Photo by Margo Stahl
Kearney, New York

Energy transition: a new path to power in Africa

KEARNEY

At the dawn of a new age for power, companies with hybrid business models can make the best of both traditional utilities and renewable energy.

Africa's hunger for power has intensified, thanks to a larger GDP fueled by population growth and primary resource-based economic advancement. But for the power supply to keep up with demand, Africa will need to invest more than $43 billion in the power sector every year from now until 2040.

In our paper *A private path to power in Africa*, we discussed how the private sector can contribute to this major investment. The sector's participation is a robust recipe—a solution to a traditional problem that mature markets have already successfully applied. African countries can learn from this precedent.

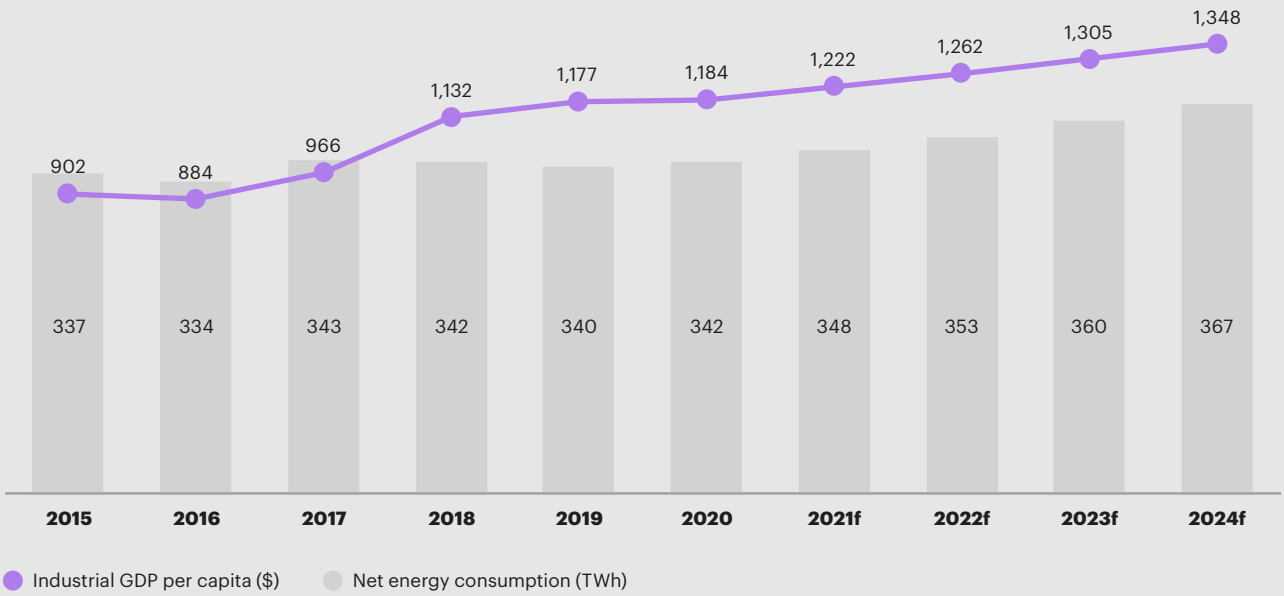
But at the same time, we are living in an energy transition: a period of unprecedented change in the global energy sector in both mature and emerging markets. The essential question looks beyond the scope of traditional solutions to discover what the new age of energy can bring to chart a sustainable path for Africa's utilities, its economies, and ultimately its citizens.

