable energy development in Sub-Saharan Africa have to be recognized. In most countries, the portfolio remains underdeveloped despite the potential. As we highlight below, many countries continue to struggle to attract investment. Moreover, while renewable technologies have the potential to reach marginalized groups, there is no automatic link between development of renewable energy and equity in energy. While Kenya's national grid is transmitting more geothermal and wind power, the grid itself has been designed principally to serve urban elites and large commercial farms. The northern region of Turkana, the site of some ambitious wind-power projects, has some of the lowest electricity access rates in Africa and the rural poor have seen few benefits from the growth of geothermal power generation. An obvious danger is that the expanded flow of electricity will bypass the rural poor en route to commercial farms and middle-class urban suburbs benefits from the growth of geothermal power generation. An obvious danger is that the expanded flow of electricity will bypass the rural poor en route to commercial farms and middle-class urban suburbs.

BOX 11 IGNITING POWER IN RWANDA

Renewable technologies are transforming what is possible through decentralized provision. One example comes from a private initiative to extend Rwanda's power into areas beyond the grid.

Ignite Power, the first part of an ambitious plan aimed at achieving universal access to clean energy coverage, brings together the combined capabilities of many organizations, including Bloomberg New Energy Finance, the Milken Institute, a Rwandan government partner and several private actors. The first pillar is off-grid solar technology: a pre-paid system that can power four lights, a radios and televisions, and charge cell phones. The total cost for a household would start at just over US$1 per week under a "rent-to-own" model.

In September 2014, Ignite Power signed an agreement to install the technology for 250,000 to 1 million households. Less than three months later a pilot phase of 1,008 units was completed. The company is now gearing up to provide 750,000 units in the next two years.

The project has lessons that are of wider application. First, it has demonstrated the potential for speedy delivery, going from vision to plan and deployment in less than two years. Second, the active participation of government has been critical to the success of the project. The Rwandan government has provided credit guarantees and, most importantly, a stable planning environment for private investors.[159]

Regional cooperation is deepening

African governments increasingly recognize the benefits of developing larger regional markets. Cross-border trade in electricity can help to drive down costs, create economies of scale and stimulate investment. While current levels of cross-border trade are limited, the established power pools are deepening and the rise of potential exporters has given new impetus to the development of regional grids.

Cross-border trade in electricity can help to drive down costs, create economies of scale and stimulate investment. While current levels of cross-border trade are limited, the established power pools are deepening and the rise of potential exporters has given new impetus to the development of regional grids.

Part of the change has been driven by a higher level of ambition in national strategies. The African Union is backing a US$22 billion project to develop a pan-African electricity highway by 2020 under the Programme for the Infrastructure Development of Africa (PIDA). Elements of that highway are starting to emerge. The AfDB and the World Bank are providing financing to support electricity exports from Ethiopia, including a US$1.5 billion link to Kenya with the capacity to transport up to 2,000MW of power. Kenya has signed a memorandum of understanding to buy about 400MW. Ethiopia is in talks with Tanzania for a similar deal.[160]

In West Africa, governments and donors are financing and implementing project plans that have spent many years on the shelf. The AfDB in 2014 awarded a US$193 million grant for a project that will create a 1,400km 225 kilovolt (kV) line to connect the national networks of Côte d'Ivoire, Guinea, Liberia and Sierra Leone. The power line is expected to increase the average rate of access to low-cost electricity for 24 million inhabitants by 5 percentage points, to 33 per cent.[161]

Future opportunities for regional trade far outstrip current practice. Today, only around 5 per cent of Sub-Saharan Africa's power generation is traded across borders, mostly in southern Africa. The development of hydropower resources in Ethiopia, natural gas in Mozambique, Tanzania and Nigeria, and renewables across many countries could create vibrant subregional and regional markets. One detailed market analysis has shown how a trunk gas pipeline originating in Tanzania and Mozambique and spanning from Ethiopia to South Africa could become the backbone of a regional energy system reaching 263 major urban areas across eight countries. The benefits of the infrastructure would reach 185 million people directly and three times that number indirectly. Increased economic growth and revenue collection could recoup the costs, expected to be about US$57 billion, over a 20-year period.[162]

The biggest prize for regional energy cooperation is the Inga III dam in the Democratic Republic of Congo. While the history of the project provides plenty of causes for pessimism, there are grounds for guarded optimism. Over the past two years, efforts to take the project from design to implementation have gathered pace. Negotiations between the Democratic Republic of the Congo and South Africa have explored contractual arrangements under which Eskom, the state energy provider in South Africa, could underwrite guaranteed purchase arrangements. Several donors, including China and the United States, have agreed to work together in mobilizing finance. Perhaps most encouraging of all, there are proposals to develop the Grand Inga project in incremental stages that generate early results at affordable cost, building trust and confidence in the process.

Deeper regional cooperation could greatly reduce the costs of meeting Africa's goals of sustainable energy for all. In one scenario developed by McKinsey, regional integration produces a net saving of US$63 billion, or 14 per cent of total costs, on investments needed to quadruple electricity generation by 2040.[163] Another modelling exercise suggests that the returns on cross-border transmission investment could be 20-30 per cent across much of the region, rising to 120 per cent for southern Africa. These figures bear testimony both to the inefficiencies associated with current investment practices and to an immense market opportunity.[164]

The four existing regional power pools provide an embryonic institutional structure for deeper cooperation.[165] Power pools have facilitated dialogue between energy utilities and made progress in developing standard agreements that will allow trade to grow.

These are all positive developments. However, Africa is very far from the development of genuinely integrated regional grids. Some of the greatest barriers to such integration can be traced to governance arrangements. The regulatory challenges evident within most countries are compounded many times over when utilities seek to operate across borders. Uncertainty over the enforceability of agreements on purchase prices and volumes, over-investment by utilities and risk arrangements remain formidable barriers that only sustained political leadership and cooperation can remove.

Delivering on the promise of energy for all

Twenty years ago, Africa's telecommunication systems bore many of the hallmarks of today's energy systems. Markets were dominated by state monopolies that had little incentive to extend connections, innovate and invest in new technologies. The result was a high-cost, low-coverage telephone system. That was consigned to history by the mobile-phone revolution, which has driven down charges, connected people and spread into other areas such as banking. While still embryonic, a parallel process is emerging in the energy sector.

Utility reform, new technologies and new business models could be every bit as transformative in energy as the mobile phone was for telecommunications.

In energy strategies, providing universal access to energy has traditionally taken a distant second place to expanding power generation. This approach has left the majority of Africans lacking access to electricity, hampered the development of small and medium enterprises, and undermined the development of markets for utilities. The end result has been a vicious cycle of unreliable and unequal power distribution. Rural areas have been especially badly served. But even in urban areas, where the costs of connecting new households are far lower, utilities have lacked incentives to expand into low-income areas.

This picture is starting to change. Utility reform, new technologies and new business models could be every bit as transformative in energy as the mobile phone was for telecommunications. Governments have been slow to grasp the potential. Energy plans in many African countries do not envisage universal access by 2030 and adhere to increasingly anachronistic, centralized, grid-based energy models.

Utility reform can extend the reach of national grids

Emerging energy utility-reform models attach more weight to expanding access. Reform is arriving at a desperately slow pace, but there is a critical mass of evidence demonstrating what can be achieved through good practice.

High connection charges remain a major barrier for people and enterprises. The barrier can be lowered by adopting less stringent technical specifications, spreading payment over time and subsidizing connections for poor households or marginalized regions. Many governments have taken such measures as part of wider strategies for achieving universal access to electricity.[166] The Ethiopian Electric Power Corporation has connected around 60,000 poor households under an Electricity Access Rural Expansion Project, co-funded by donors.

Tariff charges are also a concern. Households on low incomes would be unable to afford electricity tariffs in many cases, even if they could get connected. Utilities can reduce the cost of tariffs by subsidising an initial "lifeline tariff". This approach has been adopted but unevenly applied in South Africa.[167]

Several countries have demonstrated the potential for expanding grid access in rural areas. In Senegal, successive governments have greatly expanded rural access to electricity through a distinctive programme of concessions operated through private companies.[168] Concession-holders are required to meet targets for new connections in poor and remote areas. Government subsidies cover part of the cost of providing an initial connection, while the private operator recovers their share of capital costs of connections through monthly payments rather than through up-front charges. The Office National de l'Electricité (ONE) is committed to increasing both the overall number of connections and the proportion of connections using renewable energy.

Another example comes from Ghana. Over the past 15 years the country has registered one of Africa's fastest growth rates for rural electrification. Around two-thirds of the country's rural population has access to electricity, which is seven times the average level for Sub-Saharan Africa. The national strategy envisages connecting every village of more than 500 households to the grid by 2020. Aid has played a role. But the strategy is underpinned by national investment, allied to local government and community-level self-help initiatives that have mobilized finance for low-cost connections The success of the programme can be traced to sustained political leadership across political cycles, long-term planning and a commitment to national investment for rural electrification. Incentives for community engagement have also played an important role.

New technologies and innovative business models are transforming the potential for off grid provision. Prices for renewable mini-grid and stand-alone technologies are falling. Progressive investors are developing innovative payment systems to reduce the initial cost of market entry for poor households.

Beyond the grid – innovative technologies and business models

New technologies and innovative business models are transforming the potential for off-grid provision. Prices for renewable mini-grid and stand-alone technologies are falling. Meanwhile, progressive investors are developing innovative payment systems to reduce the initial cost of market entry for poor households. Like other regions around the world, Africa is participating in the early stages of an off-grid revolution.

That revolution is driven by economics. Renewable energy providers are increasingly competitive off-grid, mirroring the situation for on-grid provision. While hydropower, geothermal and most biomass-combustion technologies are mature, with limited potential to reduce costs further, solar and wind generation is likely to see rapid price declines as technological developments in mature emerging markets and developed countries penetrate developing countries.[169] So steep are the prospective price declines that they call into question the current utility-based centralized provision model. Perceptions are still widespread that technologies to generate renewable power are expensive or uncompetitive. Those perceptions are at best outdated and at worst a dangerous fallacy.

IRENA estimates that almost 26 million households, an estimated 100 million people, are served through off-grid renewable energy systems. Some 20 million of these households are supplied through solar home systems, 5 million through mini-grids based on renewable sources of energy and 0.8 million through small wind turbines.[170] There is growing evidence to suggest that renewables are now competitive with alternatives. Oil-price volatility and the high costs of small-scale diesel-fired electricity generation are exacerbated in remote locations, where transport costs increase the cost of diesel by 10 per cent to 100 per cent compared with prices in major cities.[171]

Solar lighting illustrates the power of technological change. In 2015 the cost of delivering a single watt of solar power fell to one-quarter of the level in 2008. More efficient light bulbs have contributed to the steep decline in price. The efficiency of storage batteries has also improved.

Financing for off-grid provision remains limited, but it is rising fast. In 2014, early-stage investments in off-grid solar companies operating in developing countries stood at a record US$63.9 million. This was led by two large deals: US$20 million in debt and grants to Kenya's M-KOPA Solar and US$23 million in venture funding for Tanzania-based Off-Grid Electric.[172] In the first half of 2015, private-equity firms,

venture investors and development banks invested US$42 million in off-grid solar companies working in developing countries, mostly in Africa.

Market demand in Africa is expanding. On one estimate, 5 per cent of Sub-Saharan African households now use some form of solar lighting, compared with 1 per cent in 2009. The success of the IFC/World Bank Lighting Africa programme illustrates the scale of the market. Sales of products registered under the programme have reached 5 million, with demand doubling over the past year. Local manufacturing companies are expanding their operations, with 39 registered in 2014.

Despite these developments, renewable mini-grid and stand-alone systems have yet to reach a critical mass. While poor households stand to save over time from adopting new technologies, the initial capital costs can act as a barrier to entry. Simple solar lamps can cost US$8- US$12, but the solar panels needed to provide 250 kWh can cost US$80- US$200. Poor households are often priced out of markets from which they stand to benefit.

Innovative business models can lower the cost barriers. One example comes from Kenya. M-KOPA has brought together solar and mobile technology to bring affordable solar technologies to off-grid villages. Customers pay a small deposit for a solar home system that would usually retail for US$200, including a solar panel, three ceiling lights, a radio and charging outlets for mobile phones. The balance is repaid in small instalments on a pay-as-you-use basis through M-PESA, a widely available mobile payment platform that is used by a third of the population. The payments are cheaper than the equivalent cost of using alternative fuels. After several months, customers own their systems outright.

Other companies are building on this model. The Groupe Speciale Mobile Association (GSMA association of mobile operators) estimates that 60,000 pay-as-you-go solar devices were sold in Sub-Saharan Africa in 2013. The combination of pre-payment and mobile-payment technologies make revenue collection less costly and more efficient. Mini-grids can also use technical means, such as load limiters, to ensure that household consumption does not rise above a pre-determined maximum.

Innovative companies have evolved a suite of credit and payment systems for stand-alone systems sold to households. In Kenya, Azuri Technologies has emerged as one of Africa's most dynamic stand-alone solar providers for low-income households **(Box 12)**. In Uganda, SolarNow, a company established in 2011, has sold 5,000 off-grid systems. A customized business model allows 80 per cent of the invoice value to be spread over 18 monthly instalments. This arrangement lowers the up-front capital costs that might otherwise exclude poor households. The company has done market projections for rural Uganda and Tanzania and suggests potential markets could be US$630 million and US$975 million respectively.[173]

One of the most striking examples of off-grid renewable provision comes from Bangladesh. As in much of Africa, Bangladesh's grid has limited reach and is both inaccessible and unaffordable for millions of households. However, a combination of upward pressure of demand from poor households and downward pressure from public policy reform has enabled many of these households to leapfrog the grid into decentralized solar power **(Box 13)**.

BOX 12 AZURI TECHNOLOGIES – BREAKING THROUGH THE PRICE BARRIER IN KENYA

Azuri Technologies in Kenya produces solar home systems that incorporate a pay-as-you-go controller. This is activated by a code which is obtained by purchasing a scratchcard and is then sent by SMS to Azuri.

Customers pay an initial fee of about US$10 for the installation of the lighting system in their home, comprising a 2.5 watt peak capacity (Wp) solar PV module, a battery, two LED light bulbs and a USB socket for charging phones. They pay about US$1.50 for a weekly scratchcard, which is about half of the typical US$3 a week spent on kerosene for lighting. After 18 months, users can pay a fee of about US$5 to have the system permanently unlocked or they can upgrade to a larger system.

Following a pilot in 2011, Azuri began commercial sales in Kenya the following year and 2,400 systems had been installed by March 2013. By 2015, the system was expected to be available in 11 African countries. An impact study in 2014 found that the main use of the lighting provided by the solar home systems was for studying and that mobile phone charging was the second most important use of the systems.[174]

Several governments and donors are supporting the development of off-grid and mini-grid capabilities. In Ethiopia, the Ministry of Water and Energy's strategic plan for 2015 indicates dissemination of 150,000 solar home systems, 3,000 institutional solar PV systems and 300 solar pumps, as well as 3 million solar lanterns in rural areas. In Tanzania, the Rural Energy Agency is collaborating with private investors and donors to develop a 10MW small hydropower project. NextGen Solar, a US-based investor into renewable energy, is undertaking the development of a 5MW solar PV generation plant in a rural area.

Mobile technology is creating wider opportunities. The rapid spread of mobile-phone usage across Africa has been accompanied by the spread of an off-grid network of cellphone towers stretching into the most remote rural areas. There were an estimated 639,000 off-grid base stations in 2012 and the number is rising every month. These base stations are traditionally powered by diesel generators, though many operators are now exploring the use of diesel-solar hybrid technologies. Because the power for the base station is geared towards peak use, there is a large underutilized capacity in off-peak periods that can be used by local communities.

Reaching people and communities beyond the grid requires more than innovation on the part of companies. A widespread lack of bank accounts can make it difficult for households to enter into contracts with energy providers. Financial exclusion represents another barrier to energy access because it is the poor and particularly those in rural areas that face the greatest difficulty in meeting up-front payment costs.

Financing is not the only barrier to off-grid renewable energy provision. Reaching critical mass in market development will require public-private partnerships to provide training and capacity building, foster the growth of local enterprises through business incubation and access to enterprise and consumer financing, quality assurance provisions, and enabling regulations for tariff setting, collection (for example, through the use of mobile payment platforms) and innovative financing mechanisms.[175]

BOX 13 BANGLADESH'S SOLAR BOOM – GREEN JOBS, BRIGHTER HOMES

Off-grid development has the potential to deliver energy to low-income households and to create jobs. Bangladesh provides a powerful example for countries across Africa. Households across the country are leapfrogging a national grid marked by limited reach, low levels of efficiency and high cost. Ten years ago, there were an estimated 25,000 small photovoltaic systems in the country. That figure has now reached 3.5 million. The boom has created some 114,000 jobs in solar panel assembly.

In 2002, the government launched an off-grid electrification programme implemented through a dedicated agency, the Infrastructure Development Company Limited (IDCOL), charged with bridging the financing gap between large-scale and small-scale energy programmes.

IDCOL works through around 30 participating agencies, including many of the country's largest non-government organizations. The agencies provide a grassroots network covering much of the country. IDCOL supports microcredit schemes for the installation of solar home systems and offers grants to subsidize soft loans and finance installations.

Solar home systems are small photovoltaic systems that provide a decentralized power supply for individual users. Peak capacity is limited (typically 10-30 watts) but sufficient for small electrical appliances, lighting and mobile phone charging. Consumers buy the systems directly from IDCOL's agency network. The capital cost of the system is around US$350 and it is financed by a small fixed grant, with the balance covered by micro-credit loans. Several donors and development finance institutions, including the Islamic Solidarity Fund for Development, the World Bank and the Asian Development Bank, have supported the initiative.

The initiative is one element in an ambitious national strategy. Current plans envisage an increase from 5 per cent to 10 per cent in the share of renewable energy in electricity generation. Grameen Shakti, a sister organization of the Grameen Bank, produces 36MW of solar power across rural Bangladesh and provides electricity to 280,000 households.[176]

Making the breakthrough in clean cooking facilities

With national debates focused on national grids, electricity generation and the mix of fuels used in power generation, insufficient attention has been paid to one of Africa's greatest energy challenges: the use of biofuels by households. Replacing or reducing demand for traditional biomass fuels such as wood and dung and increasing demand for clean, efficient cooking-stoves would save lives, liberate millions of women and girls from the drudgery of collecting firewood and generate wide-ranging environmental benefits. Progress has been painfully slow. Yet evidence from a number of countries demonstrates that accelerated change is possible.

