

# *A new Africa energy world*

## A more positive power utilities outlook



**88%**

expect future power utility business models will be transformed by 2030, with a quarter of them saying they will be unrecognisable from those operating today.

**94%**

say there is a medium or high probability that, by 2025, the challenge of finding a market design that can balance investment, affordability and access issues will have been largely solved.

**96%**

say there is a medium or high probability that load shedding will be the exception rather than the norm by 2025.

## Capturing African power and utility viewpoints

# 51

senior power  
and utility sector  
participants

# 15

countries

Botswana

Ghana

Kenya

Lesotho

Malawi

Mozambique

Namibia

Nigeria

Rwanda

South Africa

Swaziland

Tanzania

Uganda

Zambia

Zimbabwe

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### About the survey

The PwC Africa Power & Utilities Sector Survey is based on research conducted between November 2014 and March 2015 with 51 people holding senior leadership positions in the power sectors of 15 African countries. Twenty two participants were from power utility companies, 12 were from independent power producers and investors, seven were from government energy departments, nine were from regulatory bodies, one from an organisation with interest in the sector. The majority of participants were CEOs, board members or hold senior management positions.

### Acknowledgements

PwC thanks all the participants who took time to respond to the survey.

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# Introduction

*Welcome to the first edition of the PwC Africa Power & Utilities Sector Survey. The survey goes to the heart of boardroom thinking in utility companies and other sector stakeholders across the continent. It supplements our Global Power & Utilities Survey with a deeper dive into the African power utility sector.*

We look ahead to the future world of electricity in Africa as well as taking a hard look also at the key challenges the power sector faces today. The changes that lie ahead are of great potential significance. New technologies, unforeseen possibilities, different ways of generating, distributing, storing and using electricity will all play their part.

But equally important and more urgent is how the companies in the sector, governments and policymakers address the many pressing challenges that constrain existing power systems. The investment requirement is substantial. The road of market reform remains long. And the scope for improvement within power companies themselves is significant.

In this survey report, we look at these and other issues. There is much that we can be optimistic about and the results point the way to improvements ahead. But the development of effective policy frameworks and the attraction of adequate investment continue to be the number one priorities. Until they are resolved, power systems will remain on a knife edge.



*Angeli Hoekstra*

**Angeli Hoekstra**  
Africa Power & Utility Leader

# Executive summary

*Africa faces a huge electricity demand challenge. Existing infrastructure is insufficient to meet current requirements, let alone the growth of the coming decades. Installed power capacity is expected to rise from 2012's 90GW to 380GW in 2040 in sub-Saharan Africa. Nonetheless 530 million people, primarily in rural communities, are expected to remain without power.<sup>1</sup> But difficulties such as the investment barriers facing the sector are being addressed. An era of rapid technological change is also coming at a pivotal time in the expansion of African power infrastructure.*

Our report examines industry opinion on these issues as well as a range of other important challenges facing the sector in the period ahead. Here are some of the key findings.

## **Bright spots among the challenges**

Two-thirds (67%) of those we interviewed cited ageing or badly maintained infrastructure as a high or very high concern. Encouragingly, many felt this situation would improve, with only 39 per cent predicting that it would be a similarly high or very high concern in five years' time. If this proves to be the case, it is very significant. We estimate that raising the availability of generation by ten percentage points could add significantly to the continent's GDP. There are other near-term bright spots as well, with the level of concern about skills shortages and, to a lesser extent, market reforms easing in the next five years. However, other pressing concerns are not set to change. Affordability and access to primary resources were the other two issues among the top concerns mentioned, highlighted as high or very high concerns by around three-fifths of those surveyed and with very little change expected in the near-term future.

## **Optimism on a number of fronts**

Insufficient generation and creaking infrastructure mean that planned power outages and load shedding are a well-established feature of life for many African power consumers. But our survey participants are optimistic that improvements are on the way. An overwhelming majority (96%) say there is a medium or high probability that load shedding will be the exception rather than the norm by 2025. Indeed, nearly three-quarters (72%) are confident enough to rate that scenario as a high probability. The mood of optimism also extends to regulatory change. Ninety four per cent say there is a medium or high probability that, by 2025, the challenge of finding a market design that can balance investment, affordability and access issues will have been largely solved.



## An energy-transformed landscape

A range of technologies are combining, in different ways, to move power systems away from being top-down centralised systems to ones that are much more decentralised and fragmented. Seventy per cent of our survey respondents believe there is a medium to high probability that advances and cost reductions in green renewable off-grid technology will deliver an exponential increase in rural electrification levels by 2025. The prospect of future local mini-grids and off-grid distributed generation being an important feature of the African power mix, alongside centralised generation, is an energy market vision that is viewed as likely or highly likely by 83 per cent of survey participants. But the majority of survey participants (54%) continue to see centralised generation and interconnections being the main future energy provision to meet demand growth in urban areas.

## Business model transformation lies ahead

When we asked survey respondents about the impact of these and other changes on future power utility business models, only around one in eight (12%) thought that future business models would be the same or similar. Instead, the vast majority (88%) said that power utility business models would be transformed. Most respondents thought that some features of current models would remain in place but nearly a quarter (22% of all respondents) went so far as to say that business models would be completely transformed and unrecognisable from those operating today.

## Cost-reflective tariffs remain a big challenge

Two-thirds of our survey participants pinpoint the inability to recover the cost of new generation via current electricity tariffs as a major barrier to investing in new large-scale generation and transmission projects. It's a recurrent theme in our survey and heads the list of energy policy measures needed to address the key problems of expanding power provision and making existing assets more reliable. Eighty three per cent say that moving to cost-reflective tariffs would have a high or very high impact on increasing electrification and improving reliability.

## Room for big performance improvement

While policy reforms are a key requirement, many African power utility companies are conscious of the need to reform their own organisations. Making limited resources go further is an essential part of maximising power availability and adding to investor confidence. The vast majority (70%) report that cost base savings and efficiency improvements of more than 10 per cent are possible and many (42%) say there is scope for African power and utility companies to achieve savings in excess of 20 per cent. Between 70 and 80 per cent of all survey participants see high or very high scope for performance improvement in asset risk management, customer service and capital project management. And around two-thirds see the same big scope for improvement in loss reduction and in the development of local skills.

## Private investment

Many of the essential prerequisites are in place for an increase in private investment and participation in the sector but there is still a considerable way to go. As well as the big issue of the need for cost-reflective tariffs (see above), between a third and two-fifths of our survey participants reported that they didn't feel there was sufficient transparency around the procurement of new power capacity and sufficient certainty on government backing for power purchase agreements (PPAs). And only six per cent felt that the local commercial banking industry had sufficient liquidity to finance new power projects without some form of credit enhancement being available. Indeed half said that even then such finance was not possible.

## At a glance Africa's positive power outlook

Many of the survey results reflect a very positive outlook on the prospects ahead for power in Africa. All the following are seen as medium to high probabilities:

**96%** say that load shedding will be the exception rather than the norm by 2025.

**94%** expect the challenge of finding a market design that can balance investment, affordability and access issues will have been largely solved by 2025.

**70%** expect cross-border electricity flows to be significant by 2025, accounting for a third or more of electricity generated.

....and finally....

**67%** down to **39%** – the number of survey participants expecting ageing or badly maintained infrastructure to be a major concern in 2020 compared to today.

# Big challenges

*Many of the megatrends that are acting as big influences on the power sector globally are amplified in Africa. It is one of the most vulnerable continents, for example, to climate change and climate variability. In particular, climate change is expected to intensify the existing stresses on water availability in Africa. The continent is also a major driver of the megatrend of the continued shift in global economic power to emerging markets.*

## Megatrends, growth and infrastructure

An era of rapid technological change is coming at a pivotal time in the expansion of African power infrastructure, opening up the prospect of more affordable off-grid energy solutions in rural areas. The continent is also a major focus for the demographic megatrends shaping the world.

Africa continues to provide a bright spot in global economic growth. Current growth remains ahead of many other parts of the world and Africa is forecast to remain one of the world's three fastest-growing regions in the coming years.<sup>2</sup> In the International Energy Agency's central outlook for energy in Africa, the sub-Saharan economy is projected to quadruple in size in the period to 2040.<sup>3</sup>

All over Africa, governments are looking to the power sector for improvement and expansion. The under-electrification of much of the continent is a constraint on growth. Only 39 per cent of the African population has access to electricity, compared to 70–90% in other parts of the developing world. In north Africa access is very high (more than 95%) while in rural areas elsewhere it is only 12.9 per cent. Across sub-Saharan Africa only 31.8 per cent have electricity access.<sup>4</sup> And in many places, even where there is access, power cuts and the need for load shedding, with its negative economic and social implications, continue to be a regular occurrence.

Alongside economic growth, population pressures are adding to energy demand. More than half of global population growth between now and 2050 is expected to occur in Africa.<sup>5</sup> This is set to add to the pressure on urban areas. Africa has at least 120 cities of over half a million residents and 47 of over a million, spread out among 54 countries<sup>6</sup>. Africa is already home to three megacities – Cairo, Kinshasa and Lagos. Three more are expected to emerge by 2030, as Dar es Salaam, Johannesburg and Luanda are each projected to surpass the 10 million mark.<sup>7</sup> The number of large cities with populations between 5 and 10 million in Africa is also expected to increase, from three in 2014 to twelve in 2030.<sup>8</sup>

<sup>2</sup> Francisco Ferreira, Chief Economist for Africa, World Bank, press release, 7 October 2014.