The dual mandate of power: available for economic growth and affordable for social development

Power is essential for economic growth. Since 2009, sub-Saharan Africa's 4.1 percent average annual GDP growth has largely been fueled by natural resources. The uncertainty is whether such economic growth is sustainable and will lead to GDP per capita similar to the levels in mature markets or whether it will taper off and require a step change in the form of increased industrialization for the region to continue its growth story. There is a strong correlation between the industry share of GDP and electricity consumption per capita, although not indicative of the direction of causality between them (see figure 1). Therefore, Africa's path to sustainable growth and economic development will have to involve readily available power. And this presents a real challenge since lack of power is a major obstacle for African businesses. In other continents, access to power is usually the second or third biggest challenge, but for sub-Saharan Africa, it ranks first (see figure 2 on page 2). The path to sustaining the industrialization growth curve rests on widening power availability and making it more reliable.

Figure 1
Power is essential to industrialization

Sub-Saharan Africa's share of GDP per capita compared with electricity consumption



Sources: EMIS, The Economist, International Monetary Fund; Kearney analysis

Figure 2

Access to power is the biggest obstacle for businesses in sub-Saharan Africa

Top five major or severe constraints that businesses face

	Sub-Saharan Africa	East Asia and Pacific	Europe and Central Asia	Latin and Central America	South Asia	Middle East and North Africa
1	Power	Corruption	Tax rate	Corruption	Political instability	Corruption
2	Finance	Power	Political instability	Skills	Power	Political instability
3	Informality	Skills	Power	Power	Corruption	Land
4	Corruption	Political instability	Corruption	Tax rate	Finance	Power
5	Tax rate	Tax rate	Skills	Political instability	Land	Informality

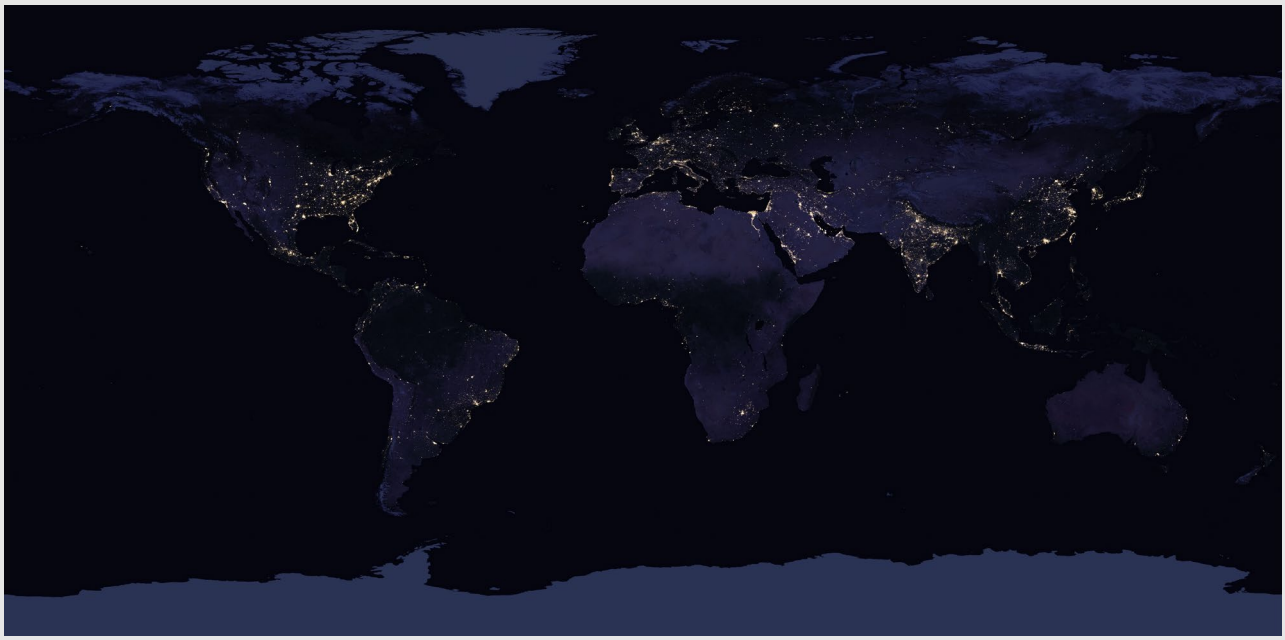
Sources: IEG World Bank's The Big Business of Small Enterprises; Kearney analysis

However, industrial development fueling GDP growth is only half the story. Countries need power not only for economic development but also for social development. A variety of statistics can prove this correlation, but it is so profound that it can simply but vividly be illustrated by comparing nighttime lights in Africa with other regions of the world (see figure 3 on page 3). Just as industrial development and power availability move in parallel, so do social development and power availability.