More efficient cooking-stoves provide a cost-effective way to reduce household air pollution and the environmental and other risks associated with using solid biomass. In many rural areas, where alternative fuels are either unavailable or unaffordable, efficient stoves are often the only practicable way forward. Universal access to clean cooking stoves in Africa would generate a wide range of "win-win" scenarios. They would cut the amount that households currently spend on charcoal and firewood, and

reduce the health risks that come with household air pollution. The labour demands of collecting fuelwood would decline and one of the primary drivers of land degradation and deforestation would be weakened. The transition to clean cooking stoves could act as a powerful force for reducing poverty, promoting economic growth and limiting greenhouse gas emissions.

If the benefits are so wide-ranging, why are over 700 million Africans still without clean cooking stoves? Efficient cooking-stoves can pay for themselves over a few months as households save money on charcoal expenditure but millions of people cannot afford the initial cost. Households may view biomass as a "free" good and they may be unaware of health pollution costs. Governments have limited the take-up of clean cook-stoves through generalized neglect of household energy needs.

If the benefits are so wide-ranging, why are over 700 million Africans still without clean cooking stoves? Governments have limited the take-up of clean cook-stoves through generalized neglect of household energy needs.

Recent years have seen a new momentum in efforts to overcome these barriers. Many countries in Africa, including Kenya, Ghana, Ethiopia and Nigeria, have integrated the promotion of clean cooking stoves in rural areas into national energy strategies.

Innovative business models are seeking to overcome the constraint posed by poverty on market demand for efficient stoves. In Ghana, local company Toyola Energy Limited (TEL) has successfully entered the market and sold over 400,000 units between 2009 and 2014. In Mali Katene Kadji company has developed an efficient stove that costs less than US$6.

Several lessons emerge from the experience of companies such as Toyola and Katene Kadji. Both struggled to mobilize credit from commercial banks during the early stages of their development and expansion. Another constraint is that most of their customers are excluded from the financial institutions that provide savings and credit facilities. Both companies were able partially to overcome financial constraints of their domestic markets through recourse to carbon financing and support from international aid agencies. More systemic solutions will require the development of banking systems equipped to respond to the financing needs of viable small enterprises, along with measures to overcome financial exclusion in rural areas.

02

AFRICA'S OPPORTUNITY TO LEAD ON CLIMATE

More than any other issue, climate change confronts people and governments around the world with the reality of our interdependence. International cooperation and multilateralism represent our only source of protection. Our mutual vulnerability provides an incentive and an opportunity to act on the basis of human solidarity, shared values and respect for universal rights. As the UN secretary-general's Special Envoy on Climate Change, Mary Robinson, has said, climate justice is the cause of our day – a cause that crosses the boundaries that separate nations.

Our mutual vulnerability provides an incentive and an opportunity to act on the basis of human solidarity, share values and respects for universal rights.

Climate change also provides another opportunity. Global warming is the product of a misalignment between the energy systems that power economies and Planet Earth's ecological systems. As a global community, we are living beyond our planetary boundaries. Correcting the misalignment demands a fundamental rethink of the carbon-intensive route to development that countries around the world have followed since the industrial revolution. More than that, it demands that governments, investors, firms and citizens work together to develop and deploy the low-carbon technologies that can sustain growth within our planetary boundaries.

Change is already under way. The Global Commission on the Economy and Climate has comprehensively shattered the myth that societies have to choose between economic growth and jobs on the one hand and climate stability on the other. There is no trade-off. Shifting towards low-carbon energy systems can avert climate catastrophe while creating new opportunities for investment, growth and job creation. The challenge is to put in place the low-carbon infrastructure investment, the urban-planning models and the changed land-use practices before it is too late.

Sub-Saharan Africa has a great deal at stake in international cooperation on climate. Impressive human development gains are taking place but climate change has the potential to reverse these in the second half of the 21st century.

Viewed from the other end of the telescope, Africa is part of the climate opportunity. Climate change has given an added urgency to the development of policies that should be introduced irrespective of the climate threat. These are policies that the Africa Progress Panel has advocated over many years. African governments should be doing far more to develop the more resilient agricultural systems needed to manage climate risk, raise productivity and strengthen food security. Tackling the inequalities that have accompanied the recent growth surge and expanding social-protection systems could generate gains for climate resilience and development. And as we highlight in Part I, Africa's energy planners have an opportunity to ride the global wave of innovation that has brought the world to the cusp of a renewable energy revolution.

Africa is also well placed to contribute to international action on climate. While the region cannot make a premature leap into a wholly low-carbon future, it has the potential to scale up the renewable energy investments needed today to reduce greenhouse gas emissions in the future. Africa stands to gain from increased low-carbon power generation and expanded access to modern energy; the world stands to gain from avoiding "lock-in" of carbon-intensive energy systems.

Win-win scenarios are also present in agriculture and land-use. Today, rural poverty and unsustainable energy-use patterns are driving deforestation and land degradation. Africa is depleting ecological assets of great social, economic and environmental

value. The world is losing vital carbon sinks and the carbon generated by dependence on fuel-wood and charcoal is polluting the atmosphere. As we show here, there is an alternative that is good for reducing poverty and improving people's lives in Africa, and good for the planet.

This part of the report looks at Africa's stake in the climate challenge. It is divided into three sections. The first looks at the global deal and why it matters for Africa. The second section outlines priorities for the Paris negotiations. Climate justice for Africa demands that the Paris climate summit sets the world on a course that will keep global warming below 2°C, with a realistic prospect of restricting the increase to 1.5°C by the end of the 21st century. Current policies and pledges of action will leave the world far from the trajectory needed to stay below a 2°C increase, with potentially disastrous consequences for Africa. The third section looks at climate finance, one of the key building blocks for an ambitious agreement. It argues that the current financing architecture is comprehensively failing Africa, and sets out directions for reform.

"We have a mandate from science, from our people, from the African continent and from the UN itself to strive for enhanced global climate activities to reduce greenhouse gas (GHG) emissions and strengthen adaptation."

Nagmeldin Goutbi Elhassan, Chair, African Group of Negotiators under the UNFCCC 2014-2015

AFRICA'S STAKE IN THE GLOBAL DEAL

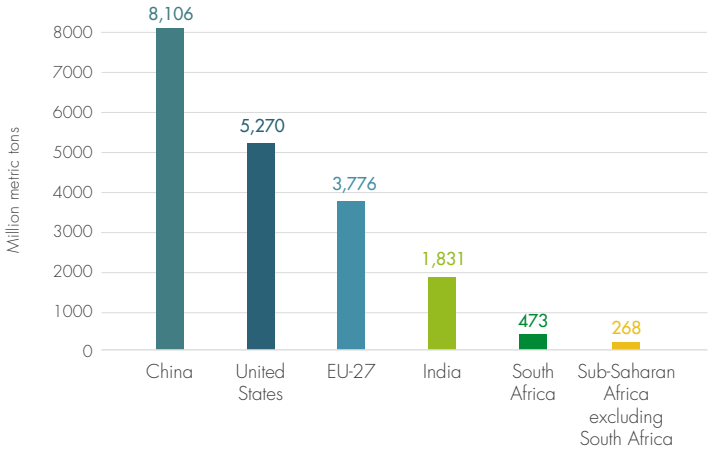
Climate change is the point at which two of Africa's most pressing policy challenges come together. The first, dealt with in the first section of this report, is the energy challenge. Energy systems in many countries are geared towards providing subsidized energy, based on fossil fuels, to a small minority. These systems are a constraint on economic growth and a source of inequality. The second challenge relates to agriculture. In Africa, agriculture accounts for two-thirds of livelihoods and food accounts for two-thirds of poor people's household budgets. Sustaining growth, reducing poverty and making progress in other areas of human development depend critically on increasing agricultural productivity. In the absence of these gains, rising prices will undermine food security, hold back urbanization and inflate wage costs, with damaging prospects for investment, employment and Africa's competitive position in the global economy.

There is another reason to place agriculture at the heart of Africa's climate priorities. A consistent theme to emerge from global and regional macro-economic modelling of climate-change impacts is that asset-poor people in rural areas face the greatest risks. The Intergovernmental Panel on Climate Change (IPCC) has identified Sub-Saharan Africa as one of the most vulnerable regions to climate change.[177] This is because of the dependence of agriculture in the region on rainfall, the high levels of background poverty and the combined impact of higher food prices and lower yields.[178]

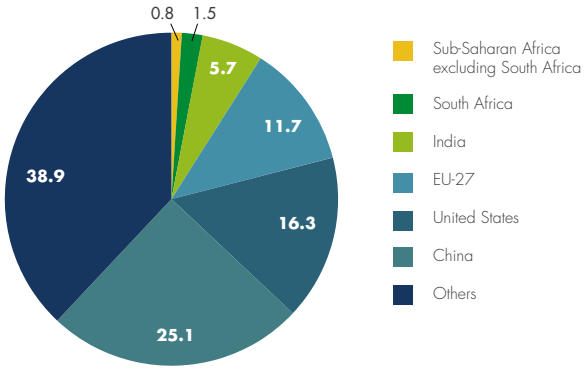
Viewed from the perspective of the climate negotiations, both Africa and the wider international community have reasons to prioritize agriculture. To the extent that Africa's carbon footprint registers in the Earth's atmosphere it is a land-use footprint. Excluding land use, the region's share of greenhouse gas emissions is minuscule. In 2012, Sub-Saharan Africa (minus South Africa) emitted only 2 per cent of total global emissions of greenhouse gases (Figures 32 and 33). It would take the average Ethiopian 240 years to register the same carbon footprint as the average American.

FIGURE 32 AFRICA ACCOUNTS FOR A SMALL SHARE OF CARBON EMISSIONS

TOTAL CO_2 EMISSIONS FROM CONSUMPTION OF ENERGY (MILLION METRIC TONS, 2012)

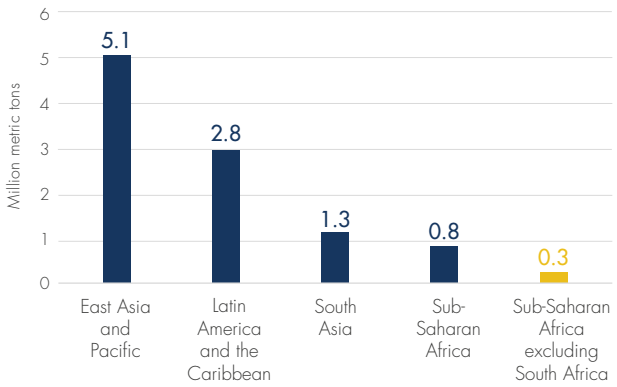


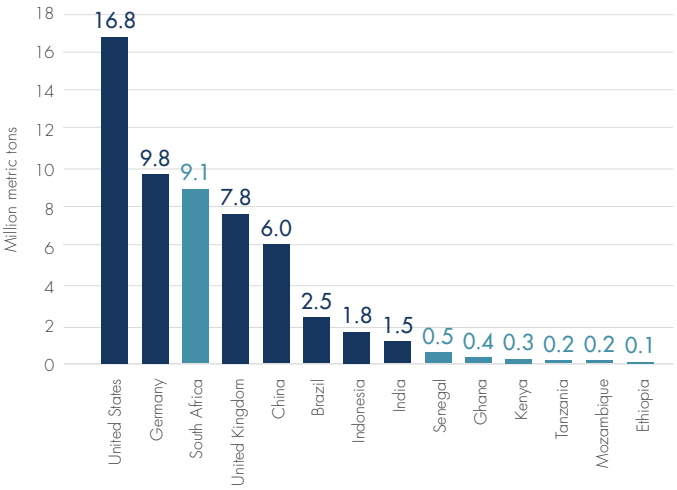
SHARE OF TOTAL CO_2 EMISSIONS FROM CONSUMPTION OF ENERGY (PERCENT, 2012)



Data source: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Carbon Dioxide Emissions from the Consumption of Energy (Million Metric Tons).

FIGURE 33 AFRICA'S SHALLOW CARBON FOOTPRINT: TOTAL CO_2 EMISSIONS FROM CONSUMPTION OF ENERGY PER CAPITA (METRIC TONS, 2012)





Data source: U.S. Energy Information Administration. (2012). International Energy Statistics: Total Carbon Dioxide Emissions from the Consumption of Energy (Million Metric Tons).

Under the IEA's baseline energy scenario to 2040, power generation in Sub-Saharan Africa would quadruple but the region's share of global CO_2 emissions would increase only from 2 per cent to 3 per cent. Around two-thirds of the region's emissions (excluding Nigeria and South Africa) can be traced to land use. While the precise mix varies across countries, agriculture and livestock dominate, with forest degradation and deforestation contributing the balance. Much of that balance is intimately tied to the production of charcoal, an US$8 billion-a-year industry that accounted for about half of all tree removals between 2000 and 2010.[179]

This backdrop has important implications for how African governments approach the climate negotiations. Given that land use dominates the region's greenhouse gas emissions, there is a widespread, though often unstated, concern that any activities aimed at reducing or mitigating emissions might hurt the interests of rural populations facing the greatest climate risks despite carrying the smallest burden of responsibility. Similarly, with power generation producing modest greenhouse gas emissions, there is a view that Africa has much to lose from any commitments to mitigate while the world has little to gain.

These are misperceptions. Agriculture and land use is an area in which there are triple wins available for agricultural productivity, climate resilience and climate mitigation. As in other areas identified by the Global Commission on the Economy and Climate, the widely feared trade-offs are more imagined than real. In the case of power generation, international support for renewable energy today would expand the choices open to policymakers and help countries avoid the high carbon lock-in that China and others are now seeking to escape. Here, too, there are triple-win scenarios. As we highlighted in Part I, renewable technologies have the potential to support utility-scale grid development and reach rural areas beyond the grid, creating opportunities for increased productivity, greater resilience and long-term carbon mitigation, even if that is modest on a current scale.

The world is heading for dangerous climate change

The agreement to be negotiated in Paris aims at two different but related global-warming limits. Keeping warming below a 2°C increase above pre-industrial levels is a long-standing commitment of the United Nations Framework Convention on Climate Change (UNFCCC) and agreed at the 2010 climate change conference in Cancun, Mexico. The second target centres on reducing global warming to below 1.5°C by 2100.

Some commentators have questioned the scientific and political basis for the 2°C target.[180] But there is compelling scientific evidence that warming above this level will be associated with potentially catastrophic effects as ice sheets collapse, oceans warm and thawing permafrost releases greenhouse gases.[181]

Climate science provides the basic roadmap for avoiding dangerous climate change. Because the capacity of the atmosphere to absorb greenhouse gases without generating heat-trapping warming effects is fixed, scientists have been able to determine a "carbon budget" for the 21st century consistent with staying within 2°C. That budget is around the equivalent of 1,000 gigatonnes of CO_2 ($GtCO_2e$). On current trends, that budget will be exhausted between 2040 and 2050. Emissions are projected under a wide range of scenarios to rise from 49 $GtCO_2e$ a year to 87 $GtCO_2e$ by 2050.

Climate modelling converts these scenarios into global-warming probabilities. At the greenhouse gas concentration levels in prospect under current trajectories, the likelihood of staying below 2°C is extremely small. Temperatures at the end of the 21st century could be more than 4°C above pre-industrial levels, and Sub-Saharan Africa could experience warming of 5°C above the baseline towards the end of the 21st century or in the following century.[182] The risks associated with such an outcome for the lives, livelihoods and security of future generations are beyond estimation. So too are the implications for Africa's development prospects.

What would it take to get the world on track for avoiding dangerous climate change? To summarize a complex issue briefly, retaining a likelihood of staying below 2°C will require:[183]

- greenhouse gas emission reductions of 40-70 per cent by 2050 from 2010 levels, with zero emissions by 2080-2100.
- global energy and industry CO_2 emissions reaching zero by 2060-2075.

Keeping within a 1.5°C threshold will require more exacting measures. The date for reaching zero emissions is 20 years earlier and the required cuts by 2050 are in the range 70-95 per cent.[184] Most of the scenarios for a 1.5°C threshold involve an overshoot, with deep net emission reductions in the second half of the 21st century.

Delayed action would be fatal, because the effects of greenhouse gas emissions are cumulative. In contrast to the Doha Round of trade talks, for example, where negotiations continued for over a decade with no tangible damage to the world trading system, inertia in the climate system means that inaction today locks in future warming. Around half of CO_2 emissions are dissipated over decades, but the other half remains in the atmosphere for over a century. Current emissions therefore produce warming effects that are for all practical purposes irreversible for future generations.

The weaker the measures introduced today, the more stringent the action needed in the future. Early action on mitigation expands the carbon budget available in future years, and increases the likelihood of staying within a 2°C increase.

"The outcomes of the negotiation of a future legal outcome should provide for developmental priorities of Africa, whilst ensuring adequacy of a global emission reduction effort to keep the continent safe."

Xolisa Ngwadla,
African Group of Negotiators Lead Coordinator on the Ad-hoc working group on the Durban Platform.

Africa is facing acute climate risks

Climate change impacts will be transmitted through a complex array of mechanisms. The effects on individual countries, and parts of countries, will depend on specific social, economic and environmental circumstances. Many effects will be associated with water in the form of drought, floods, uncertain rainfall and stress on watersheds and river systems. Part of the region's vulnerability can be traced to the fact that over 90 per cent of agriculture is dependent on rainfall.

The following are among the effects predicted by a range of modelling exercises.

- **Agricultural yields and food security:** The IPCC's Fifth Assessment concluded that "climate change is very likely to have an overall negative effect on yields of major cereals crops across Africa."[185] Significant crop effects are already being felt. Even under warming of less than 2°C by the 2050s, total crop production could be reduced by 10 per cent.[186] Across the region, yields of maize are predicted to decline sharply by 2050, with average predicted losses on this basic food staple ranging from 5 per cent for the region overall to 11 per cent in southern Africa.[187]

Models for the Sahel predict a 20 per cent decline in yields for millet and a 13 per cent decline for maize. For higher levels of warming, yields may decrease by around 15–20 per cent across all crops and regions.[188]

- Extreme climate events: As global warming levels increase, drought, heat waves and heavy rainfall will become more pronounced. Southern Africa faces the risk of more severe and protracted droughts and periods of extremely low and extremely high rainfall could become more common. Climate models are broadly consistent in predicting that rains will be heavier, particularly in the wetter areas of tropical Africa, increasing flood hazards. Eastern Africa is projected to become wetter. As exposure to flood risk goes up, socio-economic losses will increase, especially in smaller catchments that are prone to flash floods and have high population densities.[189] Unprecedented heat extremes are projected over an increasing percentage of land area as warming goes from 2°C to 4°C, resulting in significant changes in vegetative cover and putting some species at risk of extinction. Heat and drought would also result in severe losses of livestock.