<sup>3</sup> International Energy Agency, World Energy Outlook, 2014.

<sup>4</sup> IEA, PIDA and OECD sources.

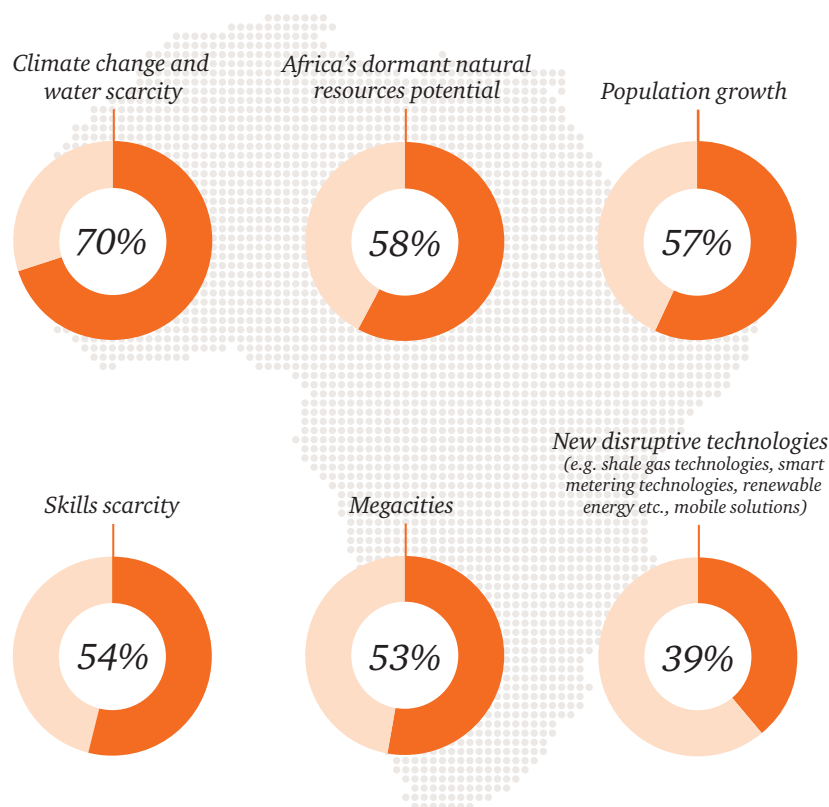
<sup>5</sup> World Population Prospects: The 2012 Revision, Population Division, UN Department of Economic and Social Affairs.

All of these trends pose a major infrastructure challenge to the power sector. Not surprisingly, many of them are top of mind among the power sector executives and stakeholders that we interviewed. Heading the list (figure 1), over two-thirds (70%) anticipate that climate change and water scarcity will have a high or very high impact on the power sector. Increased exploitation of the continent's dormant natural resources potential, with its associated power requirement, was rated as having the second highest impact on our list. And more than half of those interviewed also felt that population growth (57%) and megacities (53%) would have similarly high impacts.

A similar proportion of those interviewed (54%) were also concerned about skills scarcities, which is a particular worry for the power sector, especially at a time of major capital project expansion. But, encouragingly, in answer to a separate question, many felt that the issue of access to skills is set to improve over the next five years – 60 per cent reported it as of high or very high concern now but this dropped to 40 per cent when asked to look ahead five years.

Two-fifths (39%) said that new disruptive technologies, such as smart grids and distributed power generation, are set to have a high or very high impact. And, although rated below other megatrends in terms of high impact, it is clear that disruptive technologies are being taken very seriously by most in the sector – a minority of just one in three felt that such technologies would have only a low impact versus two-thirds saying their impact would be medium to high.

**Figure 1: Which of the following global and Africa megatrends will have a significant impact on your power sector?**  
% reporting high or very high impact



Score from 1–5, where 1 = very low impact and 5 = very high impact.  
Source: PwC Africa Power & Utilities Sector Survey

# 70%

anticipate that climate change and water scarcity will have a high or very high impact on the power sector.

6 For cities of over half a million, see Demographia World Urban Areas: 11th Annual Edition: 2015:01, Table 5: Summary: Urban Areas 500,000 & Over, p. 132, Demographia, January 2015, at <http://www.demographia.com/db-worldua.pdf>; for cities of over a million, see the infographic by Future Cape Town on its website at <http://futurecapetown.com/2013/07/infographic-fastest-growing-african-cities/#.VMqShqlv3dl>.

7 World Urbanization Prospects, UN Department of Economic and Social Affairs, 2014.

8 Ibid.

## Big challenges

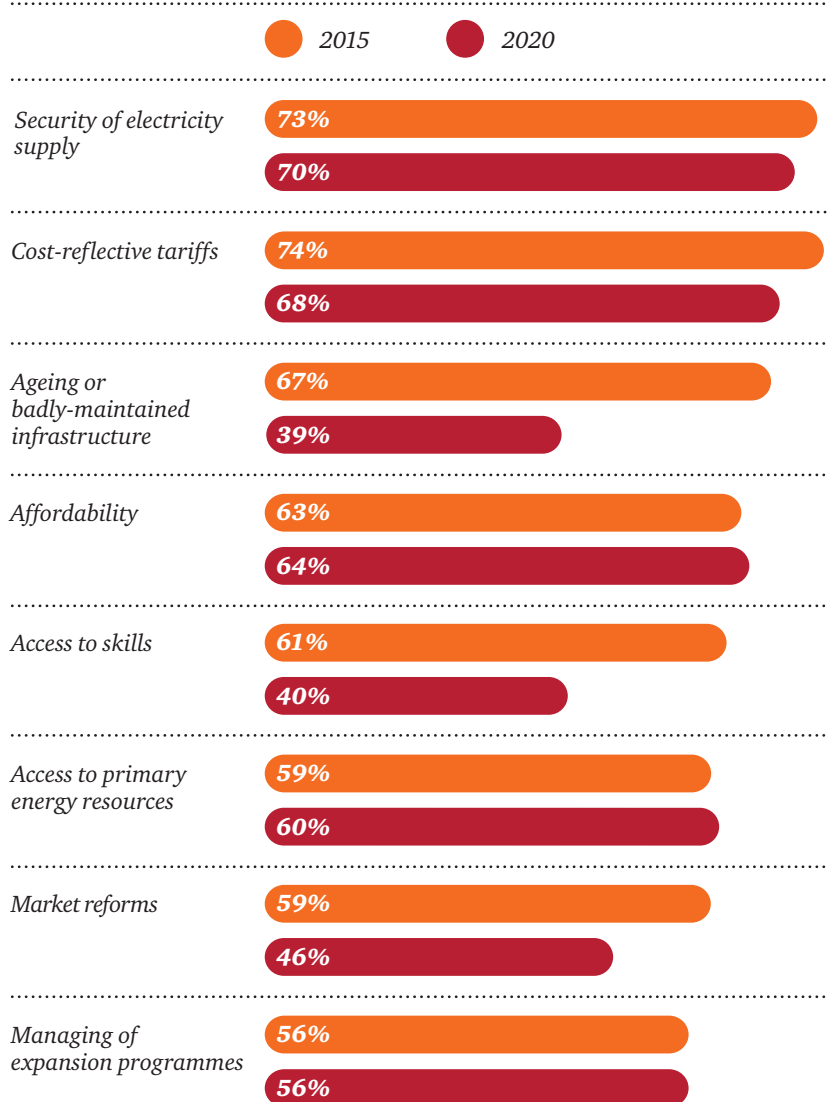
Not surprisingly, given that around two-thirds of the population in sub-Saharan Africa live without electricity, security of supply tops the list when we turn to the challenges faced by our survey participants (figure 2). Nearly three-quarters (73%) rated security of supply as a high or very high concern now and nearly the same proportion (70%) felt it would still be running at the same high level of concern in five years' time. Part of the problem is that the tariffs for electricity typically do not reflect the actual cost of its generation and supply, thus inhibiting investment. The issue of cost-reflective tariffs ranked alongside security of supply as a concern, although there was a degree of optimism that this would not be quite such an issue in five years' time.

Security of supply problems are exacerbated by the lack of availability of many existing generation assets due to ageing, disrepair or poor asset management. It's again not surprising then that two-thirds (67%) of our survey participants cited ageing or badly maintained infrastructure as a high or very high concern.

Encouragingly, many felt this situation would improve, with only 39 per cent predicting that it would be a high or very high concern in five years' time. If accomplished, such an improvement would be very noteworthy. We estimate that raising the availability of generation by ten percentage points could add significantly to the continent's GDP. However, improving the availability of the asset base in generation also needs to be matched by improvements in the rollout of transmission lines, grid connections and distribution capacity.