From a quantitative perspective, the parallel between the United Nations Human Development Index and electricity consumption demonstrates this relationship. Electricity usage has a direct impact on the Index, and access to electricity is inextricably linked to improved welfare and human development (see figure 4 on page 3).

Power availability is essential for economic growth and social development. Research studies agree that two factors influence household electricity consumption the most: price and economic growth. Long-term income elasticity is typically evaluated at close to unitary, whereas long-term price elasticity tends to be around half of that and negative by nature. Therefore, affordable electricity is a major factor in domestic electricity consumption and social development. At the same time, major cost components of the electricity supply build-up are not country-specific, including fuel (if it is imported) as well as power generation technology. Hence, in countries that have a lower GDP per capita, there is a gap between the market economics of electricity supply and its affordability within the context of the country's level of economic development. For example, there is a wide gap between power affordability and cost in sub-Saharan Africa: the cost of power is on par or higher than in mature markets, but GDP per capita is only a fraction of more mature markets' GDP. For example, in the second half of 2019, the average price of electricity for non-household customers in the EU 27 was $0.13, and only four countries in sub-Saharan Africa had lower prices.

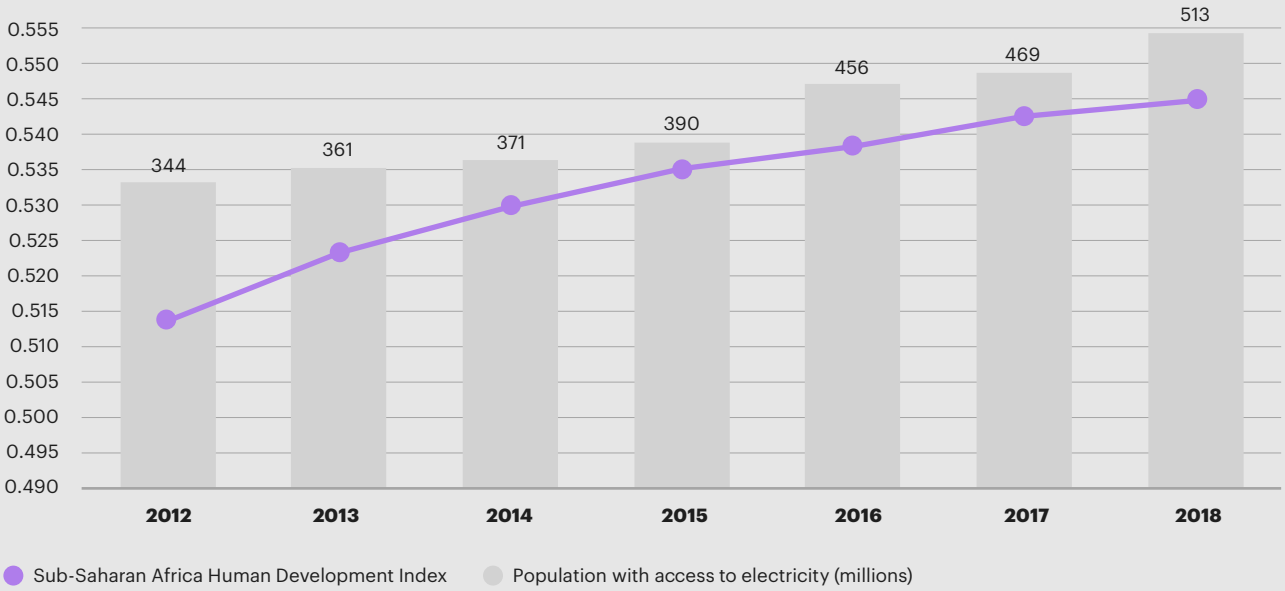
Figure 3
Africa has much fewer nighttime lights than other regions of the world