- Groundwater: Most Africans rely on groundwater for domestic supply, particularly in rural areas. Precipitation changes could substantially limit water availability in some regions. One model for southern and west Africa predicts decreases in groundwater recharge rates of 50–70 per cent.[190] The combination of changes in the flow of streams and rising temperatures is also expected to have broadly negative impacts on freshwater ecosystems and water quality.[191] In other regions, such as the Horn of Africa, greater rainfall could increase groundwater levels.

- Rising sea levels: Global mean sea levels in the last two decades of the 21st century will be 45-82 centimetres (cm) higher under a high-emission scenario. This implies significant risks for Africa's coastal settlements and emerging mega-cities such as Lagos, Dar es Salaam, Accra and Maputo. Estimates of risk vary. One model, based on a 40-cm rise in sea levels, puts the number of people threatened by flooding in the four worst affected countries – Cameroon, Mozambique, Senegal and Tanzania – at 10 million. There are high concentrations of poverty and low levels of investment in drainage and flood defences in many of the areas under most-immediate threat.

- Energy-sector impacts: Climate change could have far-reaching consequences for Africa's energy systems, principally through its impact on hydropower. Increased rainfall and run-off could raise capacity to generate hydropower in East Africa but have the opposite effect in parts of West and Southern Africa.[192] Increased evaporation will affect the level of "stored" energy in reservoirs, while increasing temperatures can be expected to boost demand for water resources from other sectors, such as for irrigation, intensifying water scarcity.[193]

- Health: Warmer temperatures and, in some subregions, more water could enable disease-carrying insects to spread to new latitudes. Increased flooding in urban coastal areas lacking sanitation and waste-disposal infrastructure could increase human exposure to a range of infectious diseases. Changes in agricultural productivity could also have long-term health implications, including child malnutrition.

- Fisheries: Marine ecosystems, including coral reefs and the fisheries that depend on them, are expected to be among the natural systems affected the earliest by climatic changes.[194] Coral reefs off the coasts of Africa are very likely to experience thermal stress by 2050 at warming levels of 1.5°C–2°C above pre-industrial levels and there is likely to be a severe coral-bleaching event once, or more, every ten years. Most coral reefs are projected to be extinct long before 4°C warming is reached, with associated losses for marine fisheries, tourism and coastal protection. Evidence

on fish stocks is more limited, but worrying. One study projects losses in maximum catch potential of up to 50 per cent along the West African coast from Gabon to Mauritania, harming communities that depend on fish for protein.[195]

Presenting evidence from modelling exercises in this fashion does not capture the full magnitude of the risks. Climate-change effects will not occur in isolation but will interact with wider forces. Economic growth, population growth and urbanization are already increasing pressure on land and water resources. Changes will occur incrementally, but for the millions of Africans living close to the margins of survival, it only requires a small increment in risk to be pushed over the edge into an inescapable poverty trap.

Climate is already among the most potent risk factors for poverty. Climate change is a risk multiplier. Recent experience illustrates the power of climate to send development into reverse. The floods that swept across Malawi in January 2015 displaced 250,000 people, destroyed homes, crops and productive assets, and led to an increase in infectious diseases. In 2010, a severe drought affected 10 million people across Chad, Cameroon, Mali and Niger. The loss of livestock and crops increased food prices and left 7.1 million people hungry in Niger alone. The 2011 drought in the Horn of Africa caused up to 100,000 deaths, half of them among children under 5, and widespread malnutrition; 13 million people required life-saving assistance. It should be emphasized that it is not possible to attribute specific climate events to human-induced climate change. However, the United Kingdom's Met Office attributes 24-99 per cent of the increased risk of the dry conditions seen during the East African long rains season of 2011 to human influence on climate.[196]

Infrastructure deficits magnify the risks. Irrigation and water-storage systems provide a vital buffer against rainfall variability. Yet only around 5 per cent of Africa's cultivated land is irrigated and storage capacity is the lowest of any region.[197] On one estimate Mozambique's GDP growth is reduced by 1 percentage point annually because of water shocks.[198] These economic impacts fall disproportionately on poorer people, who depend on rain-fed agriculture and unprotected domestic water sources, and are exposed to more frequent floods and droughts.[199]

Wider macro-economic effects will be transmitted through the energy system. Much of East Africa and West Africa already experiences high levels of power outages during the dry season. In 2011, the Tanzania energy utility TANESCO announced indefinite 12-hour power cuts as lower water levels reduced generation capacity at hydropower dams. The power cuts lowered GDP growth by 1 percentage point. Reduced energy levels will hold back growth, with implications for job creation and vulnerability to climate-change effects. Disruption of agriculture will affect food prices, wages and malnutrition.

Uncertainty is fundamental to climate change. This is because of the time-scales over which climate change is expected to occur and the limitations of climate models in predicting the location, timing and scale of impacts. The limitations are especially marked in Sub-Saharan Africa because of the gaps in data from climate observation. In Africa, over 80 percent of National Meteorological and Hydrological Services are unable to adequately provide ground observation data and related warnings. Uncertainty does not mean action should be postponed. It means that decision-makers have to commit to investments that reflect likely climate risks (for example, in water harvesting and the development of infrastructure) while strengthening resilience and lowering the background risks that come with poverty and low productivity.

Poor households will bear the brunt

Whatever the precise nature, timing and location of the impacts of climate change, the poor will bear the brunt. The earliest and most damaging impacts will be felt by those whose livelihoods are most prone to risks caused by the climate. These include, for example, smallholder farmers and pastoralists who depend on rain-fed agriculture, live in marginal areas and have the most limited human, financial and physical coping mechanisms.[200]

Background poverty, allied to the limited reach of welfare safety nets and underdeveloped infrastructure, is at the heart of Africa's vulnerability. Despite some gains over the past decade, the region has the world's highest incidence of poverty (47 per cent) and by some distance the greatest depth of poverty. The income, measured by consumption level, of the average person living on less than US$1.25 a day is just US$0.74 a day.

Poverty is most widespread and most intense in rural areas. According to the International Fund for Agricultural Development (IFAD), 60 per cent of rural Africans live on less than US$1.25 a day and 90 per cent on less than US$2 a day.[201] At these levels of income, even moderate climate shocks such as delayed rainfall or a slightly more protracted dry-season can have grave consequences. More extreme climate events can have catastrophic outcomes, leading to persistent welfare losses. The *Human Development Report* of the United Nations Development Programme found that children in Kenya aged 5 years old or younger were 36 per cent more likely to be malnourished if they were born during a drought year in their district, and children in Tanzania 50 per cent more likely.[202] Even 10 years after a 1990s drought in Ethiopia and Tanzania, the consumption levels of poor households remained 17 to 40 per cent below the levels before the drought.[203]

Confronted with climate-related shocks that lead to losses of crops and livestock or increased food prices, the poor may have little alternative but to cut vital expenditure or sell productive assets. Distress selling of assets in turn creates a vicious circle, reducing productivity and increasing vulnerability to future climate-shocks. Rebuilding livelihoods and restoring assets may prove impossible or take a very long time, trapping households in poverty.[204]

Lacking access to formal insurance, rural populations use their limited savings to guard against risk, which means they are effectively directing their potential investment funds into self-insurance. Data is available for 36 countries and in 34 of these resources put aside to cover emergencies accounted for over half of total savings, rising to more than 80 per cent for Tanzania, Kenya and Nigeria. There is evidence to suggest that uninsured risk itself deters farmers from investing in more productive crops varieties.[205]

There is a vicious circle linking climate change to rural poverty

Raising agricultural productivity is an imperative. The agricultural sector not only supports the livelihoods of most Africans and underpins national food security, it also accounts for 14 per cent of GDP. Agricultural growth is twice as effective in reducing poverty as growth in non-agricultural sectors.[206] The underlying problems holding back productivity were analysed extensively in last year's *Africa Progress Report*.[207] While country circumstances vary, under-investment in rural infrastructure, barriers to cross-border trade, limited agricultural research and development, and restricted development of water resources figure prominently.

It is often argued that the region's future will be increasingly urban. This is correct, but urbanization without increased rural productivity is a prescription for food insecurity, rising

food prices and increased wage costs, which will in turn limit employment and investment. Without higher levels of agricultural productivity rural areas will get left further behind, weakening the link between growth and poverty reduction, and reinforcing inequality.

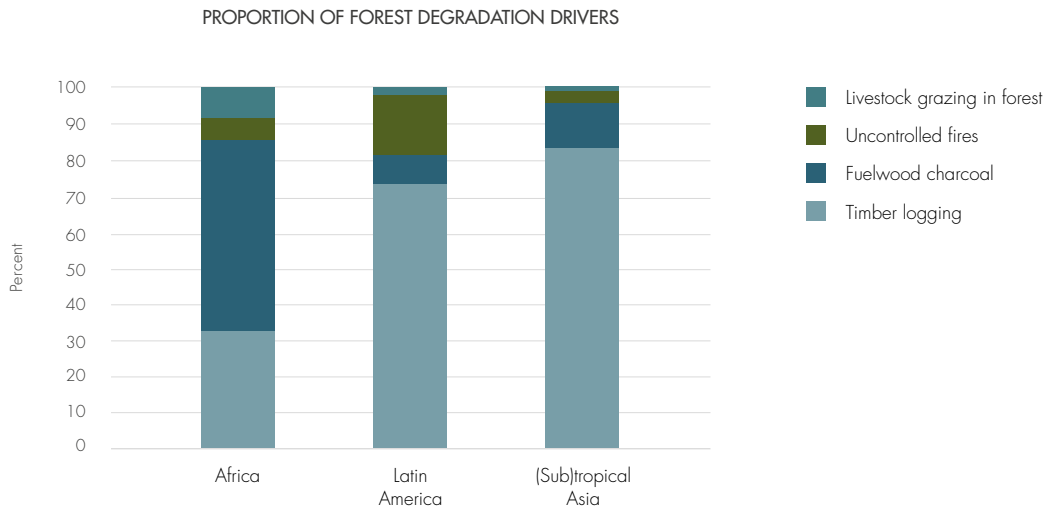
Failure to increase agricultural productivity will not only exacerbate vulnerability to climate change and undermine prospects for inclusive growth, but also exacerbate a critical but much neglected aspect of the global climate crisis: the damaging interaction between climate, ecological degradation and poverty.

The loss of ecological resources is a source of local vulnerability and global warming. Changes in agriculture, forestry and land-use patterns are responsible for emissions equivalent to 10-12 $GtCO_2e$, one-quarter of the global total.[208] Africa accounts for around 20 per cent of these emissions, divided on a roughly equal basis between agriculture, forestry and land use. Its emissions are growing at 1-2 per cent a year.[209] These agriculture, forestry and land-use changes account for about half of total emissions for Sub-Saharan Africa, and the share is rising.

Low agricultural productivity is one of the most powerful causes of land degradation in Africa. The region's farmers have increased output not by boosting productivity but by bringing more land under cultivation.[210] Limited access to fertilizer, high-yielding seeds and irrigation contributes to low productivity levels. Climate risk could ratchet the effect even further. As household incomes fall and investment in seeds and fertilizer declines, smallholder farmers may be forced to further extend the margin of cultivation.[211]

Low productivity has intersected with population growth, urbanization and demand for biomass energy sources to create acute pressure on land and forestry resources.

FIGURE 34 DEMAND FOR FUELWOOD AND CHARCOAL IS DRIVING FOREST DEGRADATION IN AFRICA



Data source: Kissinger, G., M. Herold, and De Sy, V. (2012). Drivers of Deforestation and Forest Degradation: A synthesis report for REDD+ policymakers.

Around 2 million hectares of forest were lost annually in Sub-Saharan Africa between 2000 and 2010.[212] Commercial and subsistence agriculture account for some 70 per cent of forest loss, while firewood collection and charcoal production are the primary causes of forest degradation, followed by logging **(Figure 34)**.

Forestry resources provide vital ecological services, maintain biodiversity and provide a source for food, fuel and building materials. Moreover, because forestry resources are freely available, they often serve as a safety net for the rural poor.[213] Treating forestry resources as a "free good" ignores the very real costs of depleting the assets on which so many people depend.

Reversing the vicious circle – raising productivity, building resilience and valuing ecology [214]

Failure to tackle low productivity in agriculture will compromise Africa's development. Conversely, higher productivity would open up new national, regional and global market opportunities and help to drive a more equitable pattern of growth. The extent of the opportunity should not be underestimated. Import substitution is one such opportunity. Food imports reached a record high in 2011, when the region's total agricultural imports from all suppliers reached US$43.6 billion.[215] With the right investments, Africa's farmers could displace a large share of these imports, helping to reduce rural poverty.

Restoring degraded agricultural land provides another mechanism for turning the vicious circle into a virtuous circle of rising smallholder income, reduced vulnerability and strengthened national food security. There would be significant global benefits whose effect stretches beyond Africa in the form of reduced emissions related to agriculture, forestry and land use. Africa has the potential to demonstrate global leadership in this area, which is of vital importance for international efforts to combat climate change.

Several countries are already providing that leadership. One of the most striking examples comes from Niger, where smallholder farmers have transformed the productivity and sustainability of agriculture across 5 million hectares of land.[216] The key in this case was the introduction of legal reforms providing communities with a stake in the conservation of trees **(Box 14)**.

Another example comes from the Tigray region of Ethiopia, where communities have developed and successfully implemented strategies regulating access to communal grazing areas in order to combat land degradation. The government has scaled up these local initiatives through a national policy framework, increasing farm incomes and reducing poverty.

Some governments have put sustainability at the centre of wider agricultural strategies. Rwanda has the highest population density in Africa and 90 per cent of arable land is located on hillsides dominated by small farms. Soil erosion is a major threat. In 2008 the government adopted a Land Husbandry, Water Harvesting and Hillside Irrigation Programme that invests in terraces, bunds (low retaining walls) and small-scale water harvesting. Some 20,000 hectares of land has been covered, with co-financing of US$140 million from the World Bank, a group of bilateral donors and the Global Agriculture and Food Security Programme. Yields have increased by 30 per cent for

BOX 14 NIGER'S SMALLHOLDER FARMERS LEAD THE WAY FOR SUSTAINABLE LAND USE

Niger's farmer-led approach to agroforestry demonstrates how a policy change can substantially improve livelihoods while contributing to both adaptation and mitigation.

Smallholder farmers have introduced sustainable practices on 5 million hectares of land through sparse inter-planting of nitrogen-fixing trees. Tree and shrub cover has increased 10-to 20-fold, and 250,000 hectares of severely degraded soils have been reclaimed. Since the programme started in the early 1990s, 200 million trees have been planted.

The changes in Niger can be traced to legislation adopted in the 1990s. Rights of tree-ownership were transferred from the state to farmers, who responded by planting, protecting and managing tree resources that were previously seen as a "free good".

There have been impressive gains. Farm yields have increased by at least 100 kilograms (kg) per hectare.[217] Gross real annual income has grown by US$1,000 per household for over a million households, more than doubling real farm incomes and stimulating local non-farm services.[218] The programme has also lowered greenhouse gas emissions as the agroforestry parklands sequester 1.6-10 tonnes of carbon dioxide equivalent (tCO_2e) per hectare, and this figure could increase significantly as these trees age.[219]

These agroforestry techniques have spread to other countries in the Sahel. On the Seno Plains in Mali, around 450,000 hectares of previously degraded area now has medium or high tree-density. Some 300 million hectares of land in Sub-Saharan Africa is suitable for similar land management techniques. Coverage of just one quarter of this land could provide 285 million people with an additional 615 kcal per day per person in the zones concerned.[220]

maize and 167 per cent for beans. This is a far more effective model for responding to climate change and poverty risks than the small-scale adaptation projects supported through the current climate-finance architecture.[221]

One striking feature of the successful land conservation programmes in Niger and Ethiopia is their scale. These are national and local programmes that have been integrated into wider strategies. Similar approaches are needed for adaptation in agriculture. While millions of farmers across Africa are adapting to climate risk with every season, far too much of the national and international response has been geared towards small-scale projects, rather than transformative national programmes.

Smallholder farmers are already demonstrating an extraordinary level of ambition and innovation in adapting to climate risk. Research has identified the development of new and the restoration of old approaches to water harvesting, soil management and inter-cropping.[222] To take one example from Burkina Faso, farmers are digging small holes or planting pits on barren, degraded land and filling them with organic matter, adding nutrients to the soil where they sow their crops. They also construct stone lines on their farmland to slow water runoff, prevent erosion, and assist in recharging the groundwater. Applying small quantities of fertilizer directly to seeded crops or young shoots early in the rainy season can complement these low-tech land and

Smallholder farmers are already demonstrating an extraordinary level of ambition and innovation in adapting to climate risk.

water management techniques. These practices have reportedly more than doubled millet and sorghum yields and allowed farmers to restore degraded land completely, bringing up to 300,000 hectares into cultivation.[223]

Social protection, climate and energy

The case for "climate-smart" agriculture may be self-evident and the project evidence compelling, but building resilience requires action at an appropriate scale through national agricultural strategies. When social-protection programmes are built into these strategies, they help to mitigate climate risk, support productive investment and boost growth.

What is possible in social protection is contingent on financial and institutional capacity. Cash transfers, safety nets, social insurance programmes and other measures can all play a role in strengthening resilience. By preventing households from falling deeper into poverty, such programmes also provide a platform for early recovery.[224] Evaluations of Ethiopia's Productive Safety Net Programme (PSNP), which provides cash and food transfers in drought-prone areas, show that 60 per cent of beneficiaries avoided having to sell productive assets to buy food and achieved a larger increase of assets over time.[225] About 20 per cent of Ethiopia's total PSNP budget is held as contingency funds, used to respond to unpredictable increases in demand for assistance. In 2008, these funds were used to provide additional transfers to 4.43 million beneficiaries affected by severe drought and rising food prices.[226]

Some countries in Africa are scaling up social-protection programmes, including Ghana, Kenya and Tanzania. Rwanda's latest National Social Protection Strategy emphasizes "climate-proofing" the country's national development strategy.[227] Far more could be done to increase the reach and effectiveness of these programmes through increased investment, better targeting and integrating climate-risk assessments into design and implementation. Part of the additional finance required could be made available by reducing the energy subsidies that principally benefit high-income households.

Social protection is neither a panacea nor a stand-alone strategy, however. Effective adaptation to climate change requires a coherent strategy for managing systemic climate risk. The experience of Ethiopia is instructive because it marks an attempt to develop an integrated national strategy **(Box 15)**.