There are other near-term bright spots as well, with the level of concern about skills shortages and, to a lesser extent, market reforms easing in the next five years. However, other pressing concerns are not set to change. Affordability and access to primary energy resources were the other two issues among the top issues mentioned, highlighted as high or very high concerns by around three-fifths of those surveyed and with very little change expected in the near-term future.

**Figure 2: Which of the following big challenges in the power industry are you most concerned about now and in the next 5 years?**  
% rating high or very high concern



Scale of 1–5, where 1 = little concern or no concern and 5 = very high concern.  
Source: PwC Africa Power & Utilities Sector Survey



## *Future scenario* Availability

*“Investment in generation and other infrastructure advances will mean that load shedding will be the exception rather than the rule by 2025”*

Insufficient generation and creaking infrastructure mean that planned power outages and load shedding are a well-established feature of life for many African power consumers. But our survey participants are optimistic that improvements are on the way. An overwhelming majority (96%) say there is a medium or high probability that load shedding will be the exception rather than the norm by 2025. Indeed, nearly three-quarters (72%) are confident enough to rate that scenario as a high probability.



**4%**

attach a low probability score to this scenario.



**96%**

give it a medium or high probability score.

**Big challenges**

**The energy trilemma**

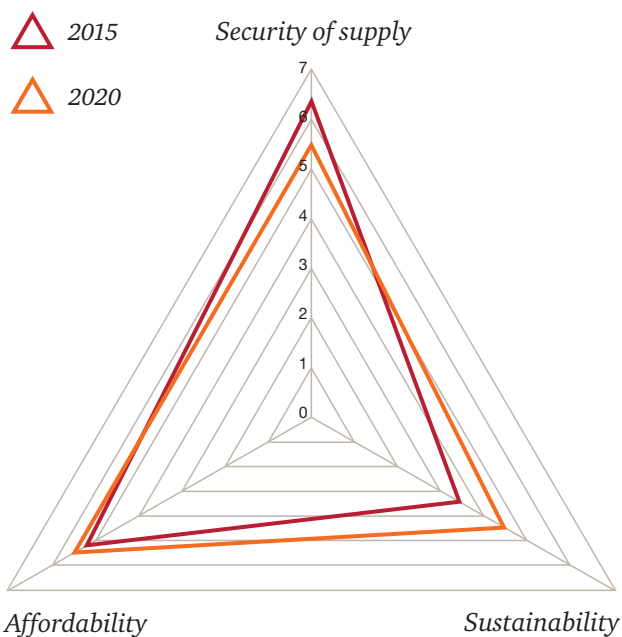
The trade-off between the three classic energy objectives of security of supply, affordability and sustainability has long been recognised as a central dilemma, or ‘trilemma’, for energy policy. The energy supply that might be the most secure may not be the most affordable and/or the most sustainable and vice versa. As the World Energy Council points out, “delivering policies which simultaneously address energy security, universal access to affordable energy services, and environmentally sensitive production and use of energy is one of the most formidable challenges facing government and industry.” And in Africa, of course, there is the added issue of access to energy in the first place, which adds an additional element to the ‘security of supply’ dimension.

We put the question of this ‘energy trilemma’ to our survey participants. We asked them to assess how well they feel the continent rates on each dimension of the trilemma but also forced them to make trade-offs between the different elements, in a reflection of the real-life trade-offs that exist. Not surprisingly, security of supply is confirmed as the number one priority but survey participants expect significant change in the next five years.

Currently they give sustainability only 45 per cent of the emphasis given to security of supply (with affordability receiving 82 per cent). By 2020 they expect this gap to close significantly, with sustainability moving up to 64 per cent of the emphasis given to security of supply. When we asked the same question in our global power and utilities survey, we found that this is a trend that is expected by survey participants in every main region of the world.

**Figure 3: Energy trilemma**

Where do you see Africa positioned in the ‘trilemma’ between security of supply, affordability and sustainability now and where do you foresee Africa being positioned by 2020?



2015	Average score	Africa index	Global index*
<i>Security of supply</i>	6.3	100	100
<i>Affordability</i>	5.2	82	92
<i>Sustainability</i>	2.9	45	61

2020	Average score	Africa index	Global index*
<i>Security of supply</i>	5.5	100	100
<i>Affordability</i>	5.4	97	83
<i>Sustainability</i>	3.5	64	81

Respondents were asked to allocate a total sum of 15 points across each of the three trilemma goals. The lead goal is then indexed to 100.

\* Global index is from PwC’s 14th Global Power & Utilities Survey, 2015.

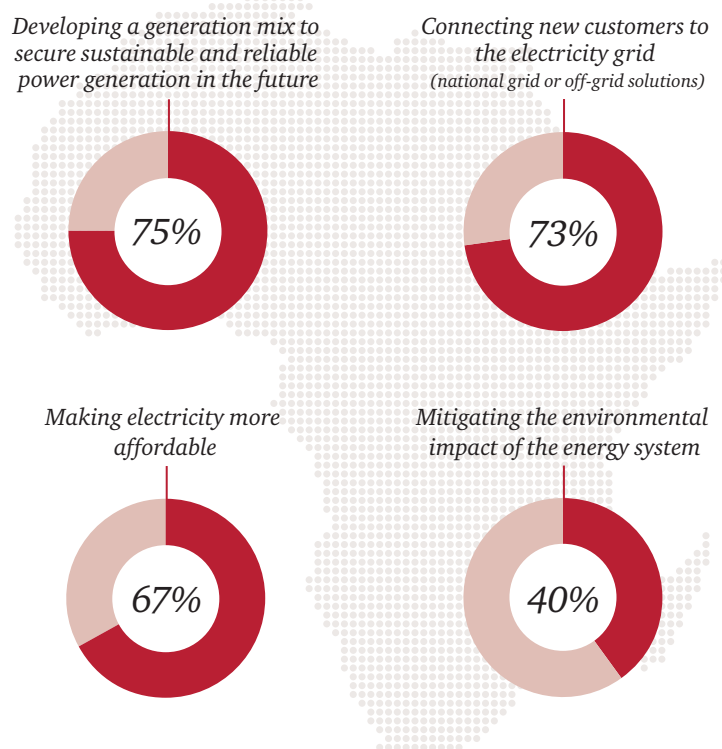
Source: PwC Africa Power & Utilities Sector Survey

Out of all the regions in the world, Africa puts least emphasis in the trilemma on sustainability, mindful of the enormous energy availability challenges it faces. Only 40 per cent of our survey participants report that it receives a major focus in their countries' policies (figure 4). In contrast, security of supply, energy access and affordability get a much higher focus. However, as the energy trilemma results show and in common with other regions, this is changing as cleaner energy rises up the agenda.

Given that nearly a third of the population of sub-Saharan Africa are without access to electricity and many of those who are connected suffer frequent supply interruptions, expansion of power generation and networks is a top priority and a major challenge. The International Energy Agency's central outlook for power in sub-Saharan Africa anticipates energy demand growth of 80 per cent in the period to 2040. But while one billion people are expected to gain access to electricity, 530 million are still expected to be without power by the end of that period.<sup>10</sup>

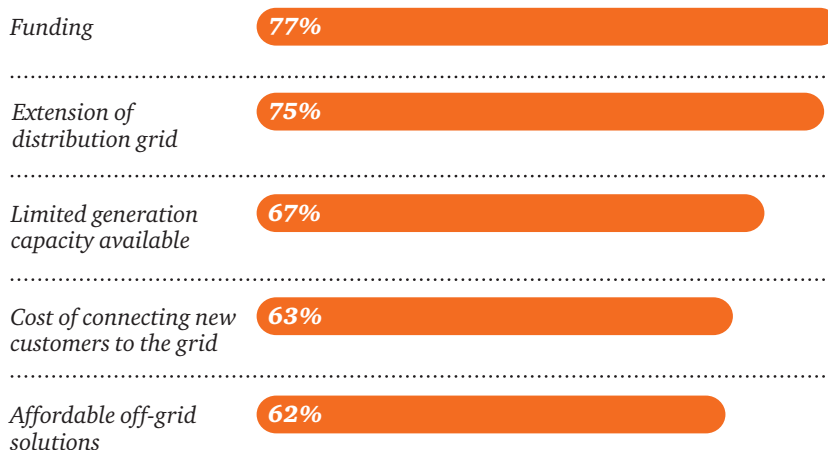
We asked the survey participants to explore the barriers to electrification (figure 5). Funding topped the list with over three-quarters (77%) reporting that it was a big or very big barrier. And while the issue of insufficient generation was seen as a major barrier by two-thirds (67%) of those interviewed, an even more significant barrier is the need to extend the distribution grid to get power to homes and businesses. In turn, this lack of distribution infrastructure is a major factor in stacking up a prohibitive cost for connecting new customers to the grid, which was seen as a major barrier by 63 per cent of those surveyed. A similar proportion also said the affordability of off-grid solutions remained a major barrier.