Sources: NASA's Earth at Night 2017; Kearney analysis

Figure 4
A society's development depends on access to power

Sub-Saharan Africa's electricity access and Human Development Index growth



Sources: United Nations Development Programme, World Bank; Kearney analysis

Africa's governments and utilities are facing a strategic dilemma: either provide rapid access to energy with decentralized solutions, which come at a higher cost with imported technologies, or develop integrated networks, which require more investments and time but at a lower cost with the added opportunity of developing local economies.

The question is how to bridge this gap in a sustainable way that can accelerate electrification to a level of GDP per capita that eliminates the cost–affordability gap. Utilities have traditionally been the focal point where the disparity between the cost of electricity and the revenue from demand has materialized. As a result, household electricity tariffs (if they even exist) have been artificially low, and governments have subsidized utilities with funds from other economic sectors, such as exploiting natural resources, in order to bridge the affordability gap to the actual cost of electricity supply. However, these subsidies are not the only priority for government budgets. Depending on the economic and political situation, the priorities change—and so does the availability of funds for subsidizing utilities, ultimately resulting in low profitability and high indebtedness.

Going forward, this equation will have to be moderated so that utilities can gradually become self-sustainable operations solely on the basis of cost-reflective tariffs without any government subsidies.

Commercialize operations and unbundle the value chain to boost competition and create transparency

Traditional utilities emerged as vertically integrated state-owned energy companies spanning the whole value chain from mining and extraction through generation, transmission, and distribution to the supply to the final customer. The dual mandate of African utilities is embedded in this model. However, equally inherent is that utilities operate almost as government bodies rather than for-profit self-sustainable economic agents. The result: low efficiency because of a lack of competitive market forces that would otherwise drive inefficient companies out of business in unregulated markets as well as the need for government subsidies to bridge the gap between the affordability of tariffs and the cost of the power supply.

Two factors can help utilities transition to self-sustainability. First, fully commercialize operations to establish the legal, regulatory, and operational basis to charge for services, collect payments from customers, and discontinue service when customers do not honor their obligations. Second, unbundle the value chain with legal and functional separation of generation, transmission, distribution, and retail to shed light on the individual balance sheets and income statements of the components of electricity supply to open up the components that are not natural monopolies for competition and thus for market-driven efficiency.

Utilities have emerged as state-owned vertically integrated undertakings to minimize the complexity of their management and encourage internal cross-subsidies across the value chain. Africa's utilities are no exception. In fact, they rely on it because of the relative importance of development financing for African economies, which is channeled through governments—hence the need for close relations between utilities and government bodies. The first step to establish a commercial basis for self-sustainable utilities is to create a legislative right for them to charge for their services along with regulatory rules for measuring and pricing those services.

This is a move away from funding utilities' operations via government budget allocations, including infrastructure industries such as roads, and toward funding the operations from generated revenues—a fundamental utility transformation from government-like structures to commercial enterprises. Initially, the tariffs that utilities charge might not be cost-reflective, so they might still have to rely on partial government funding. It is also foreseeable that the commercialization of operations will be a process rather than a one-off solution—a process that will start with transparency about the funding sources and relative shares to fund the universal service that utilities provide to customers among revenue from customers, government budgets, and development financing.