One area in which African governments can provide leadership in the global climate negotiations is in approaches to adaptation. Climate change has brought in its wake a new aid industry associated with adaptation. The overall intention of building the resilience needed to cope with emerging climate risks is commendable. However, aid for adaptation practices has suffered from a small-scale, project-based approach that is ill-equipped to respond to the emerging risks facing farmers across Africa. The IPCC Fifth Assessment Report called for a new model of "transformative adaptation" that "changes the fundamental attributes of a system in response to climate and its effects."[228] African governments should champion this approach by pressing for a fundamental overhaul of the current climate finance architecture for adaptation.

BOX 15 ETHIOPIA'S CLIMATE RESILIENT GREEN ECONOMY STRATEGY

High levels of rural poverty, coupled with ecological stress on land and water resources, and rapid population growth make Ethiopia acutely vulnerable to climate change. The 2011 Climate Resilient Green Economy (CRGE) strategy marks a bold response to the challenges facing the country, but its success will depend critically on international support.

Two main strands make up the CRGE strategy: the first focuses on the green economy, where the strategy identifies four priority investments – in hydropower development, rural cooking technologies, the livestock value chain and forestry development. The second strand addresses climate resilience, with agriculture identified as a priority. The annual investment required for implementing the strategy in agriculture is estimated at around US$1 billion, with 40 per cent channelled through the Ministry of Agriculture. It is envisaged that the private sector's role in financing it will rise from 20 per cent to over 40 per cent by 2030.

Implementing the CRGE strategy confronts Ethiopia with challenges at many levels. Institutional constraints figure prominently, although innovation is already taking place at the sector level. The Ministry of Agriculture, for example, has established a CRGE unit under the Natural Resource Sector, headed by a state minister. In the Ministry of Water, Irrigation and Energy, a new emphasis on irrigation reflects a shift away from rain-fed agriculture as an explicit adaptation strategy. Finance for climate-change adaptation remains a major challenge, yet the government is already committing significant funds in key sectors.[229]

INTERNATIONAL ACTION
Priorities for Paris

Since the near collapse of the 2009 Copenhagen summit on climate, governments have tended to treat the avoidance of a breakdown in the global talks as an indicator of success. The world cannot afford to continue this pattern of climate diplomacy. The window of opportunity to limit global warming to 2°C is closing.

For Sub-Saharan Africa, the Paris summit in late 2015 represents a fork in the road. Failure to agree on an ambitious and practical agenda for action will greatly increase the likelihood of reversals in human development. The consequences will be measured in lost opportunities for Africa and the rest of the world to sustain growth and reduce poverty.

The Paris summit also provides governments in Africa with an opportunity to demonstrate climate leadership. There are two strands to that opportunity. The first relates to the overall level of ambition and commitment. In 2010, governments adopted the principle of "equitable access to sustainable development" as a guiding theme for the UNFCCC agreement. African governments have played an important role in articulating how that principle can advance the cause of climate justice, steering negotiations away from the sterile deadlock over "common but differentiated responsibilities". The bottom line for the region is that (i) the Paris summit must result in the commitments needed to stay within the 2°C threshold; and (ii) developing countries must secure the support they need to embark on a low-carbon transition.

The second thread relates to Africa's own development. Governments across the region increasingly recognize that the trade-off between growth and climate action is illusory. The climate-strategy document published by the government of Kenya reads: *"the conundrum of choosing between action on climate change and action on development is a false one: the two are interlinked and will become increasingly so over the coming decades. Building climate resilience, or increasing the ability to adapt to climate change, in as low-carbon a way as possible will help Kenya achieve sustainable development."* [230]

The conundrum of choosing between action on climate change and action on development is a false one: the two are interlinked and will become so over the coming decades.

Climate-resilient development is a vital part of any strategy for inclusive growth. Increased agricultural productivity allied to reforestation, conservation and restoration of degraded land can accelerate the reduction of rural poverty. Improving crop and livestock production practices would increase food yields, boosting food security and farmers' incomes. Expanding renewable energy could reduce pressure on forests, cut energy costs for the poorest households and increase the power generation needed to underpin economic growth. In each of these areas, African governments could generate benefits for their own citizens while reducing greenhouse gas emissions.

This is where international cooperation and climate finance have a vital role to play. The choices open to African governments are constrained by financing gaps. More effective cooperation would enable Africa to seize the opportunities offered by renewable energy, conservation and agricultural productivity, benefiting the region and the world.

The road to Paris – there has been a shift in approach to the negotiations

The Paris summit in December 2015 will negotiate a successor to the 1997 Kyoto Protocol, which is the legally binding international treaty linked to the United Nations Framework Convention on Climate Change (UNFCCC). Negotiations are taking place through a process known as the Durban Platform for Enhanced Action. The new agreement will be implemented from 2020 in the form of a protocol, another legal instrument or "an agreed outcome with legal force". It will be applicable to all parties.

The strength of the Kyoto Protocol was arguably also its weakness: it set internationally binding targets for reducing emissions between 2013 and 2020, but these targets have applied only to rich countries. The principle of "common but differentiated responsibility" was applied to exclude developing country commitments, effectively putting fast-growing emerging economies and middle-income countries on a par with the world's poorest countries in Africa. Moreover, the sanctions available for enforcement were not applied and countries faced with the prospect of such sanctions could simply withdraw from the Protocol.[231]

The road to Paris has seen the emergence of a new approach to climate negotiations. In 2011 the Durban Platform marked a new phase in climate diplomacy as it recognized that the 20-year North-South standoff was a barrier to effective action. Wider resentments over aid, trade and development financing were being played out in climate talks, delaying progress in an area where delay intensifies the problem. The long-overdue recognition that countries such as China and Ethiopia cannot be treated with equivalence has opened the door to more constructive dialogue.

Under the Kyoto Protocol, governments signed up for emission reductions under a legally binding treaty. The UNFCCC negotiations for Paris have been organized differently. Each country will determine its contribution to global climate mitigation by preparing and presenting Intended Nationally Determined Contributions (INDCs) documents, which are scheduled to be submitted before the negotiations.

The new approach could help or hinder efforts to tackle climate change. Countries may be more likely to table ambitious commitments if they are not legally binding. But building a new international climate agreement on bottom-up commitments could foster a stronger focus on national policies, laws and monitoring arrangements.

On the other hand, there is a danger that countries will volunteer actions that fall far short of the levels required to meet the targets for an average global temperature increase of between 1.5°C and 2°C.[232] Another risk is that governments will adopt a high level of ambition in the INDCs tabled at Paris, safe in the knowledge that there are no mechanisms for holding them or their successors to account for delivery. This is why any agreement built on a bottom-up approach has to incorporate strong national and international commitments to monitoring, reporting and verification, backed by well-defined rules and a transparent institutional structure.

In the last analysis, the outcomes will be determined less by legal form than by political leadership. Success at Paris will hinge on combining bottom-up with top-down approaches. In their submissions, countries will propose national targets and the steps they will take to reduce emissions. Subjecting countries' submissions to a top-down review is vital to ensure that the package adds up to sufficient cuts in greenhouse gas emissions.

Governments in Africa have mixed views on the INDC approach. Given the limited volume of greenhouse gas emissions from the region, the content of submissions from Africa – with the partial exception of South Africa – are unlikely to figure prominently in the negotiating process. Yet the INDCs could, and should, be used for a positive purpose. They provide a vehicle for African governments to describe the actions that are already under way to develop renewable energy and tackle land-use degradation. More important, African governments could use the INDCs to outline ambitious strategies for scaling up current efforts through international cooperation backed by finance.

Current pledges of action fall far short of what is required

Climate-change negotiations are unique in one key respect. In other areas of international negotiations, such as on trade, finance, debt relief or arms control, governments negotiate with each other to secure deals reflecting their perception of national interest. Their negotiating partners are other governments doing the same. In the case of global warming, the negotiating partner is Planet Earth's ecological capacity for absorbing greenhouse gas emissions. Planetary boundaries do not negotiate.

There is some evidence of a new momentum in climate negotiations. Between them, the United States, China and the European Union account for 42 per cent of global greenhouse gas emissions. All three announced new commitments during 2014. In November 2014, China and the United States announced a US-China Joint Announcement on Climate Change on emission reductions. Under the agreement,

China stated an intention to a peak in emissions by 2030, together with increasing the share of renewable energy to 20 per cent of the country's energy mix.

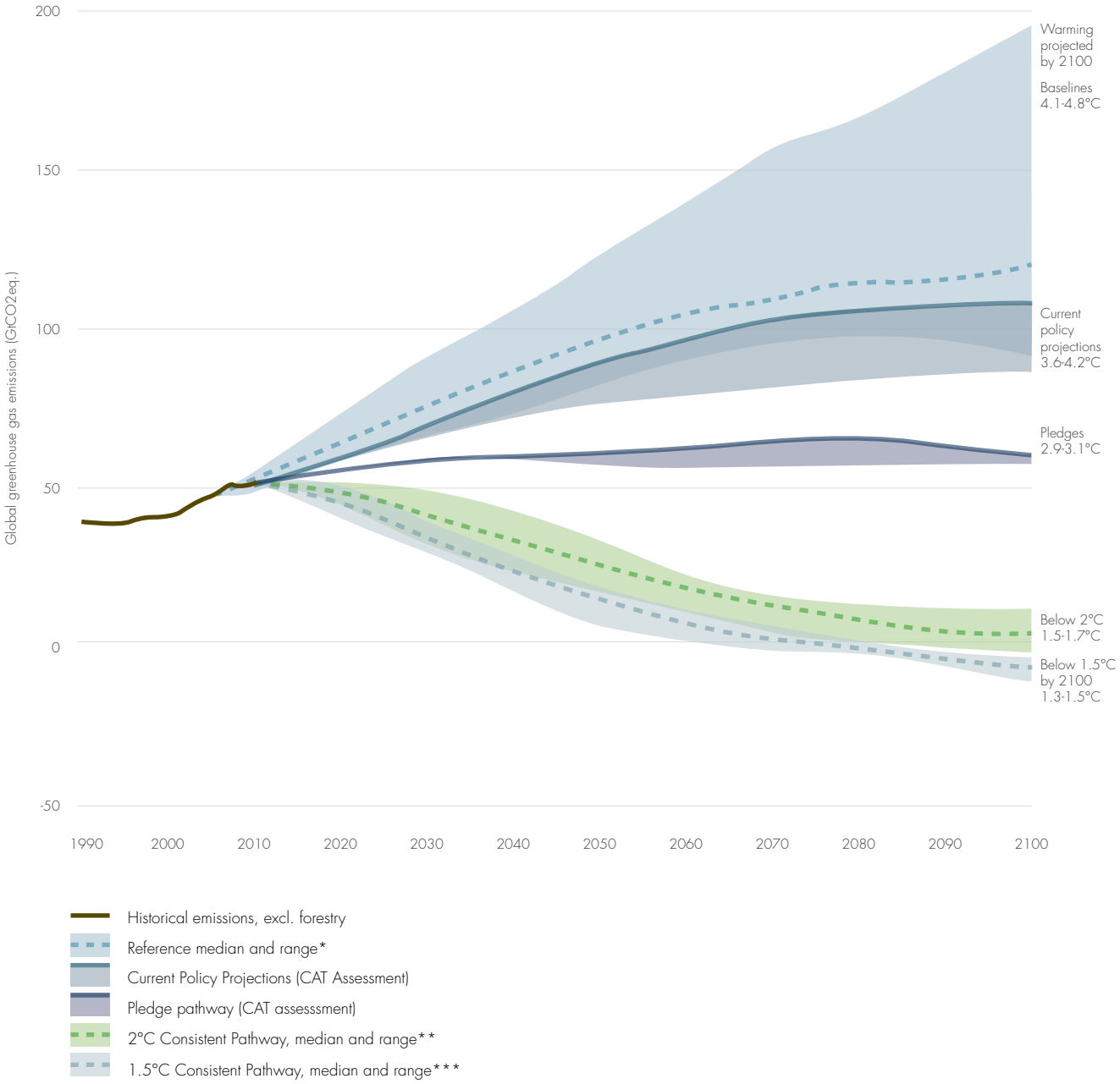
The United States announced that they intended to reduce emissions by 26-28 per cent below 2005 levels by 2025. The European Union has also adopted more ambitious targets. These include a 40 per cent reduction in domestic emissions by 2030 (against a 1990 benchmark). The 2014 commitments build on an earlier pledge to cut emissions by 20 per cent by 2020, and by 30 per cent conditional on wider international action.

National policies in many countries are moving in a more positive direction. President Barack Obama's 2013 Climate Action Plan has strengthened the regulatory environment for reducing greenhouse gas emissions, while the 2014 Clean Power Plan aims at a 30 per cent reduction in emissions from the power sector.[233] China's 2014 National Action Plan on Climate Change includes a cap on coal-fired power generation by 2020, targets for enhanced energy efficiency, more stringent controls on air pollution, and strong commitments on renewable energy. In 2013, China overtook the United States as the world's largest investor in renewable energy. India, the world's fourth-largest emitter of greenhouse gases, has tabled modest pledges, centred on a reduction in the emissions intensity of GDP by 20-25 per cent in 2020. However, the new Indian government is accelerating and deepening implementation of major reforms, including the ambitious National Solar Mission. Brazil is aggressively promoting a climate strategy aimed at reducing emissions, with a strong focus on land use and forest conservation.

The commitments made in 2014 also illustrate that "the devil is in the detail" in climate proposals. China has adopted a 2030 emissions peak, but no quantitative target has been set for the peak. The United States has yet to elaborate on which policies will underpin the higher level of ambition in its 2025 target. Meanwhile, the framing of the EU policy has raised questions over what is included, the links to energy-efficiency targets and the alignment of the goals with reform of the EU emissions trading scheme.[234] Independent analysis suggests that current policies will also leave the European Union some way short of the target of a 40 per cent reduction in emissions by 2040. The most detailed estimates available put emission reductions at 23-35 per cent by 2030.[235]

What ultimately counts is not whether countries achieve their own targets, but whether their commitments and actions will leave the world within the threshold of an average 2°C temperature increase. Research by scientists at Climate Action Tracker (CAT), an independent assessment group, shows that the world is heading for temperature increases well in excess of 2°C, based on current commitments and policies being implemented **(Figure 35)**. If all governments were to act on their commitments, projected warming over the course of the 21st century would be in the range of 2.9-3.1°C, which is still well above the threshold levels set for the Paris climate negotiations. The word "if" is operative. If governments fail to meet their commitments, the world is heading towards 4°C warming. The CAT analysis is consistent with other scenarios. The IPCC projects that by 2100 global average temperature levels will be 3.7° to 4.8°C above pre-industrial levels. The IEA's baseline scenario anticipates temperature increases of 4-6°C by the end of the 21st century.[236] These figures point to large emission gaps. The world is moving far too slowly towards a zero-emissions future.

FIGURE 35 WITH CURRENT POLICIES THE WORLD IS HEADING FOR 4ºC WARMING OVER THE 21ST CENTURY



Notes:
* 5-95th percentile of AR5 WGII scenarios in concentration category 7, containing 64% of the baseline scenarios assessed by the IPCC
** Greater than 66% chance of staying within 2C in 2100. Median and 10th to 90th percentile range. Pathway range excludes delayed action scenarios and any that deviate more than 5% from historic emissions in 2010.
*** Greater than or equal to 50% change of staying below 1.5C in 2100. Median and 10th to 90th percentile range. Pathwa range exlucludes any delayed action scenarios and any that deviate more than 5% from historic emissions in 2010.

Data source: Climate Action Tracker. (2014). Effect of current pledges and policies on global temperature.

There is good news and bad news in the run-up to the Paris summit

The Paris summit agreement has to be based on scientific evidence, but the outcome will be dictated by politics and by political leadership. There are encouraging signs of a renewed momentum but concerns continue over the gap between problem recognition and action.

The Paris summit agreement has to be based on scientific evidence, but the outcome will be dictated by politics and by political leadership.

On the good news front, climate diplomacy has moved into a higher gear. The commitments from the US, China and the EU do not go far enough, but they signal an end to the damaging US-China standoff and a stronger commitment. The UN secretary-general has put climate change at the top of his agenda and the Conference of the Parties (CoP) gathering of climate-change decision-makers held in Lima, Peru, in December 2014 produced a call for climate action, including elements for a draft negotiating text in Paris. However vague and riddled with competing options the text may be, worse outcomes were possible.

Beyond the inter-governmental process, there is evidence of a new momentum in other areas. Cities have emerged as a powerful force for climate action. Around 228 cities have set greenhouse gas reduction targets amounting to 30 $GtCO_2e$ by 2050, which is equivalent to the combined annual emissions of China and India.[237] The C40 Cities Climate Leadership Group initiative, launched in 2005, has provided a focal point for cooperation. Three of Africa's mega-cities – Lagos, Johannesburg and Addis Ababa – are actively engaged, and Dar es Salaam, Nairobi and Cape Town have observer status.

Evidence from the field of economics demonstrates that combating climate change is not just affordable but could also benefit growth.

The business community is also more actively engaged. Companies around the world are setting their goals and targets. Major multinational companies have called on governments to set carbon prices in order to promote investments in green energy. An emerging coalition of companies, pension funds and municipalities is actively promoting disinvestment from coal and other fossil fuels.

Evidence from the field of economics demonstrates that combating climate change is not just affordable but could also benefit growth. The Global Commission on Economy and Climate has presented a compelling case for low-carbon investment. The Commission projects that US$90 trillion will be spent on infrastructure over the next 15 years. Shifting to a low-carbon trajectory would require a 5 per cent increase in that investment, most of which would be off-set by efficiency gains, lower pollution costs and the benefits of a move towards better-planned, more compact cities.[238] The findings are consistent with other evidence.

Another positive development has been the growth of carbon markets. Some 39 national and 23 sub-national jurisdictions are implementing or putting in place carbon-pricing instruments, including emissions-trading schemes and taxes.[239] This is adding to the momentum for a bottom-up approach to climate action. The jurisdictions in question account for almost one quarter of global greenhouse gas emissions.

Set against the encouraging news there is no shortage of less positive news. Outright climate change scepticism is on the retreat. Yet the world still lacks the critical mass of political leadership needed for a breakthrough. Moreover, there is a large gap between the policy statements and actions of many governments and businesses.

Several developed countries including Australia, Canada, Japan and Russia appear to have withdrawn from the community of nations seeking to tackle dangerous climate change **(Box 16)**. Viewed from Africa, this calls into question their commitment to national and international efforts to reduce poverty and the wider sustainable development agenda enshrined in the post-2015 goals. Most Arab states have made limited commitments.