**Figure 4: How much focus on the following objectives does energy policy have in your market?**  
% scoring 4 or 5



Rated from 1–5, where 1 = little or no focus and 5 = a very high focus.  
Source: PwC Africa Power & Utilities Sector Survey

**Figure 5: What are the main barriers to improving the electrification rates in your country?**  
% rating barriers as 4/5



Score from 1–5 where 1 = minor barrier and 5 = very big barrier.  
Source: PwC Africa Power & Utilities Sector Survey

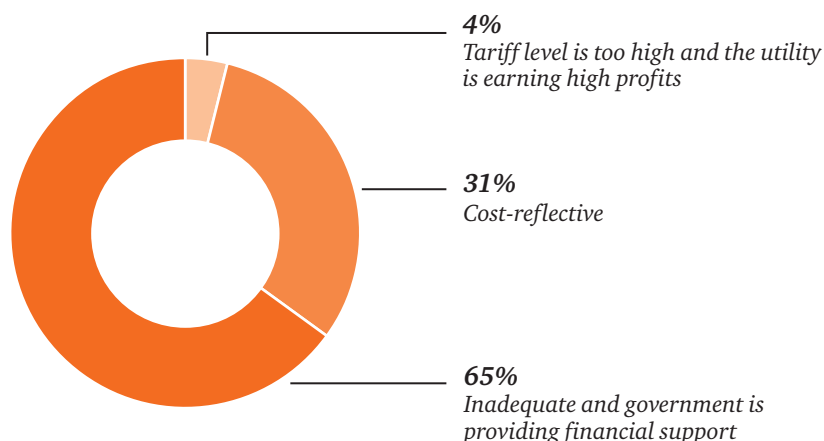
## Big challenges

### Affordability and cost recovery

As African countries seek to expand investment in the power sector, affordability is coming under strain. For a long time many policymakers have been striving to implement tariff levels that reflect the costs of electricity. In Nigeria, for example, full efficient cost recovery was provided for in legislation enacted in 2005.<sup>11</sup> Elsewhere, energy ministers in Southern African Development Community Member States adopted the principle of cost-reflective tariffs as far back as 2004. More recently, the move to cost-reflection has gained added impetus. Nigeria's Multi-Year Tariff Order for the period 2012–18 (MYTO II) sets tariffs based on the assumption of full cost recovery and financial viability, allowing licensees to recover efficient costs, including a reasonable return on capital.

But despite moves such as those in Nigeria, cost-reflective tariffs are still some way off for most countries, with governments facing the dilemma of how best to balance strategies that promote investment and energy access while also ensuring that electricity is affordable. Among our survey participants, less than a third (31%) felt that their country's electricity tariff was cost-reflective (figure 6). While this is likely to be an advance on a few years ago, it still leaves most countries reliant on government support and short of the private sector investment that would come if investors could be more confident of tariff regimes that allowed a reasonable return on investment. Speaking at a 2013 conference on cost-reflective tariffs, Dr. Sam Amadi, executive chairman of the Nigerian Electricity Regulatory Commission (NERC), observed: "Without a cost-reflective tariff, no utility provider will enter any market, however large the market. The absence of a cost-reflective tariff is a key reason for the failure of the power sector to serve Nigerians for the past three decades."<sup>12</sup>

**Figure 6: What description best fits the current electricity tariff level in your country?**



Source: PwC Africa Power & Utilities Sector Survey

11 S.76, EPSR Act, 2005.

12 13th Annual Africa Utility Week conference, Cape Town, 14–15 May 2013.

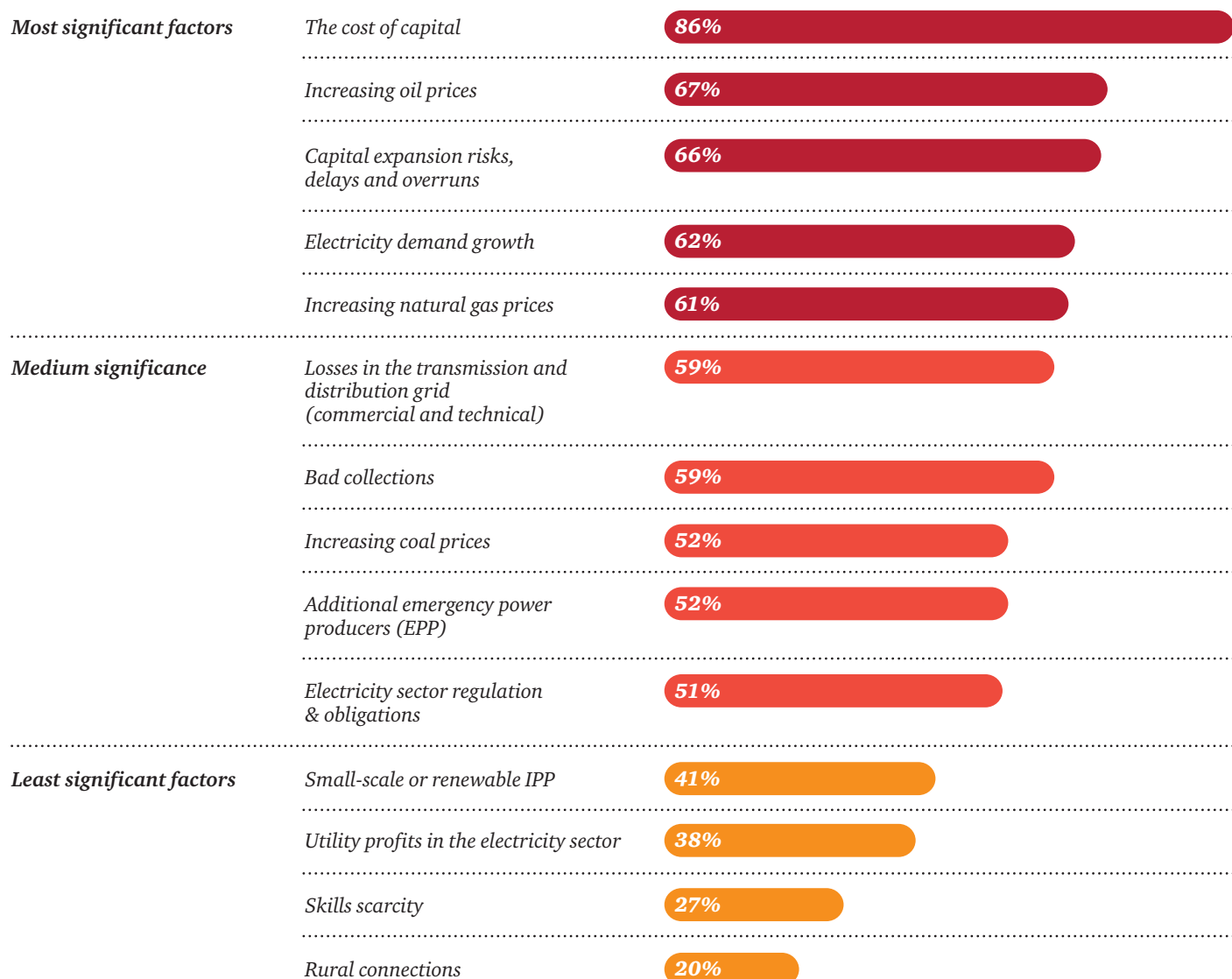
The continuing need for the development of regulatory frameworks on matters such as cost-reflective tariffs, alongside increased country risk in many African countries compared to other parts of the world, has the effect of increasing the cost of capital for power sector investment. In the view of our survey respondents, the cost of capital is the most important factor behind increasing electricity prices (figure 7). To some extent, there is a 'chicken and egg' dynamic going on here for end users – you can't reduce the price pressures coming from the cost of capital until you increase the price itself.

With so much of the power sector focused on infrastructure expansion and renewal, the risk of capital project risks, delays and overruns is seen as an important factor behind electricity price increases by two-thirds of survey respondents. Oil and gas pricing pressures are also cited by many respondents as, although hydro is a major source of power in much of the continent, fossil fuels remain the single largest source of electricity in Africa.

Despite the recent fall in the oil price, survey participants still identify oil prices as a key factor in electricity prices, perhaps mindful of the longer-term build-up of oil price pressure and the reliance of emergency power supply on oil. Other reasons for price increases, such as commercial and technical losses and bad collections, continue to be major challenges for power utility companies. In a number of countries, emergency energy solutions, which constitute a large part of installed capacity, entail generation costs that are much higher than the cost of conventional generation and are also cited as a significant contributor to higher prices.

**Figure 7: How important are the following drivers of increasing electricity prices?**

% rating large or very large driver



Rated from 1–5, where 1 = very small or no driver and 5 = very large driver.

Source: PwC Africa Power & Utilities Sector Survey



# Big responses

*Technological innovation is driving major change in the power sector. A range of technologies are combining, in different ways, to move power systems away from being top-down centralised systems to ones that are much more decentralised and fragmented. Renewable power is displacing fossil fuel generation sources. The costs of renewable energy, particularly solar, have fallen significantly. Energy efficiency is reducing the consumption requirements of many devices, buildings and processes.*

## Technology change and energy transformation

The scope for even more disruptive and seismic-shift technological breakthroughs is being taken more and more seriously all the time. A breakthrough in battery storage technology could be a quantum leap enabler, opening up the possibility of off-grid customer self-sufficiency when used in combination with 'own generation'. These developments are particularly significant in Africa where many areas are not reached by grids and existing centralised generation and grids are under strain. If feasible and affordable, they could result in Africa leapfrogging the use of centralised grids in some areas and finding local solutions to the energy trilemma.