Unbundling, however, is not without its challenges. The complexity of managing an unbundled power network will make it difficult to capture the value of some operational improvement levers, such as technology and smart grids. Additionally, a more complex system will leave room for corruption if not carefully managed. These challenges are highlighted in the unbundling of Europe's utilities. However, the opportunity for new competition will put pressure on Africa's already-high electricity prices because of the lack of competitive tariffs. Unbundling will also provide relief, capital, and an opportunity to restructure Africa's embattled vertically integrated utilities, which face a much different reality than what was happening when Europe unbundled its energy sector (see figure 5 on page 6).

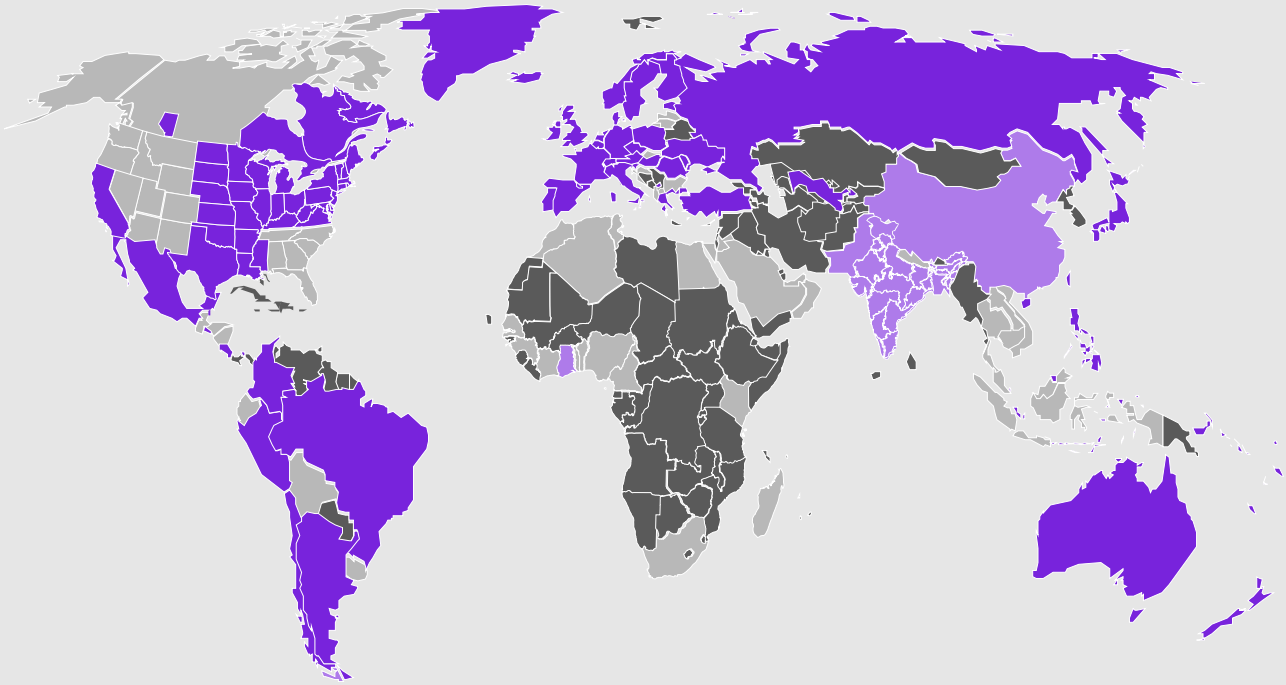
Such transparency will be a key ingredient in direction setting: establishing a horizon and measures to reach cost-reflective tariffs—that is, tariffs that will enable the universal service to be funded solely from customer revenues. This will also allow for structural focusing of the various funding sources. The first priority should be for tariffs to cover direct operational costs. Government budget funding and development funding should be directed toward capital expenditures, which will expand electrification, thereby increasing revenues, improving efficiency, and reducing costs.