BOX 16 FREE-RIDING ON CLIMATE ACTION

Climate Action Tracker identifies four countries falling short not only of credible international targets but also of their own modest national targets:

Canada's commitment under the UNFCCC is that by 2020 it will reduce emissions by 17 per cent below 2005 emission levels. This weakens a previous target and a pledge under the Copenhagen Accord to reduce emissions by 20 per cent below 2006 emissions by 2020. Canada will miss its 2020 pledge by a wide margin: current policy projections point to a 9 per cent increase in emissions to 2020.[240]

With one of the world's highest levels of per capita emissions, **Australia** has gone from leadership to free-rider status in climate diplomacy. Repeal of the Clean Energy Future Plan effectively abolished carbon pricing. Current policies will result in emissions increasing by about 12-18 per cent above 2000 emissions.[241]

In 2010, **Japan** committed to a 25 per cent reduction in emissions by 2020 (using a 1990 base year), conditional on the establishment of a fair and effective international framework. Japan has revised that pledge and now aims to reduce emissions by 3.8 per cent below 2005 levels by 2020. This is equivalent to equivalent to an increase of 5.2 per cent above 1990 levels – a marked retreat in ambition.[242]

In the Copenhagen Accord, the **Russian Federation** pledged a reduction of 15 to 25 per cent below 1990 emissions by 2020. However, this represents a 14 to 29 per cent increase from the 2010 emissions level, setting Russia on the wrong trajectory.[243]

Headline news about climate markets disguises the fact that they are broad in terms of coverage but shallow in terms of impact. Most initiatives are operating on a modest scale and at very low-carbon price levels. The European Union's emissions trading scheme (ETS) illustrates the policy failure. Prices on the ETS for carbon have hovered between EUR3 and EUR7 a tonne, which is far too low to encourage power utilities and energy companies to shift investment out of coal and oil.[244] By contrast, the United Kingdom has set its own floor price of EUR24 a tonne for carbon, pushing prices close to the EUR30 a tonne price envisaged at the ETS's inception, which could trigger switching fuel from coal to natural gas.

Energy companies based on fossil fuels represent a concentration of economic and financial power that no government can afford to ignore.

Fossil fuel companies and 'big coal' have too much sway over policy

The imperative to decarbonize energy systems raises wider political challenges. Energy companies based on fossil fuels represent a concentration of economic and financial power that no government can afford to ignore. They have deep political networks and, all too often, they use their political heft to skew public policies in a direction that is damaging for climate change.

Most major energy companies have joined initiatives calling for action on climate, often including carbon pricing.[245] Several have already integrated carbon pricing into their business strategies.[246] Yet many of the same companies are expanding investments in high-carbon fuels that are harmful for climate change, including tar sands, tar shale, shale gas extracted by fracking and methane hydrates.[247]

BP's 2013 sustainability report expresses concern over climate change, while listing an extensive portfolio in deep-water oil and gas, tar sands and fracking. Shell actively argues against applying a 2°C climate budget to emissions up to 2050, arguing speculatively that carbon capture and storage technologies may save the day.[248]

All companies, including renewable energy companies, seek to influence political decisions. What is distinctive about the fossil-fuel industry is the money they can bring to bear on political influence. One detailed analysis of spending by oil, gas and electricity utility companies in the run-up to the 2014 mid-term election in the United States puts lobbying-related expenditure at US$721 million.[249]

Coal-industry interests have become increasingly prominent, yet coal generates twice as much CO_2 as natural gas. The World Coal Association, which represents coal companies such as Rio Tinto, Peabody Energy and BHP Billiton, produced documents purporting to demonstrate that coal has a role to play in a low-carbon future.[250] The chief executive of BHP Billiton has described calls for a switch from coal to gas as "a very western, rich country solution".[251] This is a theme that echoes a long-standing campaign by Peabody Energy, the world's largest private-sector coal company.[252] Peabody claims coal is "essential to meet the scale of Africa's desperate need for electricity" and that eliminating energy poverty is one of its core business objectives.[253] Other coal companies are campaigning vigorously against climate action in Australia, the European Union and the United States.[254]

Continued dependence on coal in power generation is holding back efforts to decarbonize growth. Recent projections from the IEA point to continued growth in demand for coal of around 2.1 per cent a year to 2019.[255] Going to "zero coal" is a global priority. As we argue in Part I, coal will remain an important but shrinking part of Africa's energy mix to 2040 and beyond. However, the argument that coal holds the key to eliminating Africa's energy poverty combines implausible economics with unsubstantiated evidence.

Unburnable carbon and fossil fuel subsidies

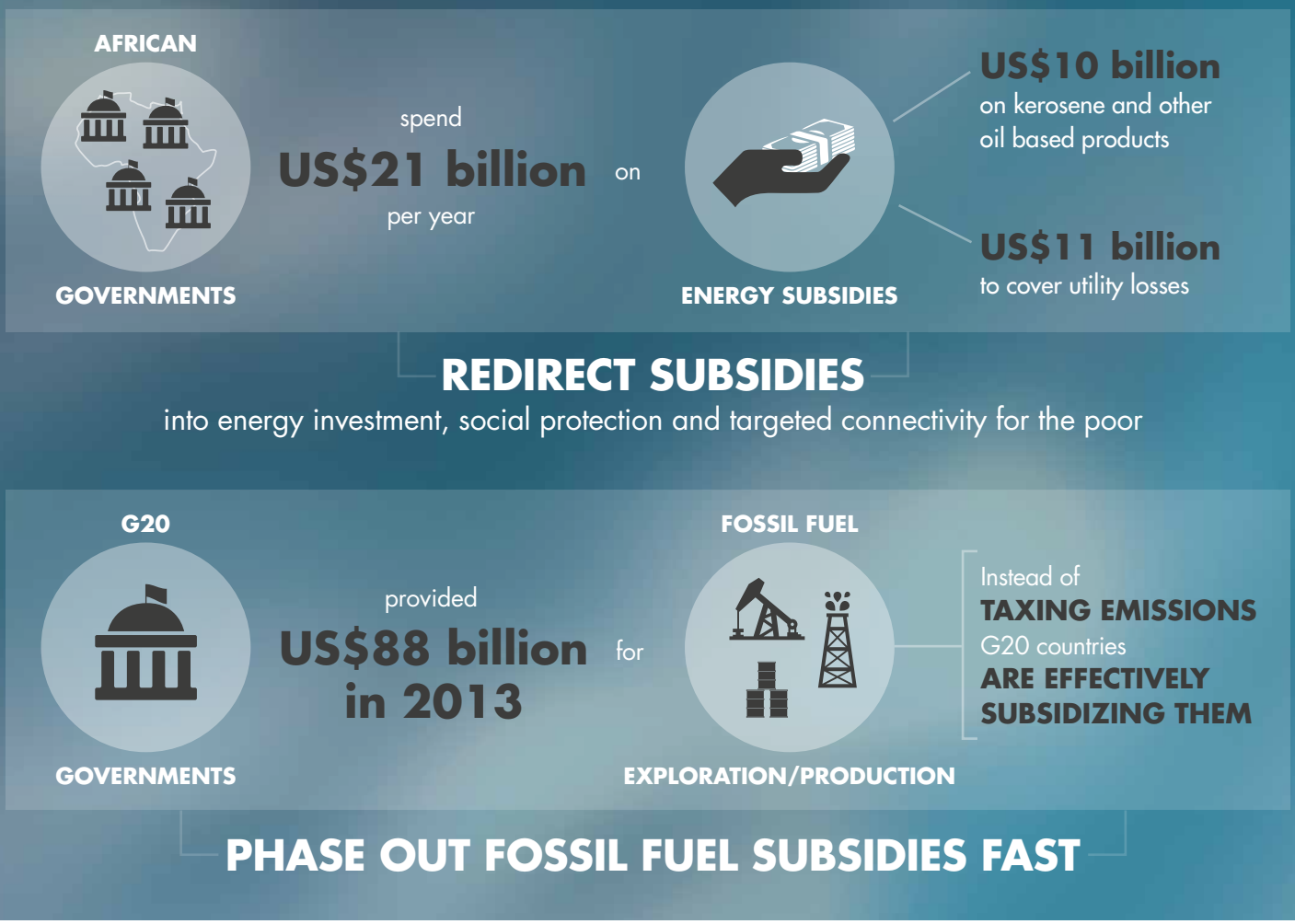
No issue serves to illustrate the tension between climate commitments and energy policy better than subsidies for fossil fuels. Effective action against climate change demands that governments push carbon out of markets through taxation, quotas and regulatory measures. Instead, they are subsidizing the discovery and use of carbon-intensive fuels.

The IMF estimates the overall level of fossil-fuel subsidies at US$2 trillion annually, or 1.2 per cent of global GDP.[256] According to the IEA, energy-related fossil-fuel subsidies are five times higher than the subsidies for renewable energy.[257]

Energy-related fossil-fuel subsidies are five times higher than the subsidies for renewable energy.

The most perverse and damaging subsidies are associated with exploration for fossil fuels. If global warming is to be kept below 2°C, one-third of known oil reserves, half of gas reserves and some 80 per cent of coal reserves must be left in the ground.[258] This is the world's existing reserve of "unburnable carbon". Yet many governments and companies are investing heavily in the discovery and exploitation of new carbon reserves, including the Arctic and deep sea areas (See infographic: Cut the waste).

CUT THE WASTE



The scale of exploration subsidies is insufficiently recognized – not least by the taxpayers who are footing the bill. The Overseas Development Institute and Oil Change International found that G20 countries provided support for exploration totalling US$88 billion in 2013.[259] These transfers included:

- The United States was spending US$5.1 billion, almost double the level in 2009;
- Russia was spending US$2.4 billion, much of it on exploration in the Arctic and permafrost locations;
- Australia was directing US$3.5 billion to developing new coal and other fossil-fuel reserves;
- The United Kingdom was spending US$1.2 billion, principally for exploration in the North Sea and fracking;
- Investment by state-owned oil, gas and coal companies was between US$2 billion and US$5 billion in Russia, Mexico and India; US$9 billion in China; US$11 billion in Brazil; and US$17 billion in Saudi Arabia.

The logic behind these subsidies is difficult to unravel. Either the new reserves discovered with the support of state subsidies will be left in the ground, which would constitute a waste of public finance during a period of acute fiscal stress; or the reserves will be used, in which case dangerous climate change is guaranteed. Despite repeated commitments since 2009 to phase out subsidies for fossil fuels, the G20 governments have failed to act.

Despite repeated commitments since 2009 to phase out subsidies for fossil fuels, the G20 governments have failed to act.

Investment in fossil fuels poses systemic financial risks in addition to considerations of climate change. Falling oil prices have exacerbated those risks. At prevailing price levels investment in exploration and extraction is uneconomic, especially for hard-to-reach oil and gas. Prospects for the coal sector are arguably even bleaker. Between 2011 and 2014 Bloomberg's Global Coal Index company valuation tracker declined by 56 per cent.[260] Since then prices have fallen again, leading to a sharp decline in both profits and planned capital investments by the world's largest coal mining company, BHP Billiton. China's decision to put a cap on coal use for power generation by 2020 could lead to a sharp reduction in demand for exports and further price declines.

Action on climate change would inevitably exacerbate market pressures on fossil fuel investments. If the world is to achieve the under 2°C target, much of the investment now wrapped up in coal, oil and tar-sands will represent "stranded assets". Given the role of energy companies in the portfolios of fund managers, these assets constitute a systemic risk for financial systems comparable in scale, if not in origin, to sub-prime mortgage stock. Estimates for the size of the energy-related stock of stranded assets range from US$300 billion to US$600 billion.[261]

There is a widespread view that Africa's primary stake in the climate negotiations is to secure more aid for adaptation. That view is deeply flawed.

SECURING A BETTER DEAL FOR AFRICA

What would a good deal for Africa look like at the Paris climate summit? International action to get on a trajectory to zero emissions consistent with the 2°C threshold is an imperative. The Paris summit also presents Africa and the world with an opportunity to build a bridge from climate action to sustainable development. The world stands to gain from Africa accelerating progress towards a low-carbon transition and different approaches to land-use, and Africa needs international support to scale up current initiatives.

Using the INDC process to set an African agenda

There is a widespread view that Africa's primary stake in the climate negotiations is to secure more aid for adaptation. That view is deeply flawed. Several countries in Africa are embarking on ambitious programmes aimed at integrating climate action with sustainable development. Part of the motivation can be traced to national self-interest. Governments increasingly recognize the costs associated with high-carbon development pathways and the potential benefits of renewable energy, sustainable land-use and low-carbon development. At the same time many governments acknowledge that, despite the responsibility of rich countries for causing the climate crisis, avoiding dangerous climate change requires action by the entire international community.

Some of the poorest countries in the region are demonstrating a high level of global leadership on climate. Ethiopia has identified a range of initiatives aimed at limiting emissions to current levels and reducing per capita emissions. These initiatives have been carefully costed and the country has the institutional capacity for implementation.

Ethiopia is one among many examples. Countries such as Kenya and Rwanda have developed climate-resilient growth strategies. In Kenya, the livestock sector accounts for two-thirds of greenhouse gas emissions, but the largest absolute growth is projected in transport, where emissions are expected to grow from 10 $MtCO_2e$ in

2010 to 33 $MtCO_2e$ in 2030. The country's strategy sets out actions to respond to these emissions, including reforestation, land conservation and a mass-transit system for Greater Nairobi. Development of Kenya's geothermal energy potential could save 14 $MtCO_2e$ of emissions a year by 2030. Other low-carbon options include expanding electricity generation based on wind and hydropower, which could save 2.5 $MtCO_2e$ by 2030.[262]

Today, governments increasingly see low-carbon development as a growth opportunity.

Rwanda has one of the world's most ambitious renewable-energy strategies. It aims at 50 per cent of power generation coming from renewable energy by 2017, starting from a base of just 4 per cent in 2008. The overall costs are put at US$500 million, of which public spending accounts for US$200 million.[263] Achieving those ambitious goals will involve serious challenges spanning all aspects of energy planning, management and operation.

What is striking about such plans is that they reflect a new approach to thinking about climate risk and resilience, as outlined in Part I. The debate in Africa has moved on. Ten years ago most governments saw an outright contradiction between climate action and strategies for growth. Indeed, climate mitigation was largely viewed as an imposition by northern governments. Today, governments increasingly see low-carbon development as a growth opportunity.

The major constraint on that opportunity is financing. The economics of energy pull very strongly in favour of emerging renewable technologies. However, the capital costs of these technologies are often higher than those of low-efficiency power plants, especially in countries with limited experience of providing renewable energy. In the agricultural sector, the measures needed to raise productivity and reduce pressure on environmental resources can be initiated at the community level, but infrastructure, research and development, and social protection require public investments on a significant scale.

The INDCs provide African governments with a vehicle to set out their ambition for the transition to a growth-oriented, climate-resilient, low-carbon development model. Building on existing strategies for the energy sector and land use, the submissions could go beyond outlining what countries are doing now to identifying what could be done through deeper international cooperation on financing, technology and capacity development.

There is an obvious drawback to investment of diplomatic capital in the INDCs. Producing credible INDCs is yet another transaction cost to be borne by already over-burdened ministries, with no guarantee of a positive response. Indeed, the history of climate finance is marked by onerous bureaucratic processes and the delivery of small amounts of money. Africa has not been well served. That is why the INDCs should include Africa-wide prescriptions for reform of the climate finance architecture.

Fixing the financial architecture

Climate finance is one of the critical links between the climate-change agenda and wider action on sustainable development. Meeting low-income countries' requirements for economic growth, poverty reduction and infrastructure development will require broader approaches to financing. That is why the Addis Ababa summit on financing for

development in July 2015 is a crucial part of the preparations for the Paris climate summit. Financing for adaption and a low-carbon transition in Africa has to come from a wide variety of sources. Domestic financing is critical. But the energy sector financing gap identified in Part I – about US$55 billion annually to 2030 – points to the need for increased private investment, alongside expanded provision of concessional and non-concessional development finance.

Official development assistance (ODA) has an important role to play in financing adaptation and in leveraging private finance. However, the limitations of aid have to be recognized. One estimate is that financing of about US$93 billion a year is needed to meet Africa's infrastructure needs.[264] This is twice the level of total aid for Sub-Saharan Africa reported in 2013. Aid flows have stagnated since 2011 and total aid for infrastructure amounts to US$18 billion.

Even under the most benign scenario, the overall magnitude of ODA is likely to remain modest in relation to financing needs. This does not imply that its importance should be understated. If rich countries lived up to their long-standing commitment to mobilize 0.7 per cent of the gross national incomes (GNI) as aid, they would generate an additional US$178 billion. Donors should be aware that Africa will view commitments in Addis Ababa as a barometer for how rich countries are approaching the climate negotiations. More immediately, the financing for development summit provides an opportunity to support concrete initiatives linked to sustainable energy for all, adaptation to the likely effects of climate change and the actions proposed in the INDCs.

Climate finance is important both in terms of its volume and symbolic value. Successive Conference of Parties gatherings, the key decision-making body of the UNFCCC, have almost been derailed as developing countries perceived that rich countries were reluctant to act on their commitments. Under the Copenhagen Accord, developed countries pledged to mobilize US$100 billion per year from public and private sources by 2020 and to provide US$30 billion between 2010 and 2012 in "fast start" finance. This commitment recognized that developing countries view financing as an integral element in any climate agreement.

An elaborate climate financing architecture has emerged. On one estimate, there are now 50 climate funds in operation with a total financing pool of around US$25 billion. These resources include both concessional and non-concessional finance.

One recent review evaluated nine separate multilateral climate-finance mechanisms, with cumulative funding approved of just under US$10 billion since 2002.[265] These mechanisms have delivered some positive results. Climate finance has supported innovative mitigation projects in major emitting countries such as Mexico, China and India, along with valuable adaptation projects. The most comprehensive independent valuation has documented governance improvements in a number of areas, including transparency and the pace of disbursement.[266]

On the other hand, Sub-Saharan Africa has been poorly served by climate finance. Modest funding has been transferred through fragmented, overly bureaucratic delivery structures that combine high transaction costs with low impact. The overwhelming bulk of finance has been earmarked for small-scale projects rather than national programmes.

"Most African countries are improving. They have climate change committees, climate policies and national climate funds. The awareness is there and the political will is a reality. Most of the times, the means of implementation from the international community is still lagging in access, adequacy and scale of finance"

Seyni Nafo,
Spokesperson, Africa Group of Negotiators under the UNFCCC 2014-2015.