Indeed, a majority of our survey respondents believe there is a medium to high probability that advances and cost reductions in green off-grid technology will deliver an exponential increase in rural electrification levels by 2025 (see panel on p. 15). The prospect of local mini-grids and off-grid distributed generation being a major feature of the African power landscape, alongside centralised generation, is an energy market vision that is viewed as likely or highly likely by 83 per cent of survey participants (figure 8).

**Figure 8: Energy market vision**

% of respondents

*A mixture of large-scale centralised generation and local mini-grid and off-grid distributed generation.*

83%

*The number of new entrants /IPPs in the market will increase.*

59%

*Large-scale centralised generation and interconnections to meet demand growth in urban areas.*

54%

*Underdeveloped centralised generation will be by-passed /superseded by local distributed generation solutions.*

11%

Scale of 1–5 where 1 = very unlikely and 5 = very likely. Scores 4/5 reported.  
Source: PwC Africa Power & Utilities Sector Survey

## *Future scenario* Rural electrification

*Advances and cost reductions in green off-grid technology will deliver an exponential increase in rural electrification levels by 2025*

The falling cost of and advances in standalone renewable generation are making survey participants optimistic about the potential for the technology to provide a solution for rural electrification. A clear majority (70%) said there is a medium to high probability that these developments could lead to an exponential increase in rural electrification levels by 2025. Opinion is split evenly between the medium and high scores.



**30%**

*attach a low probability score to this scenario.*



**70%**

*give it a medium or high probability score.*



***Future scenario***  
**Renewables and off-grid generation**

***Scenario 1: More than a third of power generation will come from renewables (excluding large-scale hydro > 100 MW) by 2025.***

***Scenario 2: Off-grid generation will account for more than a third of electricity generation by 2025.***

Current uncertainties around policy support for renewables limit the confidence in just how big a share of Africa’s power needs can be supplied from this source. The majority (63%) of survey respondents attach only a low probability to each of these scenarios. In part, this reflects the current uneven policy impetus behind non-hydro renewables. Programmes such as those in South Africa and Uganda are providing significant momentum but this is not always the case elsewhere. Nonetheless, over a third of respondents (37%) still give both scenarios a medium or high probability score.



**63%**  
 attach a low probability score to both scenarios.



**37%**  
 give both scenarios a medium to high probability score.

The survey suggests that most see such local energy systems as developing alongside rather than replacing existing centralised generation – only one in ten (11%) see centralised generation being superseded by local solutions. Instead, just over half (54%) see centralised generation and interconnections being the main future energy provision to meet demand growth in urban areas. Whether the market vision is focused on centralised large-scale systems or local systems, nearly three-fifths (59%) expect new entrants to play a big part. These will include more independent power producers (IPPs) as traditional generation expands and a variety of entrants in the case of local systems and off-grid solutions.

The energy transformation that is being spurred on by technological developments is reflected in survey respondents' assessment of which technologies they expect to have the biggest impact on their markets (figure 9). Energy efficiency, falling solar prices, smart metering and smart grids head the list. Other developments are more limited by their geographical relevance but shale gas, and other new gas sources, and run-of-the-river hydro are seen as having a major impact by around half, while geothermal technology and the falling cost of wind power are highlighted by over a third of participants. Only eight per cent of those we surveyed view new-build nuclear generation as likely to have a major impact. Although there are several African countries with nuclear aspirations, only South Africa has operational nuclear capacity.

The potential to develop new sources of generation in Africa is immense. There are project development step changes taking place in South Africa and Nigeria as well as exciting developments in other countries such as Kenya, Ghana and Zambia. 93 per cent of Africa's hydropower potential is untapped and some of this is beginning to be unlocked, such as the extension of Inga hydropower plants in the Democratic Republic of Congo. New gas fields are coming onstream. And Africa has the highest solar irradiation in the world. Regional power generation and interconnection projects have the potential to play a significant role in delivering increased access to electricity in Africa.

As the costs of solar and wind generation come down, these newer renewables are also being factored into policymakers' and companies' decisions. Geothermal resources are present in the East Africa Rift region and Kenya has successfully developed geothermal power projects. The feasibility of renewables depends on the specific policy frameworks in different country markets as well as on the natural resource context. Project viability requires clear longer-term policy commitments on the amount of capacity that will be allocated to renewables and long-term offtake agreements for projects.

The cost of renewables remains a significant barrier. It is exacerbated by the need to import equipment and, often significant, internal transportation costs. There are also gaps in infrastructure, engineering and institutional capacity that can raise costs. Developing local value chain capability and expertise in renewable power generation projects, such as has been encouraged in South Africa with the REIPP bid rounds, can help reduce costs and contribute to economic development. But well-defined frameworks are yet to take off across the continent and this helps explain why most of our survey participants don't expect renewable generation (excluding large-scale hydropower) to account for more than a third of total power generation by 2025 (see panel on p. 16).

### Figure 9: Technology impact

Which of the following technology developments do you expect to have the biggest impact on your market?

Development	Average score	% of respondents scoring 4/5
<i>Energy efficiency technologies</i>	3.8	63%
<i>Reductions in the price for solar modules</i>	3.7	56%
<i>Smart metering/grid deployment</i>	3.7	60%
<i>The deployment of demand-side management technology</i>	3.5	51%
<i>Shale gas/new gas field exploration</i>	3.3	50%
<i>Run-of-the-river hydro</i>	3.2	47%
<i>Reduction in the prices of wind generation</i>	2.9	34%
<i>Geothermal electricity technologies</i>	2.7	37%
<i>Nuclear new build</i>	1.8	8%

Scale of 1–5 where 1 = very low impact, 5 = very high impact. Scores 4/5 reported.  
Source: PwC Africa Power & Utilities Sector Survey



**Big responses**

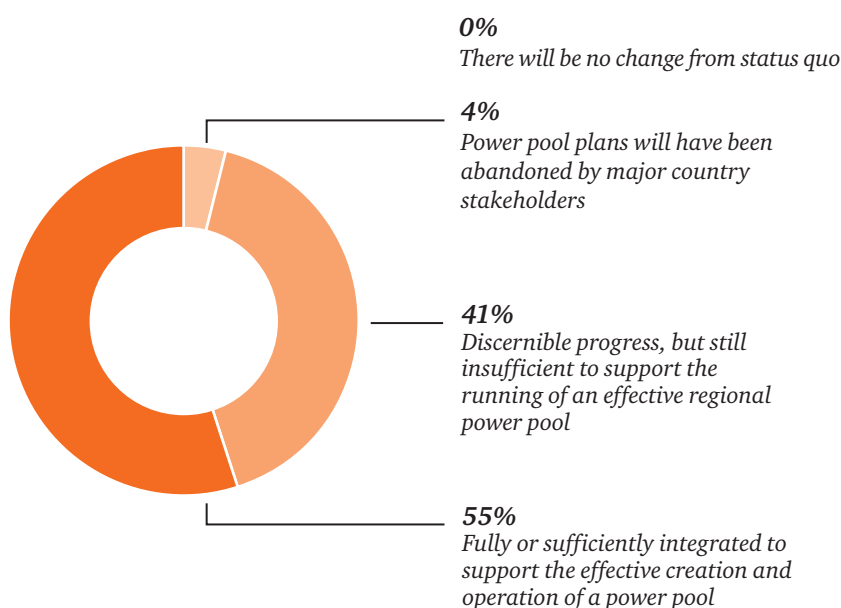
**Regional power integration**

Regional power generation and interconnection projects have the potential to play a significant role in delivering increased access to electricity in Africa. They also reduce the price of electricity because they allow the development of more, larger generation plants which, particularly in the case of large-scale hydro, produce lower-cost power. Power plants in Africa, with some exceptions in South Africa, are generally small, reflecting the fragmented nature of African power systems and the tradition of national autonomy of power systems.

There has been a major drive to create regional power pools (see panel), although the full potential of integration is a long way off. One study estimated the achievement of a ‘moderate’ level of integration would save US\$861bn over the 2011–2040 period (US\$33bn a year), or 17 per cent of the cost of electricity.<sup>13</sup>

On balance, our survey participants were optimistic about the prospects for the development of African power pools. As figure 10 shows, 55 per cent feel that integration will happen but another 41 per cent are more cautious, believing that there will be progress but it will still remain insufficient to support the running of an effective regional power pool. Nonetheless, as the response to one of our future scenarios shows, a majority feel there is a medium to high probability of a third or more of electricity coming from cross-border flows by 2025.

**Figure 10: To what extent do you think the different grids in your sub-region will be interconnected in the next 15 years?**  
% of respondents



Source: PwC Africa Power & Utilities Sector Survey

**At a glance**  
**Regional power pools**

**West Africa Power Pool (WAPP)**

Benin, Burkina Faso, Côte d’Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo.

**Southern African Power Pool (SAPP)**

Angola, Botswana, DRC, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

**Central African Power Pool (CAPP)**

Angola, Burundi, Cameroon, CAR, Chad, Congo, DRC, Equatorial Guinea, Gabon, Rwanda.