Commercializing operations is only the first step on the path to sustainability. It will also create transparency and the right motivation for utilities to optimize their use of funds and send the right signals to customers and the government. Utilities in Africa are at various stages of development, with most of them operating as vertically integrated state-owned enterprises that have partially commercialized operations. They have managed to achieve certain electrification rates, typically around the key industrial sites and major towns. However, rural electrification is posing challenges—not only in terms of funding, which governments tend to provide at least partially, but also in managing the complexity of a growing utility that spans a significant portion of the country. Initial electrification power would normally be provided to industries and limited residential areas that have high consumption density, such as the country's capital. However, further electrification yields inherently worse economics because consumption density—and affordability—become lower, which coupled with the greater complexity of operations and associated costs makes the viability of utilities even more difficult.

Commercializing operations will create transparency and the right motivation for utilities to optimize their use of funds.

Figure 5

Countries have taken different approaches to open the energy market to free competition



- **Integrated monopoly.** The electricity sector is organized as a vertically integrated utility (VIU), which is responsible for all functions: generation, transmission, and distribution and sales.

- **Independent power producers.** VIU continues to account for most of the electricity-sector activities, but part of generation is financed, constructed, and operated by independent power producers (IPPs) and the energy and capacity purchased by the VIU under long-term power purchase agreements.

- **Market opening.** The VIU is unbundled into separate entities for generation, transmission, and distribution and sales. Very large customers are allowed to choose their suppliers and enter bilateral contracts directly with IPPs and/or traders, while other customers continue to be supplied by the distribution and sales entity.

- **Competitive market.** A distribution and sales entity is unbundled into separate entities for distribution and sales, which is also typically complemented with increased private-sector participation in both distribution and sales. Most or all customers are allowed to choose their suppliers, which is typically coupled with last-resort supplier and universal service obligation to ensure safety nets, especially for small commercial and residential customers. Wholesale market advances into a combination of bilateral contracts and organized markets (pools or power exchanges).

Source: Kearney Energy Transition Institute

So what is the solution to this problem? A first step—as with the commercialization of operations—is to create transparency and motivation to become more efficient. The mechanism that mature markets have used and which is fit for this purpose is unbundling: legally and functionally separating generation from transmission, distribution, and even retail. Energy delivery from generation through wholesale to retail is functionally and commercially independent from the natural monopolistic vehicle, namely the transmission and distribution grids. Unbundling creates three major benefits: transparency, competition, and potential for private-sector participation. Transparency is created in the sense that cross-subsidies between generation and grids are no longer possible—or at least they are much more complex, which helps focus the effort on the biggest shortfalls without artificially masking them.

Competition is enabled in generation, wholesale, and potentially retail by opening those value chain segments to free entry on the back of non-discriminated access to the transmission and distribution grids. In practical terms, this means the grids will no longer be locked up for the in-house generation capacity of the previously vertically integrated monopoly even if those would have worse economic parameters but would be advantageous to the vertically integrated monopoly because of take-or-pay arrangements or other stranded costs. Last but not least, there is more potential for private-sector participation by improving the bankability of such investments because the associated risk can be limited to the particular segment of the value chain where the investment is directed rather than the all-or-nothing approach that the vertically integrated monopoly would only allow. Private-sector participation is not a universal cure for all of the power sector's ailments; some can only be cured with government intervention and regulation. Hence, packing the power-sector value chain in a manner that also matches the risks and inefficiencies to be addressed with the capabilities of the private sector can facilitate the entry—and the ultimate success—of private-sector participation.

Unbundling can create structural improvements—transparency and competition—as well as capitalization improvements—increased efficiency and greater potential for private-sector participation. Moreover, the sector's resulting footprint and mechanics bring one extra benefit: they set up the foundation for introducing solutions not only from the history of the traditional utility in mature markets but also from the future of a new energy world.

Unbundling creates three major benefits: transparency, competition, and potential for private-sector participation.

Making a quantum leap to the new energy world

With the advent of decarbonization, decentralization, and digitalization, utilities need to adjust their approach to respond to a new energy market. Traditional utilities have developed in an investment-heavy manner by building centralized fossil-fuel generation and unidirectional networks from the mega power plants to individual homes.