Bilateral aid dominates climate finance for Africa. Over the three financial years 2010–2012, US$3.7 billion was provided in "fast start" finance.

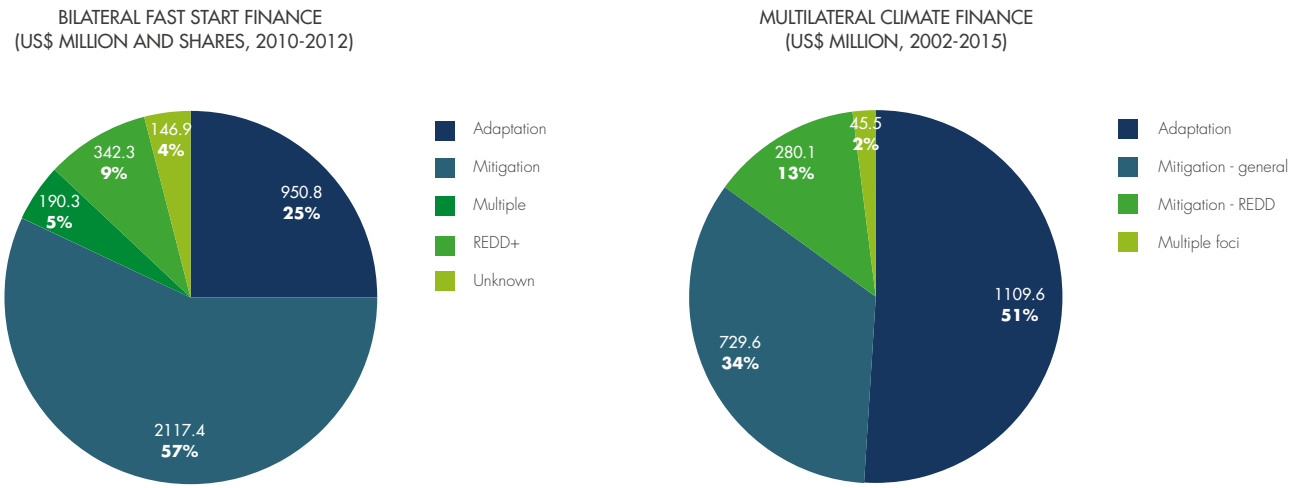
Not all of this represents new and additional aid and some may have been diverted from other projects. Transfers have averaged US$1.23 billion a year, with mitigation finance dominating. Bilateral aid has been heavily concentrated in a small number of countries, with projects in Kenya, Malawi, South Africa and Tanzania accounting for 70 per cent of mitigation finance **(Figure 36)**.

Support through the multilateral aid pipeline has been even more limited. In contrast to bilateral aid, adaptation accounts for the bigger slice of the multilateral aid pie – but the pie itself is of modest proportions. In total, US$2.1 billion has been committed since 2002. Over the period 2010 to 2015, average annual commitments amounted to US$378 million. Part of the problem is that adaptation is the least-resourced part of climate finance and accounts for just a quarter of pledges to the multilateral funds. Just over one-third of the adaptation financing provided through multilateral funds goes to Sub-Saharan Africa.[267]

Multilateral adaptation financing illustrates just how fragmented the aid delivery system has become. The Pilot Programme for Climate Resilience, the largest of the adaptation funds, has financed 44 projects with a resource envelope of US$777 million, which means an average project size of US$14 million. The Adaptation Fund has 35 projects with an average size of US$6 million.[268] The Least Developed Countries Fund's adaptation portfolio comprises 199 projects with an average project value of US$3 million.

The fragmentation is reflected in Sub-Saharan Africa. In 2013, US$291 million was approved for projects in the region through eight separate adaptation funds.

FIGURE 36 PATTERNS OF BILATERAL AND MULTILATERAL AID VARY



Data sources: Overseas Development Institute. (2013). Mobilising international climate finance: Lessons from the fast-start finance period. Climate Funds Update website with data as of February 2015.

Most of the multilateral mechanisms are delivering limited funding. Average annual commitments for the whole of Sub-Saharan Africa over the period 2010-2013 were just US$80 million for the Least Developed Countries Fund and US$66 million for the Pilot Programme for Climate Resilience, shrinking to just US$15 million for the Adaptation Fund.

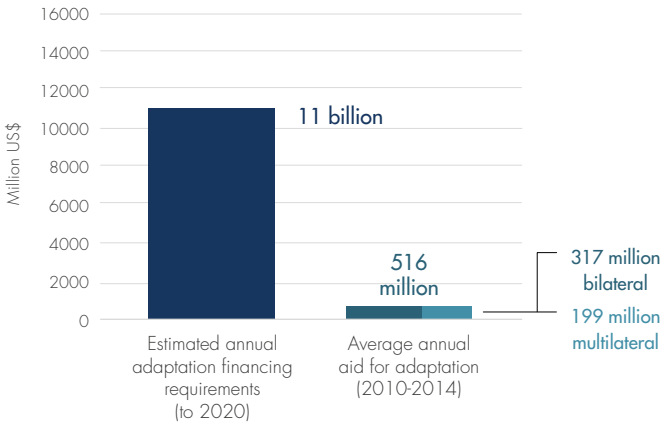
It is difficult to imagine a less efficient delivery system. Each fund has a separate set of institutions, rules and reporting requirements. The emphasis on projects diverts the resources of recipient governments away from the systemic responses needed to underpin more transformative approaches to adaptation. Government officials interviewed by the Africa Progress Panel indicated that the transaction costs were high enough to deter financing requests.

The multilateral funds do finance some important and innovative work. Niger has secured significant benefits. It is using some US$110 million in resources to develop climate-resilient land- and water-management systems, and to integrate adaptation into planning by national and local governments. However, this is an exception in what is overall an inefficient system for financing adaptation.

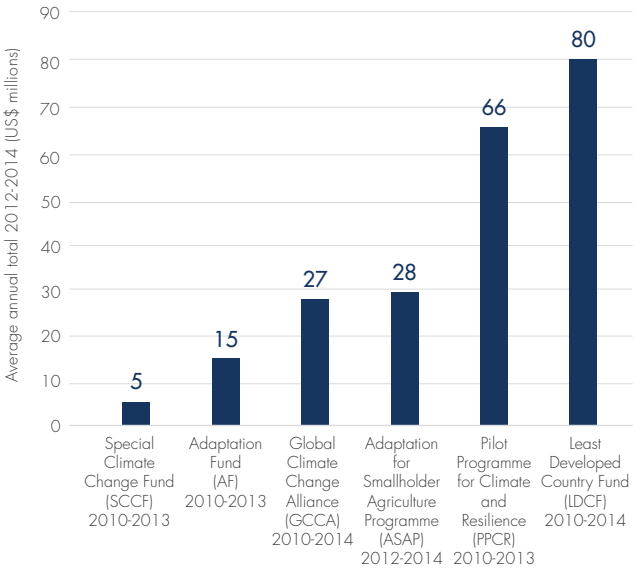
Estimating the required financing for adaptation is intrinsically difficult. The UNEP is the most comprehensive and authoritative source for adaptation financing estimates and it puts annual average costs of adapting to unavoidable climate change at US$7-15 billion (at 2010 prices) by 2020, rising to US$15-18 billion in the following decade if the world follows a trajectory that leads to 3.5°C-4°C average global warming. Taking the mid-range figure, around US$11 billion is required by 2020 but so far development finance for adaptation in Africa from both bilateral and multilateral sources has amounted to US$516 million on average each year **(Figure 37)**.

FIGURE 37 AID FOR ADAPTATION IN SUB-SAHARAN AFRICA (MILLION US$)

AFRICA HAS A LARGE AID-FOR-ADAPTATION FINANCING GAP...



... AND MULTILATERAL ADAPTATION FINANCING IS HIGHLY FRAGMENTED



Data sources: Overseas Development Institute. (2013). Mobilising international climate finance: Lessons from the fast-start finance period. Climate Funds Update website with data as of February 2015.

At a time when rich countries are spending several billions of dollars on flood defences and other climate-related adaptation measures, the imbalance raises fundamental questions about their commitment to climate justice. Indeed, it lends weight to Archbishop Desmond Tutu's memorable depiction of the imbalances as a source of "adaptation apartheid".[269]

At a time when rich countries are spending billions of dollars on flood defences and other climate-related adaptation measures, the imbalance raises fundamental questions about their commitment to climate justice.

When it comes to mitigation, Sub-Saharan Africa is picking up the small change of international climate finance. South Africa and Nigeria are the only countries to have received support from the Clean Technology Fund. A larger group of low-income Sub-Saharan Africa countries have received pledges of support from the Scaling Up Renewable Energy in Low Income Countries Program (SREP) for the development of solar, wind and geothermal power. However, as of February 2015, only Kenya, Ethiopia and Mali had received financial support through concessional loans of US$40-50 million.

International support for mitigation through agriculture, forestry and land-use changes has been limited. This is unfortunate because it is precisely this area in which Sub-Saharan Africa can make the greatest contribution to global emission-reduction goals.

When it comes to mitigation, Sub-Saharan Africa is picking up the small change of international climate finance.

Recognising the vital role played by forests as carbon sinks, governments in the UNFCCC created the Reducing Emissions from Deforestation and forest Degradation (REDD+) mechanism. REDD+ seeks to recognize the monetary value of the carbon stored in forests, creating incentives for conservation to offset the losses from activities such as commercial logging, ranching and the conversion of forests into arable land. Financial pledges over the period 2006-2014 reached US$8.7 billion, with around 16 per cent or US$1.3 billion earmarked for Sub-Saharan Africa.[270] Other facilities have also emerged, some with a distinctive focus on Africa. For example, the Congo Basin Forest Fund has received pledges of around US$180 million to support forest conservation.[271]

In the event, financial transfers through REDD+ to Sub-Saharan Africa have been limited **(Figure 38)**. Average annual commitments between 2010 and 2014 amounted to just US$167 million, allocated principally to Democratic Republic of Congo, Tanzania and Ethiopia. Approved pledges are typically very small – only the Democratic Republic of the Congo and Tanzania had total pledges in excess of US$100 million between 2006 and 2014. For many countries, there are large gaps between commitments and disbursements.

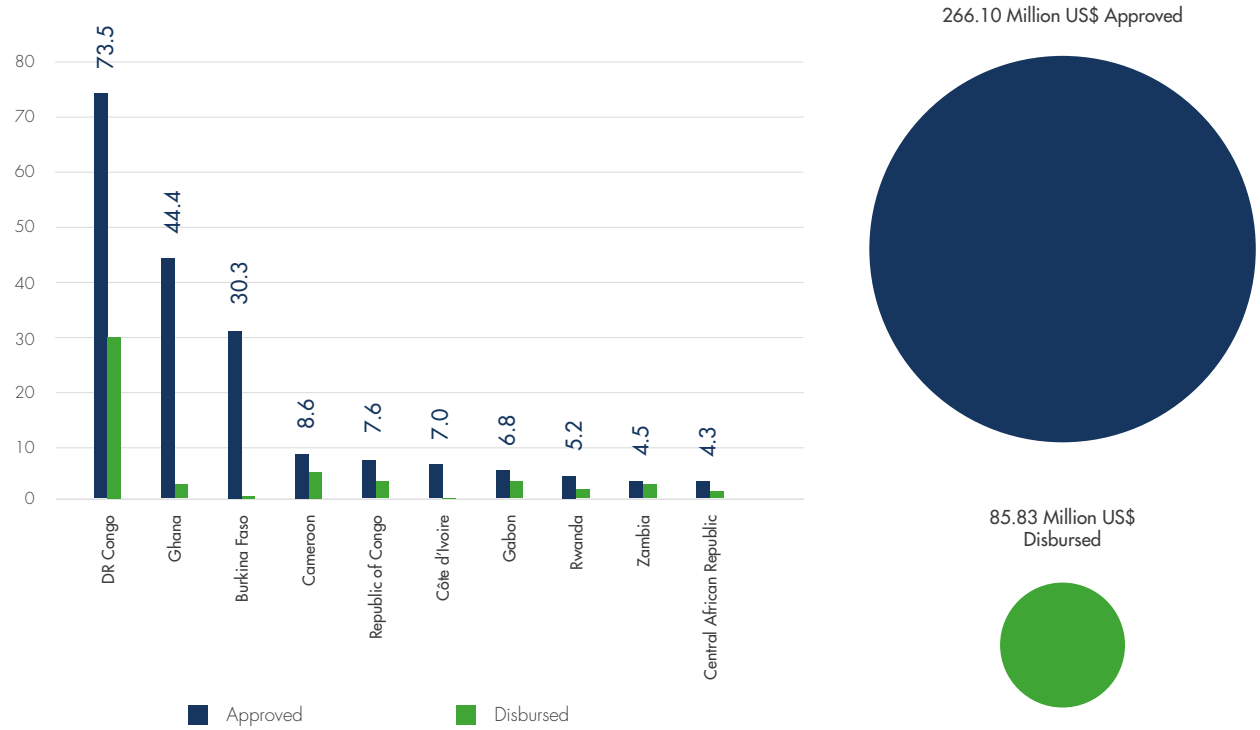
Part of the problem can be traced to the REDD+ architecture. In theory, REDD+ transfers are based on performance requirements linked to forest conservation and emission levels. Few countries in Sub-Saharan Africa have either the measurement, reporting and verification systems needed to meet the standards for reporting performance by results or the technical capacity to develop these systems.

Many governments also struggle to meet wider eligibility REDD+ criteria. One requirement is that legislation recognizes communal and private property rights over land. That legislation is missing in many countries. REDD+ also requires governments to set out benefit-sharing arrangements and participatory processes for agreeing on them, as well as safeguards to address social and environmental concerns.

Few governments in Africa are able to meet the requirements. One of the recurrent themes in REDD+ reviews is the low level of inclusion and participation in forestry management on the part of communities affected. Even where the right legislation is in place, many governments are unable or unwilling to enforce the provisions relevant to REDD+ eligibility. For example, charcoal production is dominated in most countries by small-scale informal enterprises operating beyond the reach of government agencies. Zambia's export bans on timber and charcoal are ineffective in practice. Efforts to regulate commercial logging through quotas are weakened in many countries through the corrupt sale of illegal concessions or the non-enforcement of laws.

There is a wider problem in the REDD+ approach to mitigation. In effect, the system is designed to purchase cost-effective reductions in emissions through the sequestration of carbon. Measured on a per hectare basis, sustainable land-use practices in arid and semi-arid areas and on Africa's savannah have a more limited sequestration capacity than tropical forests. However, unlocking the triple-wins outlined in this section for climate change, poverty and agricultural productivity requires investment in precisely these areas.

FIGURE 38 REDD+ SPENDING: HIGHLY CONCENTRATED AND A GAP BETWEEN APPROVALS AND DISBURSEMENTS



Data source: Overseas Development Institute and Africa Progress Panel research (2015).

03

THE ROAD AHEAD AND RECOMMENDATIONS

In energy policy and in climate policy, there are tough choices to be made. Responsibility for those choices starts and ends with governments in Africa. Ultimately, the region's leaders are accountable to their citizens for the decisions they take. Yet what is possible in Africa will also be determined in part by international action – or inaction. Unless the international community strengthens cooperation on energy, many countries will be unable to escape the gravitational pull of the "business-as-usual" pathway. In each policy area we cover here, we identify both national and international priorities.

The need to balance ambitious climate action with the principle of "common but differentiated responsibility" has been central to negotiations from the inception of the UN Framework Convention on Climate Change (UNFCCC). This section of the report sets out practical ideas and benchmarks for applying to the Paris climate summit the principles of equitable access to sustainable development.

AFRICAN LEADERS

Demonstrate greater leadership and ambition in energy and climate

1. Ensure universal access to energy by 2030

Governments must set out strategies for achieving universal access to energy, aiming at a 10-fold increase in power generation by 2040, while laying the foundations for a low-carbon transition. New technologies, policy reform and innovative business models offer promising pathways: Ethiopia, Kenya, Rwanda and South Africa are already setting examples. These strategies should be aligned with the framework of the UN secretary-general's Sustainable Energy for All (SE4ALL) initiative. African leaders must attach far greater weight to equity. The international community has to translate bold policy statements into concrete plans for action. Among the priorities:

Put access to electricity for people who are not connected at the heart of national strategies: Africa's energy strategies must measure progress not just in terms of power generation but also, crucially, in terms of connectivity. Three steps are required. First, every energy strategy should map where there are concentrations of people who do not have access to modern energy. Second, the strategies should assess the technical feasibility and costs of reaching those unconnected people through grid, mini-grid or stand-alone technologies. Third, strategies should include a plan to deliver at least entry-level supplies of electricity to all by 2030.

Support renewable providers: Governments currently buy electricity from independent power providers in order to feed the power into national grids, effectively acting as a purchasing agent for (mostly wealthy) people and companies with grid connections. The poor have no such agent. Governments could effectively purchase power from providers of off-grid renewable energy. The providers could be licensed to serve a specified number of households, with payments subject to delivery after competitive tendering. Demand for low-cost solar and mini-grid systems is highly sensitive to price, so governments could reduce the cost of renewable technologies by lowering import duties and offering carefully targeted tax concessions.

Promote clean cooking facilities: Every government should develop integrated strategies for tackling unsafe cooking practices. The starting point is to recognize the value of biomass energy and end the underpricing of charcoal and fuel-wood. As in the case of renewable-energy technologies, governments should support consumer demand for clean cooking stoves by exempting imported components from taxes and duties, and by subsidizing research and development, manufacture and distribution. Specific government agencies should be given responsibility for supporting producers of clean cooking-stoves through revolving equity and credit funds where appropriate.

2. Finance the ambition

Over the next 15 years, Sub-Saharan Africa has to close an energy financing gap of around US$55 billion. Increased domestic resource mobilization is vital, but Africa needs to tap into a wider pool of global savings and investment. There is no shortage of savings in the world: pension funds, sovereign wealth funds and other institutional investors control assets of US$90 trillion. In most cases savers are only getting limited returns on these investments, when they could secure better returns by investing in filling financing gaps in energy infrastructure in Africa. The barrier separating savers from this investment opportunity is risk, real and perceived. Institutional investors such as pension funds are unlikely to take project-development risks but represent a potential flow of investment for well-performing assets in a stable policy environment. To attract such affordable, high-quality investment, governments need to create a viable pipeline of bankable projects while providing a stable and predictable regulatory environment.