**East African Power Pool (EAPP)**

Burundi, Djibouti, DRC, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, Tanzania, Uganda.

**Communauté du Maghreb de l’Electricité (North African Power Pool) (COMELEC/NAPP)**

Algeria, Egypt, Libya, Morocco, Tunisia.

13 Study on Programme for Infrastructure Development in Africa (PIDA), Africa Energy Outlook 2040, SOFRECO-led consortium, 2011.





## *Future scenario* Cross-border electricity

***“Cross-border electricity flows will be significant by 2025 and will account for around a third or more of electricity generated.”***

More than two-thirds (70%) of survey participants give this scenario a medium or high probability score, among whom a quarter (26%) rate it as high probability. Set against this, nearly a third (30%) see it as a low probability. The outlook is influenced to some extent by which region each participant is most focused on, with the momentum in regional advances varying greatly from region to region. In some cases, the prospects for regional integration are negatively impacted by unfavourable events such as the breakdown of the state in Libya, with conflict becoming an obstacle to integration in the Maghreb.

Current cross-border electricity flow is very limited in the different power pool regions. A key constraint is the limited interconnection capacity. In addition, almost all countries in sub-Saharan Africa are short in generation capacity which also limits cross-border electricity trade. However, projects like ZIZABONA (planned between Zimbabwe, Zambia, Botswana and Namibia) and the interconnection between Ethiopia, Kenya and Tanzania look set to provide the foundation for large future cross-border electricity flows.



**30%**  
*attach a low  
probability score  
to this scenario.*



**70%**  
*give it a medium  
or high probability  
score.*

**Big responses****Energy policy and market design**

In Africa, as elsewhere in the world, clear power sector policies in combination with reliable, predictable regulation are the key to unlocking investment, improving efficiency and significantly increasing electricity access. The maturity level of the power sector in Africa differs widely. Many countries have implemented regulatory change in recent years to improve overall sector performance. But many others have kept their power sector regulation and market design unchanged. Having appropriate regulation and a well-designed regulatory strategy is important for governments, companies and investors in Africa. It's essential for stimulating the growth and performance of the sector so that it is, in turn, able to play its part in the continent's economic growth.

All around the world, power companies are concerned about regulatory uncertainty. It's a barrier to investment and a risk that consistently comes top of the list when we survey or speak with power companies or developers/investors worldwide. But it's different in Africa where a specific aspect of regulation rather than overall uncertainty tops the list. Reflecting the discussion in the preceding chapter, the single most important barriers to making large-scale investments are the failure to implement cost-reflective tariffs and the overall difficulty of raising finance which, in part, arises from that (figure 11).

**67%**

cite the problem of obtaining finance as a major barrier to investing in new large-scale generation and transmission projects.

**Figure 11: Major barriers to investing in new large-scale generation and transmission projects**

Major barriers	Average score	% of respondents scoring 4/5
<i>The inability to recover the cost of new generation via current electricity tariffs</i>	3.8	67%
<i>Obtaining finance</i>	3.8	67%
<i>Regulatory uncertainty and a lack of political commitment</i>	3.2	52%
<i>The planning process</i>	3.0	33%
<i>Government interference</i>	2.9	38%
<i>The lack of capacity payments</i>	2.7	36%
<i>Political uncertainty/Unstable government</i>	2.5	28%
<i>Access to primary energy</i>	2.4	20%
<i>An expected increase in the volatility of wholesale power prices</i>	2.4	15%

Scale of 1–5 where 1 = no barrier and 5 = very big barrier. Scores 4/5 reported.  
Source: PwC Africa Power & Utilities Sector Survey

The establishment of regulatory frameworks to transition tariffs to a level where they are cost-reflective is an ambition of many governments. But, as figure 12 shows, there are other aspects of regulatory and policy performance that could be addressed by governments. Although nearly two-thirds (63%) of survey participants feel that energy policy makers are collaborating with the sector to promote investment and protect customers, a large number also opt for more critical characterisations. More than two-fifths (43%) say they are 'slow to legislate', thereby adding to uncertainty, with others emphasising the issue of low energy process or even going so far to say that policy uncertainty is undermining investment.

Concerns about regulatory uncertainty could be addressed by clearer master planning that addresses and anticipates current and future sector challenges. But only a fifth of survey participants feel that the current master plan in their country is adequate (figure 13). Just over a third (35%) make the point that the plan is too static and needs to be able to better address changing developments and alternative futures. A similar percentage go further, reporting either that the current master plan lacks clarity and fails to set out a long-term vision (16%) or is out of date and needs a complete overhaul (18%). And nearly one in eight (12%) said they are not aware that any such plan exists in their country.

**Figure 12: Energy policy makers**

How would you characterise energy policymakers in your market?

*They collaborate with the industry to promote investment and protect customers* **63%**

*They are too slow to legislate, leading to an uncertain environment* **43%**

*They keep energy prices too low for utilities to be able to make significant investments* **37%**

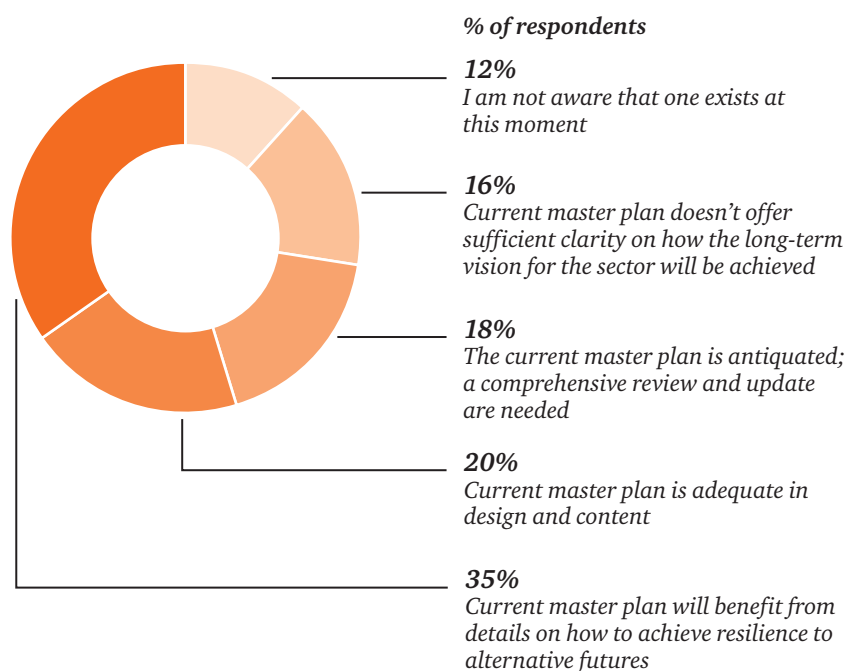
*They have produced a significant amount of policy uncertainty that is undermining investment* **35%**

*They are too interventionist and have produced a very complex market* **22%**

Respondent invited to select all that apply. Results reported as % share of all survey participants. Source: PwC Africa Power & Utilities Sector Survey

**Figure 13: Energy sector planning**

In your view, is your country's energy sector (master) plan designed to adequately anticipate and respond to the current and future challenges in the sector?



Respondents were asked to select the one option that most closely matched their view. Results may not total 100% due to rounding.

Source: PwC Africa Power & Utilities Sector Survey





## *Future scenario* Market design

*“By 2025 the challenge of finding a market design that can balance investment, affordability and access issues will have been largely solved”*

Survey participants are clearly optimistic about the direction of travel of regulatory reform. 94% say there is a medium or high probability that, by 2025, the challenge of finding a market design that can balance investment, affordability and access issues will have been largely solved. Just 6% see this as only a low probability. But opinion is divided on whether it will be a medium (52%) or a high (42%) probability, with the more cautious just tilting the balance.



**6%**

attach a low probability score to this scenario.



**94%**

give it a medium to high probability score.

What then do survey respondents tell us about the policy improvements they would like to see to address the key problems of expanding power provision and making existing assets more reliable? Emphasising the importance of financial viability, 83 per cent of those surveyed stressed the effect that moving to cost-reflective tariffs would have, saying it would have a high or very high impact (figure 14). And nearly as many (77%) said more reliable frameworks for PPI (private participation in infrastructure) and better risk-balancing in power purchase agreements (PPAs) would also have a major impact. Both PPIs and PPAs are well established in some African countries but significant improvements and macro-economic stability are required in order to ensure bankable off-take agreements across the continent.

The opening up of markets, in the form of unbundling and liberalisation, would have a high or very high impact on electrification and supply reliability according to nearly two-thirds (64%) of those surveyed. But a similarly high impact, in the view of survey respondents, would be achieved by moves to ensure that regulation is modernised to keep up with and encourage the potential of off-grid and mini-grid solutions (63% rating this is high or very high impact) and the development of effective regional power markets to improve cross-border trade. Better frameworks to incentivise renewable energy and rural electrification were also rated as having a potentially major impact by a majority of those surveyed.

# 83%

stressed the positive effect that moving to cost-reflective tariffs would have on electrification and supply reliability.