Decarbonization is being driven globally by aggressive growth in the generation capacity of renewables (see figure 6). The 17.2 percent per year growth since 2010 is primarily the result of two factors:

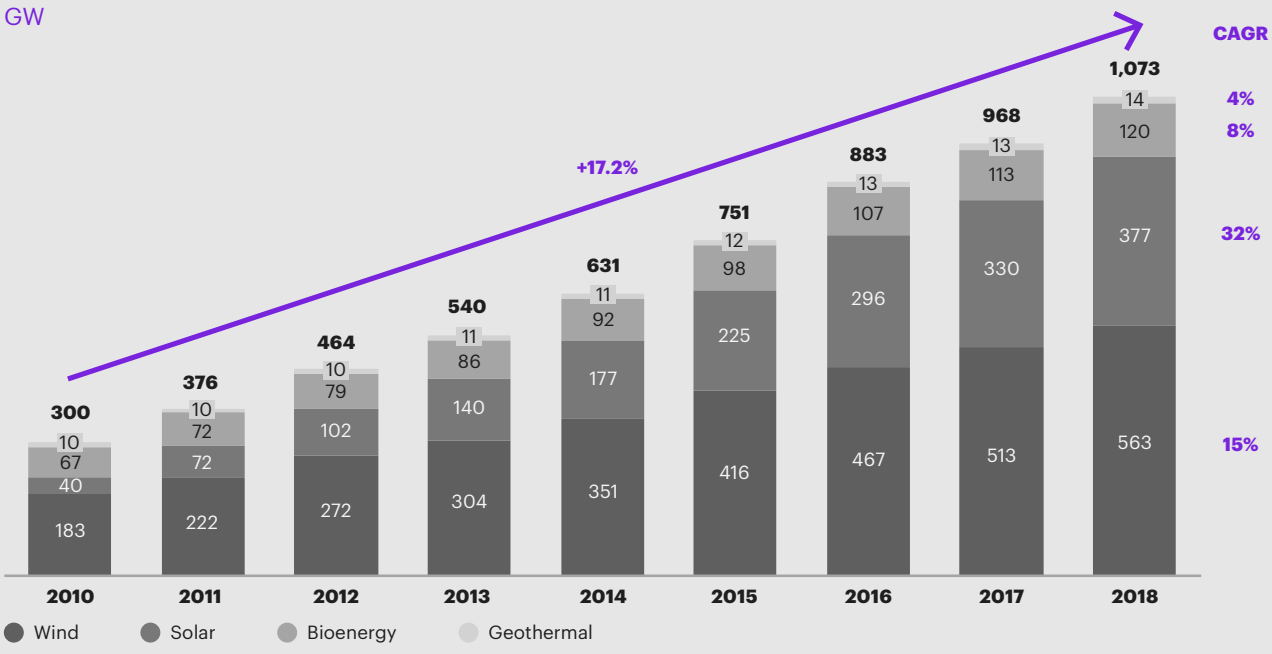
— Government enablement through renewables expansion targets as well as financial incentives for decarbonization through subsidies, such as feed-in tariffs and investment rebates

— The cost competitiveness of renewable solutions, which has seen major gains thanks to technology breakthroughs, leading to lower equipment costs and economies of scale because of the volume of projects

Furthermore, energy storage technology plays a role in the decarbonization, decentralization, and digitalization of the value chain as it allows companies to play new roles in the market (see figure 7 on page 9). The energy supplied is able to participate in the energy-only market through primary wholesale energy as well as in the operating reserve market through the provision of ancillary service and primary, secondary, and minute reserve energy. Additionally, improved storage technologies will make grid expansion more efficient for grid operators and expand the share of self-consumption from a decentralized generation for end users.