Go the extra mile – national financing: The total cost of achieving universal access to electricity in Africa is around US$20 billion. Governments in Sub-Saharan Africa should finance half of this initial cost because they will recoup most of this spending over time through electricity charges. Financing priorities include lowering the cost of initial connections to the grid, subsidizing connections for rural populations and urban informal settlements, and supporting off-grid provision. Concessional aid should be increased by US$2 billion to co-finance initiatives aimed at bringing electricity to informal urban settlements.

Governments should spend 3-4 per cent of gross domestic product (GDP) on energy-sector development, with at least 60 per cent of that on investment:

- **Reform and strengthen tax administration** to increase tax-to-GDP ratios. Low-income countries in the region should aim at a tax-to-GDP ratio of at least 20 per cent, including by ending the under-taxation of land, property, wealth of high-income people and informal-sector activity. Some countries have used increases in revenues from natural resources to put on hold long-overdue reforms in these areas or – even worse – to cut taxes in other areas.[272]

- **Convert fossil-fuel subsidies into sustainable energy investments:** Governments spend 1.3 per cent of regional GDP on subsidizing utilities and they should draw up strategies for transferring all of part of this into productive long-term investments in sustainable energy.

- **Remove tax concessions for multinational investors:** Many countries provide foreign investors with excessively generous tax breaks in the form of tax holidays, capital-gains tax allowances and royalty exemptions.[273]

Governments and finance institutions should sustain energy reform and restructure risk:

- **Provide clear, consistent and transparent regulations:** The greatest barrier to private investment is uncertainty. Governments, utilities and regulators have to establish well-defined ground rules for power-purchase agreements, investment in infrastructure and the delineation of responsibility. They also need to build a track record in adhering to the rules.
- **Allocate risk and returns:** Governments need to secure the right investment for the right purpose. The design stage of a project is the catalyst for it to be launched. This stage is the most risky but the financing can be structured between public finance, investment by a multilateral development bank and possibly by an investment bank or private venture capital. Equity may not be suitable for project development, but can be useful in construction and initial operations, where risks are higher that the project may not succeed. Once plants are established and producing revenues, governments need to fund them through long-term investments which cost much less than the returns demanded by equity markets. This operations phase is low-risk but requires large amounts of money and is an appropriate activity for pension funds in Africa and OECD member countries. Governments also have to assess the balance of sharing risks and returns, ensuring that public-private partnerships (PPPs) are not associated with excessive margins for the private sector and excessive liabilities for public finance.
- **Provide a credible off-taker:** Perhaps the single most important concern for private investors in the electricity sector is security with respect to the buyer or "off-taker". In Nigeria, the government established a new entity, the Nigerian Bulk Electricity Trader, to buy electricity and it provided capitalization and market guarantees. This model could be more widely applied, especially in countries which do not have credible utilities.

Mobilize international development finance: International funds providing climate finance for renewable energy have proliferated. Africa has not yet been well served. In part this is for an obvious reason: the financing instruments themselves are linked to performance targets for reducing greenhouse gas emissions. Outside South Africa, Sub-Saharan Africa has limited emissions to offer for mitigation. Yet there are grounds for the international community to support a low-carbon development pathway in Africa. The Climate Investment Funds and the Green Climate Fund (GCF) should mobilize US$10 billion annually for Sub-Saharan Africa alone. Public-finance institutions, such as Germany's KfW, could also play an expanded role.

3. Deepen regional cooperation to create an integrated African grid

The development of regional grids has a vital role to play in expanding the reach and efficiency of Africa's electricity distribution. Regional trade in electricity offers economies of scale and opportunities to link supply to demand. By creating larger markets, cross-border trade could stimulate investment and reduce the cost of electricity. Yet despite a steady stream of initiatives and policy pronouncements, regional cooperation is poor.

Build cross-border grids for renewable energy: Regional and inter-regional power-sector integration provides opportunities for exploiting large hydropower, geothermal, wind, solar and biomass projects, potentially saving billions of dollars in development, operation and maintenance costs. The Africa Clean Energy Corridor, developed by the International Renewable Energy Agency (IRENA) and several African governments, is a step in the right direction but limited in scope.[274]

Building on current initiatives, political leaders should prioritize the development of an "Africa grid": Political leaders should be far more actively engaged in developing regional markets and in honouring their African Union commitments. Deeper integration could generate significant benefits. Investing US$17 billion in transmission lines could save the region US$40 billion in capital spending on generation through efficiency gains.[275] The International Energy Agency estimates that increased regional integration could reduce average electricity costs by 8 per cent. However, many countries would see reductions of 20-60 per cent.[276] An integrated Africa grid needs to be established and cross-border trade in energy expanded. The 15 energy-sector projects in the Priority Action Plan of the Programme for Infrastructure Development in Africa (PIDA), including the North-South Power Transmission Corridor, the West African Power Transmission Corridor and the Inga III Hydro project, must be under way by 2020. Countries in eastern and southern Africa must prioritize the development of a regional gas grid. The development of natural gas markets in eastern and southern Africa will require deeper cooperation and the regional power pools should be deepened. Consideration should be given to a regional power summit in 2015 attended by political leaders and charged with setting an agenda for strengthened cooperation.

Prioritise the Grand Inga project: The Grand Inga project in the Democratic Republic of Congo (DRC) is a potential game-changer. Prospects for its success will be enhanced through an incremental approach. South Africa needs to provide a commercial market and DRC has to fix problems with institutional governance. Both South Africa and the wider international community should use the project as the catalyst for a wider programme aimed at expanding access to affordable energy in the DRC. Additional hydropower from DRC would displace coal-fired power generation in South Africa, lowering costs and delivering significant climate-change benefits.

4. Power up Africa's agriculture sector

Increasing energy use is essential to transform Africa's agriculture. At the same time, governments should take advantage of "triple-win" adaptation opportunities that integrate social protection with climate-smart strategies. Such approaches would raise agricultural productivity and develop rural infrastructure, including crop storage, agro-processing and transport, cutting poverty while strengthening international efforts to combat climate change. Simple agriculture waste-to-energy opportunities must be exploited. African governments should modernize National Meteorological and Hydrological Services (NMHS) and strengthen regional centers to better deliver ground observation data for agriculture and development planning purposes.

5. Use national climate plans to chart desired energy transition

Submit Intended Nationally Determined Contributions (INDCs) documents ahead of Paris summit: Africa is responsible for a negligible percentage of global emissions and therefore has concerns over the INDC process. Nonetheless, African negotiators and leaders could use their INDCs to outline how their growth strategies are related to climate emissions and energy. African countries can effect a faster and smoother transition from high-carbon to low-carbon growth than was possible for industrialized nations – but they need support. The INDCs can provide a platform to make that case, articulate energy-mix scenarios and adaptation plans, and quantify the cost of each option.

African countries' INDCs should reflect national strategies for climate-resilient development and identify policies that should be introduced irrespective of wider international actions.

The offers should also include a challenge to the international community, identifying the financing requirements for a higher level of ambition on renewable energy and land use.

Make the link to national energy planning and renewable energy ambition: If Sub-Saharan Africa aggressively promotes renewables, it could reduce CO_2 emissions by 27 per cent. But this would require an additional US$153 billion in finance to 2040.[277]

- Convert fossil-fuel energy subsidies into investments in sustainable energy for all: Governments in Africa should use their INDCs to set timetables for eliminating the US$21 billion spent on subsidies to fossil-fuel energy, identifying measures for protecting the interests of poor consumers.
- End gas flaring: The flaring of gas from oil wells and gas extraction sites wastes energy, creates pollution and contributes to global warming. The principal countries involved in gas flaring –Angola, Cameroon, Congo, Gabon and Nigeria – should use their INDCs to identify the investment costs and technical requirements for phasing out flaring by 2020. Angola, Cameroon and Gabon are signatories to the Zero Routine Flaring by 2030 initiative. Other relevant countries should sign up. Private-sector companies should support this effort, working through the Gas Flaring Reduction Partnership.
- Set out strategies on land use and conservation: The INDCs could build on the strategies developed by Ethiopia to identify interventions aimed at valuing forestry resources, extending access to clean cooking facilities, and establishing communal rights to identify opportunities for scaled-up development partnerships.

6. Put the African climate vision into action

The African Common Positions developed by the African Group of Negotiators (AGN) and endorsed by the African Ministerial Conference on the Environment (AMCEN) provide the basis for a strong set of demands that African countries can collectively take to Paris. However, African governments have often failed to act on agreed positions and the shared interests that underpin those positions. "Going it alone" is an ill-advised strategy. International negotiations on climate change are marked by power asymmetry not just between African countries and the governments of rich countries, but between Africa and the major emerging economies. Acting separately, African governments will weaken the region's collective voice, opening the door to a deal that lacks sufficient ambition and fails to provide adequate adaptation finance. There is a need for greater cohesion among African countries in terms of the positions they take to Paris, as well as in how they negotiate.

Drive innovation and deliver

Africa is endowed with vast untapped resources of renewable energy. These resources can play a key role in providing electricity for all at an affordable cost, both through on-grid and off-grid applications. By mid-century, renewable sources could account for 70 per cent or more of Africa's energy provision. In planning for the development of renewable energy, African governments and development partners should:

1. Seize the opportunity to "leapfrog" to renewable-friendly regulations

Develop coherent renewable strategies: African governments should use IRENA's renewable energy assessments to identify priority areas for investment and develop long-term plans, backed by credible and transparent incentives. Current rules on the pricing of renewable energy are often unclear, and onerous administrative procedures and grid-connection requirements impede the development of utility-scale projects.

Create an enabling environment: To enable low-carbon energy providers to grow to the scale of utilities, governments need to establish targeted, long-term funding schemes and robust and supportive institutional frameworks at national level. There is need to deepen energy-sector reform and strengthen utility governance. Governments should improve technical and managerial capacity; progressively unbundle power generation, transmission and distribution; and establish robust independent regulatory systems. Prospects for attracting investment hinge critically on the establishment of credible off-take arrangements through utilities or power purchasers. Large up-front capital costs mean that renewable providers need security with respect to power-purchase agreements. In countries such as China and Brazil, national development banks have been prominently involved in the development of competitive renewable industries, providing subsidized credit to finance renewable energy.

Establish competitive pricing, auctions can supplement feed-in tariffs: African governments face a dilemma on approaches to market support for providers of renewable energy. Early investors face significant risks in complex energy markets that lack the infrastructure, local capacity and regulatory systems that have generated high returns for investors into renewable energy in other regions. One option is to incentivize investment through subsidies and feed-in tariffs of the type used in Germany. The experience of South Africa demonstrates that auctions have the potential to attract investment and drive down costs simultaneously. Despite some past difficulties in implementation, renewable-energy auctions have become a popular policy tool in recent years. When well designed, the price competition inherent in the auction scheme increases cost efficiency and allows price discovery of electricity based on renewable energy, avoiding potential windfall profits and underpayments. The potential downside is that successful bidders are often the larger players that can afford the associated administrative and transaction costs.

Develop an active industrial strategy for renewables: Aligned with the African Union's Agenda 2063, African governments need to develop an industrial strategy for scaling up renewables. Development of renewable energy in Africa is almost entirely dependent on imported technologies and there is only limited local content and value-added when investments are made. In some cases, recourse to development finance and risk instruments has locked countries into tendering processes favouring equipment imported from OECD countries, which is often more costly than comparable equipment produced by firms in China and India. Governments should give consideration to reducing import duties, while supporting the development of an African renewables sector through domestic and foreign investment. African governments should actively engage with potential investors in manufacturing solar panels, wind turbines, and other renewable technologies.

Promote science technology and research for innovation and jobs. Africa's leaders must champion local technological capability to move the continent from importing energy technologies to becoming a leading producer. This would increase Africa's productive capacity and employment. Implementation of the African Union's Science, Technology and Innovation Strategy for Africa 2024 is a key way to achieve these aims.

2. Adopt new models of planned urbanization

Only 71 per cent of Africa's urban population has connections to electricity and that proportion is declining as electricity providers cannot keep up with the rapid pace of urbanization.[278] Historically, Africa's cities have been the passive beneficiaries of national energy regimes dominated by state-owned utilities. In a reformed African energy sector, cities will take on greater responsibility for generation, distribution and demand management. More broadly, well-planned urbanization supported by world-class public transport is not only more energy-efficient but will also be crucial for decoupling future economic growth from greenhouse gas emissions.

Recognize the importance of meeting rising urban energy demand for national economic growth. Few African governments have national urbanization strategies integrated with economic policy and even fewer have comprehensive plans for meeting urban energy demand. African leaders should develop urbanization strategies with cross-departmental representation, assigned budgets and financing mechanisms, and take advantage of opportunities to galvanize action in 2015 as the sustainable development goal (SDG) for urban areas is established.

Establish independent market operators charged with procuring energy from cities, private companies and state-owned utilities by mayors working with the national government and local stakeholders. Electricity supply needs to be diversified and brought closer to rising urban demand, to avoid transmission losses and create local economic opportunity. Cities should do more to generate electricity by drawing on landfill gas, rooftop installations and strategic investments in local power producers.

Encourage urban demand-side management through the use of household-scale solar technologies. The International Finance Corporation (IFC) estimates that there could be more than 500 million micro-photovoltaic (PV) units (generating 200 watts or less) in Africa by 2030. This estimate seems conservative given the current use of kerosene and the relative cost of this fuel. Displacement of kerosene could be encouraged by quality guarantees and local incentives for PV technologies.

Encourage compact, connected urban development through zoning legislation and the strategic location of public infrastructure and public transport. Compact cities can achieve six times the neighbourhood energy efficiency (including transport) of more dispersed, sprawling, low-density development.[279] Leaders should strengthen strategic planning at the city, regional and national levels, with a focus on improved land-use and integrated multi-modal transport infrastructure. These efforts should be supported by regulatory reform to promote higher-density, mixed-use, infill development, and reforms to create more effective and accountable city-level institutions.

Pulling the plug on waste and corruption

1. Redirect the US$21 billion spent annually on subsidies

Governments should remove subsidies covering utility losses and kerosene and redirect them to productive investment in energy, social protection and subsidized connectivity for the poor. Around half of the savings, US$10 billion annually, should be diverted from consumption subsidies for the rich to connection subsidies and financing for the poor.

2. Increase the transparency of energy utilities

Leaders must tackle vested interests and break the webs of political patronage in energy utilities. Long-term national interest must override short-term political gain. Utilities must be required through legislation to publish the terms of all off-take arrangements and emergency power-purchase agreements, and tendering should only be done through locally registered and regulated companies.

3. End tax evasion and stem illicit revenue flows

African governments should support the recommendations of the African Union and UNECA's High-Level Panel on Illicit Financial Flows from Africa. These include curtailing trade-related illicit flows and integrating combating illicit financial flows as a specific component in the African Union Convention on Preventing and Combating Corruption.

African countries should ensure they have clear legislation and regulation to protect themselves against illicit financial flows, including by making trade mispricing illegal. African countries must also urgently build their tax capacity to raise tax by establishing special units with the appropriate technical and financial capabilities. These could include financial intelligence units, anti-fraud agencies, customs and border agencies, and anti-corruption agencies.

INTERNATIONAL COMMUNITY

Demonstrate leadership on reducing emissions

1. Raise the level of ambition at the Paris Climate Summit

Set a course for a sub-2°C warming threshold: The international community should set a high level of ambition, with targeted cuts of 70 per cent by 2050. This is at the upper end of the range identified in the IPPC Fifth Assessment as consistent with a pathway to global average temperature increase of 2°C and at the lower end of the range for a chance of reverting to a 1.5°C increase.

Set the right ambition: Meeting the 70 per cent reduction target in a manner consistent with basic equity will require zero net emissions from rich countries by 2050, with the major emerging markets following by 2070. This should be reflected in the INDCs.

Strengthen the commitment made by major emitting countries:

- **The European Union** should commit to 50 per cent emission cuts by 2030 and zero emissions by 2050. The EU should commit also to eliminating coal from power generation by 2030.
- **The United States** should commit to a 40 per cent reduction and the elimination of coal-fired power generation by 2030 and a zero emissions pathway to 2050.
- **China** should aim to peak in 2025 at an emissions level of 11 billion tonnes of CO_2e (0.7 billion tonnes below projected levels for 2030), building on the aggressive promotion of renewable energy, the proposed cap on coal and energy-efficiency measures.

End the free rides: Australia, Canada, Japan and the Russian Federation should set a clear course for zero emissions by 2050, with deep reductions by 2030. These countries might consider the far higher level of ambition set by Ethiopia, Kenya and Rwanda.

2. Align policies with commitments and phase out fossil-fuel subsidies

Policies are needed to drive a low-carbon transition encompass a vast array of areas, ranging from energy-efficiency standards to land-use practices and the development of renewable technologies. Several priority areas stand out:

Set carbon budgets: Carbon budgeting is critical if the decentralized INDC approach is to deliver credible results. All developed and middle-income countries should adopt carbon budgets that chart a clear course towards zero-carbon status. The budgets should include legislative provisions for a binding ceiling on emissions using five-year periods benchmarked against the 2050 targets.

Adopt stringent carbon pricing: Weak carbon pricing discourages investment in renewable energy and leads markets to underprice the costs of greenhouse gas emissions in terms of local pollution and damage to the global commons. The credible starting point for a 2015 carbon price in rich countries is around EUR21/US$23, rising to EUR41/US$45 by 2020 and at annual increments of around 7 per cent thereafter.

Cut fossil-fuel subsidies: Subsidies for fossil-fuel exploration and production are particularly damaging because they direct public money towards "unburnable" carbon assets. This combines a reckless approach to fiscal prudence with a disregard for climate change. The Paris climate agreement should aim at a comprehensive phase-out of all fossil-fuel subsidies by 2025, with appropriate support for low-income countries:

- EU members, the United States and other developed countries should withdraw by 2018 all tax concessions, royalty relief and fiscal transfers associated with fossil-fuel exploration and exploitation, and by 2020 all state aid to fossil-fuel industries.
- G20 members agreed in 2009 to "rationalize and phase out over the medium term inefficient fossil-fuel subsidies that encourage wasteful consumption." They must now act on that by agreeing on policies and monitoring mechanisms for eliminating fossil-fuel subsidies by 2020.

Get coal out of power generation in developed countries: Developed countries have the financial, technological and wider capabilities needed to stop using coal for power generation by 2030.
Review unburnable carbon assets: Financial regulators should require full disclosure reporting on financial assets and require companies and institutional investors to make provisions for loss.