**Figure 14: Policies to increase electrification and supply reliability**

How important will the following energy policy levers be in helping to increase electrification and improve reliability of power supply?

Energy policy levers	Average score	% respondents rating it high or very high impact
<i>Introduction of cost-reflective tariffs to ensure the financial viability of the sector players in the long term</i>	4.3	83%
<i>Reliable PPI policy and risk-balanced (PPA) framework to attract new investments</i>	4.0	77%
<i>A regulatory environment that encourages investment in off-grid and mini-grid solutions</i>	3.9	63%
<i>Regional power market development to trade power within the region and optimise the utilisation of generation capacities</i>	3.8	65%
<i>Unbundling and liberalisation of the power market to attract private sector investment</i>	3.7	64%
<i>Renewable-energy framework to promote climate protection and incentivise renewable-energy generation</i>	3.6	60%
<i>Rural electrification</i>	3.5	57%

Source: PwC Africa Power & Utilities Sector Survey



**Big responses**

**Power company transformation**

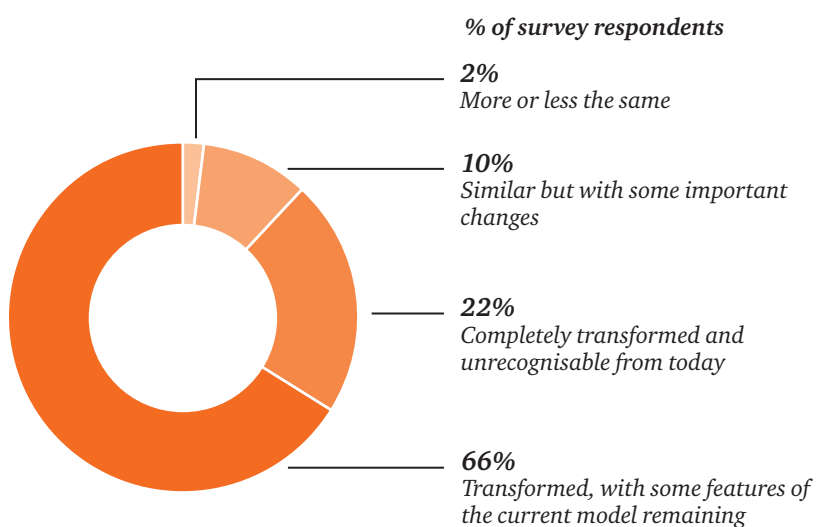
The pace of energy transformation is leading many companies around the world to look hard at their current business models and, in some cases, to implement dramatic changes. The nature of change in Africa is different from more mature power markets, not just because of the very different regulatory context, but because the starting point is that of a relatively undeveloped power system. However, this could lead to an even more profound transformation, echoing the way in which mobile telephony grew faster, in part because there wasn't a widespread legacy system already developed.

Much will depend on the pace of future technological change. Within the next decade we anticipate that step-change milestones will be reached in at least some of the key disruptive technologies – grid parity of solar distributed generation, lower-cost and mass-scale storage solutions, vibrant and secure micro-grids, attractive electric vehicle options and ubiquitous behind-the-meter devices. This will accelerate the growth of local energy systems and also lead to a more technology-enabled, customer-engaged market place in grid-supplied centralised systems.

When we asked survey respondents about the impact of these and other changes on future power utility business models, only around one in eight (12%) thought that future business models would be the same or similar. Instead, the vast majority (88%) said that power utility business models would be transformed. Most of these respondents thought that some features of current models would remain in place but a sizeable minority (22% of all respondents) went so far as to say that business models would be completely transformed and unrecognisable from today's (figure 15).

**Figure 15: Future power utility business models**

What do you expect utility business models to be like in 2030 to compared to those currently seen in your market?



Respondents were asked to select the one option that most closely matched their view.  
Source: PwC Africa Power & Utilities Sector Survey

**88%**

said that power utility business models in Africa will be transformed by 2030.

The challenge of energy transformation comes on top of significant existing challenges, which are leading many African power utility companies to reform their organisations. Many utilities are managing the biggest capex programmes they've ever undertaken. This is putting pressure on the capacity and capability of these entities to deliver. The investment in new generation capacity, the replacement of ageing infrastructure, new transmission networks and better interconnectors are all pressing concerns. Not surprisingly, when we asked survey participants to list their main challenges in order of priority, the funding and commissioning of large projects headed the list (figure 16).

As well as delivering new capital projects, power companies face a continual need to get the best from existing assets. Efficiency improvement and cost reduction are important for power utility companies everywhere to deliver the best possible return for investors and wider societal stakeholders. In Africa, efficiency is even more important given the scarcity of physical generation capacity and also skills capacity constraints. Making limited resources go further is an essential part of maximising power availability and adding to investor confidence.

According to our survey participants, companies have the potential to deliver substantial cost-base and efficiency improvement (figure 17). The vast majority (70%) report that cost-base savings and efficiency improvements of more than 10 per cent are possible and many (42%) say there is scope for African power and utility companies to achieve savings in excess of 20 per cent.

**Figure 16: Key challenges**

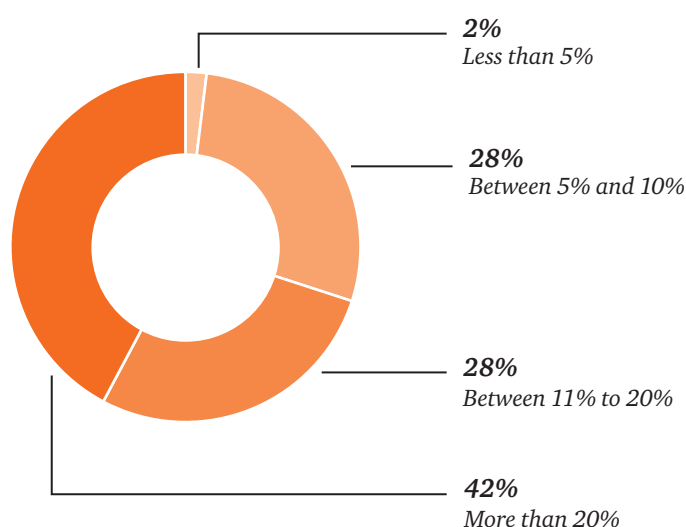
Which of the following key challenges have a high priority in your business operations today?

Key challenges	Average score	% of respondents scoring 4/5
<i>Funding (Generation, transmission &amp; distribution projects)</i>	4.4	90%
<i>Commission of new capital projects (Generation, transmission &amp; distribution)</i>	4.3	84%
<i>Adequate tariff levels</i>	4.3	79%
<i>Maintenance of generation capacities and/or transmission &amp; distribution grid</i>	4.1	77%
<i>Loss reduction</i>	3.8	65%
<i>Rural electrification</i>	3.8	55%
<i>Skills development</i>	3.7	65%
<i>Building interconnections with neighbouring countries</i>	3.2	46%

Scale of 1–5 where 1 = very low priority, 5 = very high priority. Scores 4/5 reported.  
Source: PwC Africa Power & Utilities Sector Survey

**Figure 17: Cost reduction and efficiency improvement**

Extent of scope for power utility companies to reduce their costs and improve efficiency



Respondents were asked to select the one option that most closely matched their view.  
Source: PwC Africa Power & Utilities Sector Survey

## Big responses

It is clear that the industry itself recognises the scope for major efficiency improvement. And when it comes to areas of improvement it is the core activities of capital project management, asset operations and customer relations that are singled out (figure 18). Between 70 and 80 per cent of all survey participants see high or very high scope for performance improvement in asset risk management, customer relations and capital project management. And around two-thirds see the same big scope for improvement in loss reduction and in the development of local skills.

In order to get the best from existing assets, sustainable changes must be identified and implemented to improve system reliability, control maintenance and operating costs, and extend the life of current generation, transmission and distribution assets. It means putting a focus on making the most of resource efficiency and reducing waste in high impact areas in operations, maintenance and outages. In addition, the limited availability of capital and skills and increased demand for energy availability are focusing attention on optimising power utility company resource bases.

People, as much as finance, lie at the heart of what it will take to deliver success. Building Africa's future power sector and maintaining its existing infrastructure will rely largely on how successful companies are at building their future workforces and creating the right kind of performance cultures. Finding, recruiting and developing skills and talent will be critical. Most companies are also on a major culture change journey. State-owned enterprise models are being infused with more adaptive, private sector-orientated ways of working. Privatisation is taking place in some instances. International investment is bringing different stakeholder and workforce cultures into companies. New leadership, procurement, engineering, capital project, maintenance and operating processes and customer relations cultures and practices are being developed.

**Figure 18: Areas for performance improvement**

In your view, which areas offer the biggest scope for improvement within your local power utility?