Build confidence through strengthened monitoring, reporting and verification: Effective monitoring, reporting and verification (MRV) holds the key to the credibility of the Paris agreement. The standards for monitoring have been developed through the UNFCCC. The Paris agreement should include a regular review and reporting cycle of no more than five years. The United Nations Environment Programme (UNEP) is well placed to lead this exercise, building on its current "climate gap" work.

Commit to equity: Without commitment to equity there will be no agreement in Paris. Developed countries must set a level of ambition that reflects their historic responsibility, along with their financial, technological and institutional capabilities. Their INDCs must also set out commitments in vital areas such as technology transfer, climate finance and support for adaptation.

Deliver the finance

The Paris climate summit provides an opportunity to deepen international cooperation. This is an agenda that goes far beyond aid and climate finance, though both are important. Technology transfer, trade, private investment, shared research and development, and cooperation between cities all have roles to play. For Africa, the negotiations in Paris present an opportunity to develop new partnerships for sustainable development. Linking the climate talks to action at the Addis Ababa summit on financing for development is critical.

1. Overhaul the climate-finance architecture

A global fund for connectivity operating under the SE4All framework: If current trends continue, around 645 million Africans will still lack access to electricity in 2030. Aid donors should commit at the Addis Ababa financing summit to providing US$3 billion in official development assistance and mobilizing US$7 billion in concessional finance to lower that barrier. Delivery could be coordinated and channelled through the SE4ALL partnership, and geared towards on-grid, mini-grid and off-grid provision **(Box 17)**. African governments seeking to access the finance would be required to develop national action plans for universal access and to provide co-financing. The fund for connectivity would help facilitate the development of markets for off-grid provision and stimulate the development of innovative business models aimed at lowering the up-front costs that are excluding poor households from energy provision. Effectively deployed, financing for off-grid connectivity would stimulate investment, innovation and market demand for private investors who can provide electricity to people living at the "base of the pyramid", earning less than US$2.50 a day.

Act on the Copenhagen commitment: Developed countries should commit to a clear and transparent pathway to mobilize the US$100 billion annually in public and private finance by 2020 as agreed by all Parties to the UNFCCC. This was an integral part

BOX 17 DELIVERING ENERGY FOR ALL THROUGH A GLOBAL CONNECTIVITY FUND

Roughly US$20 billion a year will be required to 2030 to achieve universal access to energy. Beyond the finance, "going to zero" so that no-one lacks access to electricity will require a mix of three broad delivery approaches:

- Extend the grid: Most of the urban population and probably around half of the rural population will be most effectively reached through the grid. Subsidizing grid connections for the poor is a more efficient and equitable use of public finance than the subsidizing energy consumption by the non-poor, which dominates current financing arrangements.
- Mini-grids: Where the distance from the grid is too large and the population density too low to make grid connection economically viable, mini-grids can be a cost-effective alternative. The IEA estimates that over 40 per cent of all installed capacity to achieve universal access to electricity by 2030 will be most economically delivered by mini-grids, though the share may be higher in Africa.
- Off-grid: Falling prices and the increased efficiency of batteries are making off-grid energy solutions, especially solar lanterns and home systems, increasing viable. Off-grid provision is likely to remain the first step on the ladder to modern energy in many rural areas and urban informal settlements.

The Sustainable Energy for All (SE4All) partnership provides a framework for international cooperation to deliver on the Sustainable Development Goal of universal access to energy. The SE4All Africa Hub, which is housed at the Africa Development Bank, brings together a range of regional organizations, alongside international agencies and financial institutions. Some 42 countries in Africa are members of the partnership. Participating countries draw up "rapid assessments", intended to lay the groundwork for scaling up in priority areas, to identify strategic reforms and to attract new investments and financial support. However, the assessments are partial in nature, are weakly linked to planning for universal access and lack bridges to concrete financing provisions.

More ambitious approaches could transform SE4All into a powerful catalyst for change:

- Governments in the SE4All partnership should development national action plans for achieving universal access by 2030, with clearly delineated financing requirements, delivery mechanisms and reporting systems.
- African governments should commit around US$10 billion in public finance to support universal access to energy.
- The SE4All financing framework should be developed to provide an equivalent amount in development finance through grant aid, risk and credit guarantees, and a mix of market-based and concessional finance to support the delivery of mini-grid and off-grid solutions to "base-of-the-pyramid" customers.

What the Africa Progress Panel envisages for the fund is not an old-style aid-financing mechanism. Universal access to energy represents an investment opportunity for companies and a savings opportunity for households and is structurally different to, for example, financing for public health and vaccines. As we show in this report, business-to-consumer providers of renewable energy can offer households energy at prices below those of kerosene and consumers can replace payments for kerosene with spending on solar home-systems. Investors can recover costs, typically in one to two years, and consumers can secure lower prices for energy. Unlocking the market failure that prevents these gains requires innovative business models allied to market support aimed at lowering up-front costs.

The operational and financial modalities would have to be worked out. One option would be to draw on some of the best practices of the global health funds, with technical support for the development of national plans submitted for independent review. However, the financing portfolio would include not just aid but a broad range of development-financing instruments, with the mix determined country by country.

of the 2009 Copenhagen climate summit commitment. Under the financial mechanism of UNFCCC, the Green Climate Fund has a central role to play in mobilizing and channelling the financial resources and has mobilized US$10 billion equivalent for 2014. Global estimates indicate that US$30 billion has been mobilized. However, there are concerns over reporting systems that appear to facilitate double counting. The Paris summit provides an opportunity to set a schedule, identify the mix of public and private finance flows, and establish a reporting system with the transparency needed to build confidence.

2. Seize the Addis opportunity

The Addis summit provides an opportunity to set out the new financing commitments needed to underpin an ambitious climate agreement. Developed countries should commit to an additional US$15 billion in public finance to support climate-resilient development and a further US$10 billion in finance for mitigation through mechanisms such as the Clean Technology Fund and the GCF.

Make the Green Climate Fund work for Africa: The GCF offers an opportunity to overcome the fragmentation in the climate-finance architecture and to correct the imbalance between mitigation and adaptation financing. The GCF has already adopted a target to balance its financing by 50-50 between mitigation and adaptation. The GCF could also provide a focal point for strengthened international cooperation on climate. For the fund to deliver on its potential, it needs to provide an early demonstration of its capacity for innovative action at scale. African leaders have a role to play in seeking transparency in the Paris Agreement on the GCF's growing amounts of new climate finance to developing countries post 2020. Among the initiatives the GCF could take up:

- Increase capitalization of the GCF: Capitalization should be increased from the current commitment level of US$ 10 billion to US$ 20 billion.

- Create a financing window for off-grid energy: The proposed window would support the private sector, government and CSO investments with a specific remit to expand electricity supply in hard to reach areas. Initially capitalised by grants and development finance, the window would provide credit guarantees and equity investment for companies providing renewable energy to households beyond the grid. Around US$5 billion would be earmarked for Sub-Saharan Africa.

- Consolidate adaptation funds: Governments in Africa and other regions are confronted with an excessively fragmented and underfunded system of adaptation finance. Bringing the existing funds under a single transformative adaptation window, housed in the GCF, would offer efficiency savings and reduce transaction costs.

- Increase transformative adaptation financing: Support for climate-resilient development should include an additional US$5 billion annually in public finance for measures aimed at supporting adaptation activities that lower risk and raise productivity, including investment in rural infrastructure, social protection, research and development, and strategies for combating soil erosion, deforestation and forest degradation.

3. Unlock private finance

Rethink global banking regulations: The global financial crisis prompted a series of reform initiatives aimed at strengthening financial regulation, including a new set of global banking standards (Basel III) that were initially intended for implementation in the most advanced economies. African countries have been urged to adhere to Basel standards, but they include more stringent rules on capital-adequacy and liquidity that are likely to deter investment in the energy sector by large investors, as well as by small and medium-sized enterprises.[280] African regulators would be well advised to avoid premature adoption of Basel III standards, or if already adopted, to reform these standards in the light of domestic market needs.

4. Boost the energy focus of multilateral institutions

Expand the role of the African Development Bank: The current project-financing architecture should be enhanced to serve Africa better. It typically takes seven years to go from conception to finance, in part because of weak capacity to develop bankable projects and in part because risk-guarantee, credit and financing arrangements are so complex. The AfDB should be financed to play a greater regional role in developing bankable projects. The Bank should also be supported to develop its range of instruments and interventions further, including public-private partnerships, partial risk guarantees, investment projects and advisory services. Innovative financing instruments that catalyze additional finance and private investment will also be essential.

Mobilize finance for the Africa50 fund: The third International Financing for Development conference in Addis Ababa in July 2015 provides an opportunity to make the commitments needed to support the Africa50 facility proposed by the AfDB. The facility is to be structured as a development-oriented entity that is operated as a commercial enterprise. The aim is to secure an equity investment of US$10 billion, thereby attracting US$100 billion of local and global capital. Governments, development-finance institutions and the World Bank Group should support an initial US$3 billion in investments to establish credibility with governments, private developers and financial markets. In order to ensure reliable access to capital markets while also offering additional operational flexibility and affordable capital, the Africa50 fund will target an investment-grade rating. The Asian Infrastructure Investment Bank established by China, the New Development Bank created by the BRICS countries (Brazil, Russia, India, China and South Africa) and the Infrastructure Fund of the Association of Southeast Asian Nations (ASEAN) represent innovative responses to systemic challenges in infrastructure financing. Each has a strong emphasis on energy. There is a danger that, in the absence of a regional initiative, the energy financing gap will widen.

Establish a "one-shop" mechanism for securing appropriate risk guarantees from different agencies: Governments and potential investors seeking risk guarantees face high transaction costs. The AfDB and the World Bank should lead the development of a coordination mechanism with development finance institutions through which project proposals can be treated on an integrated basis. Development finance institutions should scale up their risk-guarantee provisions.

Strengthen the role of multilateral development banks (MDBs): The MDBs should play a far stronger role in mobilizing investment for energy infrastructure. The World Bank is able to mobilize large multiples of its callable capital because of its AAA credit rating. Currently low-income countries access only the Bank's concessional IDA facility, which makes a modest contribution to energy-sector financing. Low-income countries in

Africa are borrowing on bond markets at 6-8 per cent, while they are unable to secure loans from the World Bank at 1-2 per cent. The time has come to revisit to institutional rules and practices that lead to this perverse outcome. The World Bank Group should also scale up its risk-guarantee instruments. Multilateral Investment Guarantee Agency (MIGA) plays a useful role, but it is small and has compliance requirements that are often difficult to meet. Its operations in Africa need to be simplified and scaled up. Concessional aid could also be used to pay MIGA's insurance premium on strategic infrastructure investments.

Explore the creation of development banks: From China and Vietnam to India and Brazil, national development banks have played a pivotal role in infrastructure development by accelerating development of bankable projects, attracting private finance and developing technical standards for regulation.

Increase investments: Subject to clear safeguards on resettlement, development financing institutions should be playing a more active role in expanding investments in cross-border transmission links and hydro projects considered too risky by the private sector. Multilateral development banks and development finance institutions should take a lead.

5. Rethink adaptation

Current approaches to climate change adaptation are not working. National adaptation plans reflect a bias towards project-based responses to climate risk. Building on the planning model adopted by Ethiopia, governments in Africa and aid agencies should adopt "transformative adaptation" planning approaches that address systemic risk on a programme basis. These approaches should include provisions for scaled-up social protection, investment measures to raise agricultural productivity and changed land-use practices. Around US$10 billion of the additional climate-resilient development aid proposed for the Addis summit should be earmarked for Sub-Saharan Africa. Donors should consider supporting climate-resilient development initiatives through matched funding for adaptation, up to a fixed ceiling.

Restore degraded lands: Africa represents around one-third of global opportunities for land and forest restoration. There is a pressing case for increasing ambition through national action and international partnerships.

Reform REDD+: The climate agreement should include provisions for sufficient, stable and durable financing through the United Nations REDD+programme for reducing deforestation and forest degradation including conservation, sustainable management of forests and enhancement of forest carbon stocks. This should include payments scaled up to at least US$5 billion annually on a global basis. African governments should seek significant reforms. REDD+should recognize the technical, capacity and governance constraints faced by many countries and allow for a narrower focus on a smaller range of themes. For example, financing could be linked to tangible reforms of the charcoal sector, support for the distribution of clean cooking stoves, and more stringent enforcement of regulations on forest conservation.

Strengthen the Global Alliance for Clean Cook-stoves: The Alliance has an ambitious 10-year goal to foster the adoption of clean cooking stoves and fuels in 100 million households by 2020. Aid donors could strengthen the alliance by creating an innovation fund that provides advance purchase commitments and by working with public, private and non-profit partners to overcome the market barriers that impede production, deployment, and use of clean cooking stoves.

Act collectively to combat global corruption and advance transparency

1. Advance transparency in energy

Contract and negotiation transparency must be increased in international energy deals. Furthermore, Africa's renewables revolution must be placed on a transparent and well-managed foundation that includes enforcement of existing certification systems and increased capacity to implement international standards in national procurement systems to avoid the dumping of old and inappropriate technologies, corruption, and mismanagement.

2. Redouble efforts to combat tax evasion

While the G20/OECD reforms on base erosion and profit shifting are powerful and essential, they must be extended more rapidly to benefit African nations. The international community should help African nations to build their capacity to raise tax domestically and to protect themselves against illicit financial outflows, especially via inaccurate trade invoicing. Other priority actions include establishing public registries of who owns companies; making automatic exchange of tax information available to African countries; with the assistance of the IMF, agreeing on how to define, measure and track illicit flows; and making accessible to African customs departments commercially available trade databases to enable them to identify, investigate and interdict good that have been misinvoiced.

PRIVATE INVESTORS AND MULTINATIONAL COMPANIES

1. Demand an ambitious Paris climate agreement

The business community should work with cities, municipal authorities, civil-society organizations and governments to demand an ambitious Paris climate agreement, backed by carbon pricing and taxation. All companies should establish and publish a "shadow price" for carbon in their company accounts.

2. Play a leadership role in the global transparency movement

Get out of carbon: The institutional investment community should demand more transparent reporting on the "unburnable" carbon assets of energy companies and move towards early divestment of fossil-fuel assets, especially coal.

Stop the secrecy: Foreign investors and African companies should provide full disclosure of their beneficial ownership structures and transparent reporting on energy-related contracts, including electricity off-take arrangements. Companies must reduce illicit financial flows and pay a fair tax in the appropriate jurisdiction.

3. Review risk assessments and invest responsibly in Africa

Africa's energy market is huge and growing. International investors should review their risk assessments for energy projects in Africa and seize opportunities to drive the development of low-carbon infrastructure. African business leaders should engage with governments to identify the conditions for increasing investment in energy-sector infrastructure and they should lead the development of new low-carbon energy partnerships. Energy investors should develop innovative business models aimed at lowering market entry costs for electricity and efficient cook-stoves.

Investors and governments should work together to establish low-carbon production capabilities. If Africa is to take off as a green energy power, the region needs to attract the necessary investment. This could initially take the form of plant to assemble equipment to generate low-carbon energy. Partnerships with Chinese, European and US investors could open the door to the production, hence reducing import costs, creating opportunities for learning and establishing links to local markets.

LIST OF ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
AF	Adaptation Found
AGN	African Group of Negotiators
AMCEN	African Ministerial Conference on the Environment
ASAP	Adaptation for Smallholder Agriculture Programme
ASEAN	Association of Southeast Asian Nations
BEL	Bujagali Energy Limited
BIO	Belgian Investment Company for Developing Countries
BRICS	Brazil Russia India China South Africa
CAT	Climate Action Tracker
CDC	Commonwealth Development Corporation
CIFs	Climate Investment Funds
$C0_2$	Carbon Dioxide
CoP	Conference of the Parties
CRGE	Climate-Resilient Green Economy
DfID	Department for International Development
DFI	development finance institution
DRC	Democratic Republic of Congo
EAIF	Emerging Africa Infrastructure Fund
EFP	European Financing Partners
EIB	European Investment Bank
EU-Africa ITF	EU-Africa Infrastructure Trust Fund
ETS	Emission trading schemes
FDI	foreign direct investment
FMO	Netherlands Development Finance Company
GCF	Green Climate Fund
GDP	gross domestic product
GERD	Grand Ethiopian Renaissance Dam
GHG	greenhouse gas
GNI	gross national income
GSMA	Groupe Spéciale Mobile Association
GT	gigatonne
GW	gigawatt
HAP	household air pollution
HDI	Human Development Index
ICBC	Industrial Commercial Bank of China
IDA	International Development Association
IDCOL	Infrastructure Development Company Limited
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IMF	International Monetary Fund
INDCs	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IPPs	Independent Power Providers
IPS	Industrial Promotion Services
IPTL	Independent Power Tanzania Limited
IRENA	International Renewable Energy Agency
KEG	Karadeniz Energy Group

KFW	German Development Bank
KV	kilovolt
kWh	kilowatt per hour
LDUs	local distribution utilities
LED	Light-emitting diodes
MDBs	Multilateral Development Banks
MDGs	Millennium Development Goals
MIGA	Multilateral Investment Guarantee Agency
MRV	monitoring, reporting and verification
MT	megaton
MW	megawatts
NBET	Nigerian Bulk Electricity Trading
NEPA	National Electric Power Authority (Nigeria)
NIPPs	National Integrated Power Projects
NMHS	National Meteorological and Hydrological Services
NORFUND	Norwegian Investment Fund for Developing Countries
ODA	official development assistance
ODCOL	Infrastructure Development Company Limited
ODF	official development finance
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
ONE	Office National de l'Electricité
OPIC	Overseas Private Investment Corporation
OAU	Organisation of African Union
PFIs	Public Finance Institutions
PHCN	Power Holding Company Nigeria
PIDA	Programme for Infrastructure Development in Africa
PPAs	Power Purchase Agreements
PPI	private participation infrastructure
PPP	Public-private partnerships
PRG	Partial Risk Guarantee
PSNP	Productive Safety Net Programme (Ethiopia)
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REIPPP	Renewable Energy Independent Power Producer Procurement
SCCF	Special Climate Change Fund
SDGs	Sustainable Development Goals
SE4All	Sustainable Energy for All
SENELEC	Société nationale d'électricité du Sénégal
SMEs	small and medium-size enterprises
SONABEL	Société Nationale d'électricité du Burkina Faso
SONABHY	Société Nationale Burkinabè d'Hydrocarbures
SREP	Scaling Up Renewable Energy in Low Countries Programme
TEL	Toyola Energy Limited
TANESCO	Tanzania Electric Supply Company Limited
TRA	Tanzania Revenue Authority
TWh	terawatt per hour
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	value-added tax
WHO	World Health Organisation

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