Areas	Average score	% of respondents scoring 4/5
<i>Capital planning, fundraising and efficiency</i>	4.3	80%
<i>Capital project management</i>	4.2	77%
<i>Asset performance &amp; maintenance management</i>	4.2	80%
<i>Customer relations and service</i>	3.9	70%
<i>Loss reduction</i>	3.9	65%
<i>Development of local skills</i>	3.7	68%
<i>Human resource management</i>	3.6	54%
<i>Competitive procurement</i>	3.6	57%
<i>Risk management and governance</i>	3.6	49%
<i>Research and development of new solutions</i>	3.4	47%
<i>Rural electrification</i>	3.2	55%

Scale of 1–5 where 1 = no barrier and 5 = very big barrier. Scores 4/5 reported.

Source: PwC Africa Power & Utilities Sector Survey

*Between 70 and 80 per cent see high or very high scope for performance improvement in asset risk management, customer relations and capital project management.*

## Investment and ownership

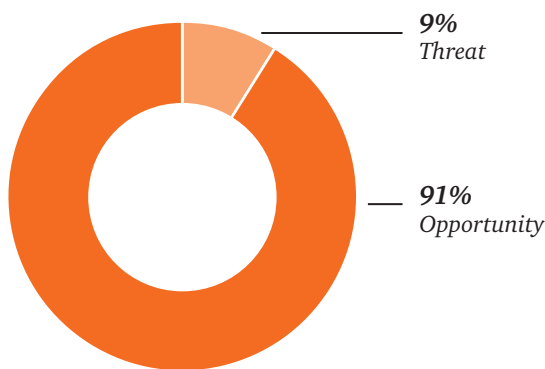
The investment required to extend and improve electricity access in Africa is immense. The International Energy Agency estimates that an additional \$450bn of investment is needed in the power sector over the next 25 years to achieve universal electricity access in urban areas alone.<sup>14</sup> There is a huge financing shortfall. An earlier study estimated the financing gap for the power utilities sector in the current decade as 50% of needs.<sup>15</sup>

Budgetary constraints leave many governments financially constrained and unable to pay for large infrastructure projects without support from the private sector. And commercial banks are adjusting to new banking regulations, such as Basel III, that will reduce their appetite and capacity to provide long-term debt. In Africa the challenges of financing infrastructure are compounded by limited institutional capacity, fragmented regulatory systems and often underdeveloped banking and capital markets outside of the larger economies of South Africa, Nigeria and Kenya.

Greater liberalisation and opening up of the power sector to private ownership and investment is gradually taking place. It's clear that most companies see this as an opportunity rather than a threat (figure 19). It's also clear that there is optimism about the climate for private investment in the sector.

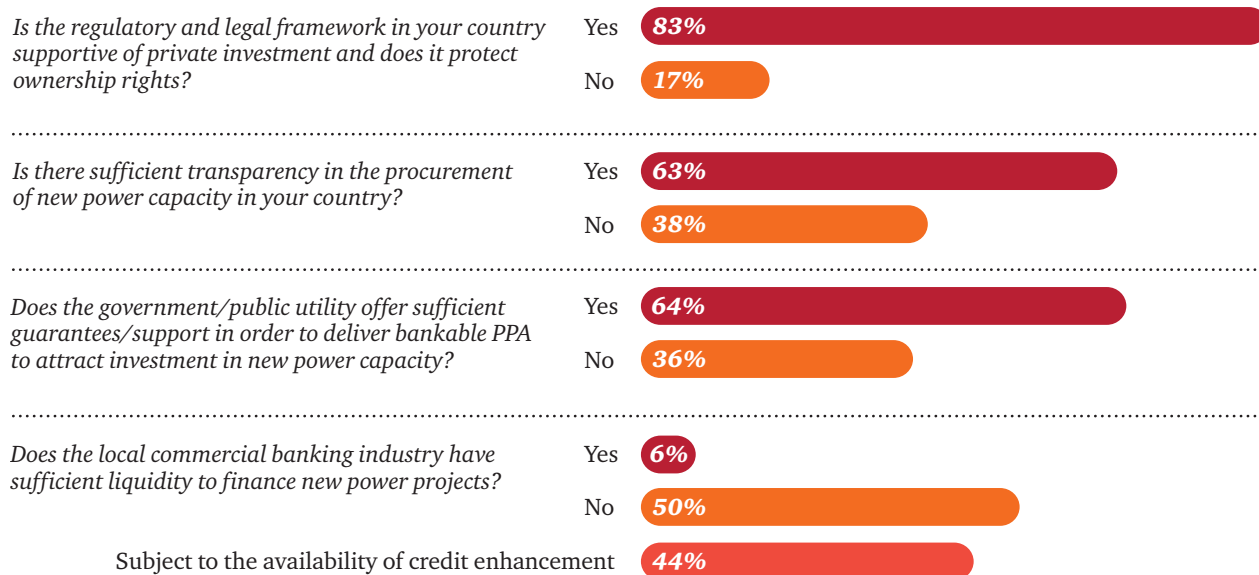
Answering a series of questions on some of the main prerequisites for private sector involvement – a supportive regulatory framework, protection of ownership rights, procurement transparency and guarantees for bankable PPAs – a large majority of our survey participants said the right pillars of support are in place (figure 20).

**Figure 19: Liberalisation and privatisation of the power sector**  
% of respondents



Source: PwC Africa Power & Utilities Sector Survey

**Figure 20: The climate for private investment**



Source: PwC Africa Power & Utilities Sector Survey

14 World Energy Outlook 2014, IEA.

15 Op.cit. Study on Programme for Infrastructure Development in Africa (PIDA).



**Big responses**

But there is still a considerable way to go. Between a third and two-fifths of those answering reported that they didn't feel there was sufficient transparency around the procurement of new power capacity and sufficient certainty on government backing for PPAs. And only six per cent felt that the local commercial banking industry had sufficient liquidity to finance new power projects without some form of credit enhancement being available. Indeed half said that even then such finance was not possible. In such an environment, the role of multilateral agencies remains paramount alongside governments and the private sector (figure 21).

Nonetheless, as the 'future scenario' panel shows, a significant proportion of our survey respondents anticipate greater future levels of private ownership of different parts of the power value chain. There is a high expectation among most survey participants that the private sector will play a major role in generation in the years ahead. Three-quarters (74%) say there is a medium to high probability that the private sector will own and operate more than half of generation by 2025.

But continued derisking is essential if players such as commercial banks are to play a greater role in projects. Issues such as off-taker creditworthiness, political risk and currency risk are all key. Government creditworthiness remains a problem and private sector off-taker involvement remains vital to get projects off the ground. As figure 22 shows, only 15 per cent of our survey respondents feel that government support alone is sufficient in order to provide off-take security. Instead, big private sector power purchasers, such as mining companies and other heavy industrial power users, play an important role in most PPAs alongside governments.

**Figure 21: Funding and financial bodies**

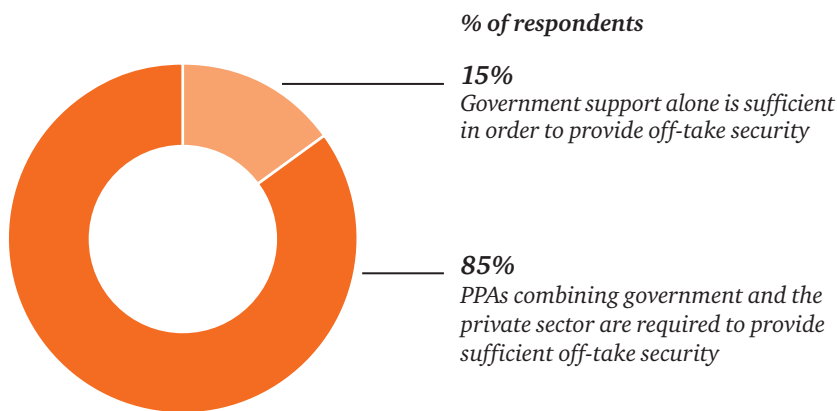
How important are the following organisations for securing future large generation, transmission and distribution expansion projects?

Funding and financial bodies	Average score	% of respondents scoring 4/5
Government	4.3	94%
World Bank & IFC	3.8	65%
African Development Bank	3.6	53%
Export credit agencies	3.4	53%
Commercial banks	3.1	33%

Scale of 1–5 where 1 = very unimportant and 5 = very important. Scores 4/5 reported. Source: PwC Africa Power & Utilities Sector Survey

**Figure 22: Offtake security is a key issue**

Which PPA structure is more appropriate?



Source: PwC Africa Power & Utilities Sector Survey

**74%**

say there is a medium to high probability that the private sector will own and operate more than half of generation by 2025.



## ***Future scenario*** Private ownership

*The private sector will own and operate more than half of the generation and distribution grid by 2025.*

*Private investors (local and foreign) will own and operate the transmission grid in your country by 2025.*

Private ownership is currently generally confined to generation assets so it's no surprise that it's in generation that most survey participants expect it to extend in the future. Three-quarters (74%) say there is a medium to high probability that the private sector will own and operate more than half of generation by 2025. But rather fewer (46%) expect the same to apply to distribution.

Indeed, the proportion attaching a high probability to such a private sector inroad into distribution was just 15 per cent compared to 38 per cent of respondents saying it would happen in generation. And when it comes to the transmission grid, most (80%) expect it to stay in public ownership. Only a fifth (20%) give a private sector ownership scenario in transmission a medium (12%) or high score (8%).

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