The energy transition has brought new technological and commercial ways of delivering power to people in a decentralized way (see figure 8 on page 9). Traditional utilities in mature markets are trying to find their places in this new energy world to avoid becoming stranded with a major infrastructure investment. Most African utilities are not burdened with such infrastructure sunk costs. Therefore, they have an opportunity to make a quantum leap over some of the development stages that utilities in mature markets went through and target a model that best fits the realities of the energy world.

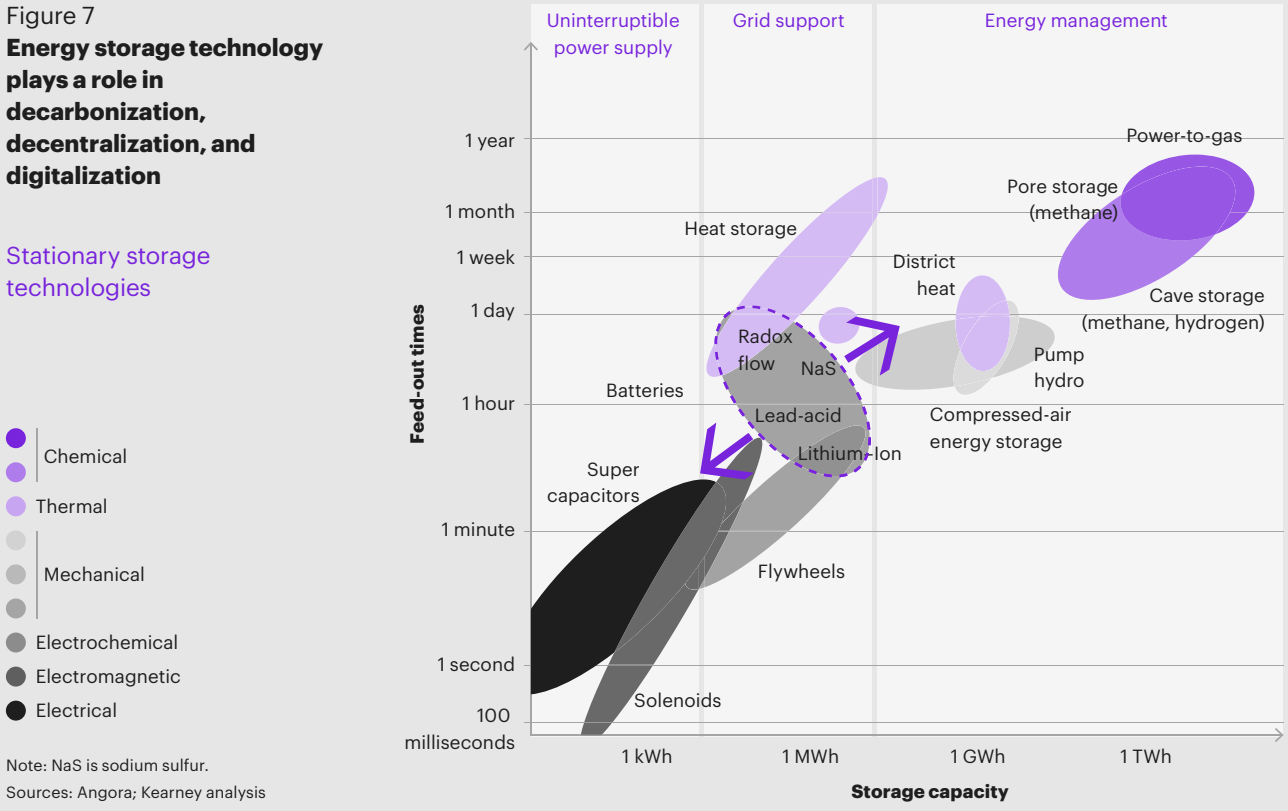
Figure 6
Alternative sources of energy are fueling the world's decarbonization



Sources: International Renewable Energy Agency; Kearney analysis

Figure 7

Energy storage technology plays a role in decarbonization, decentralization, and digitalization

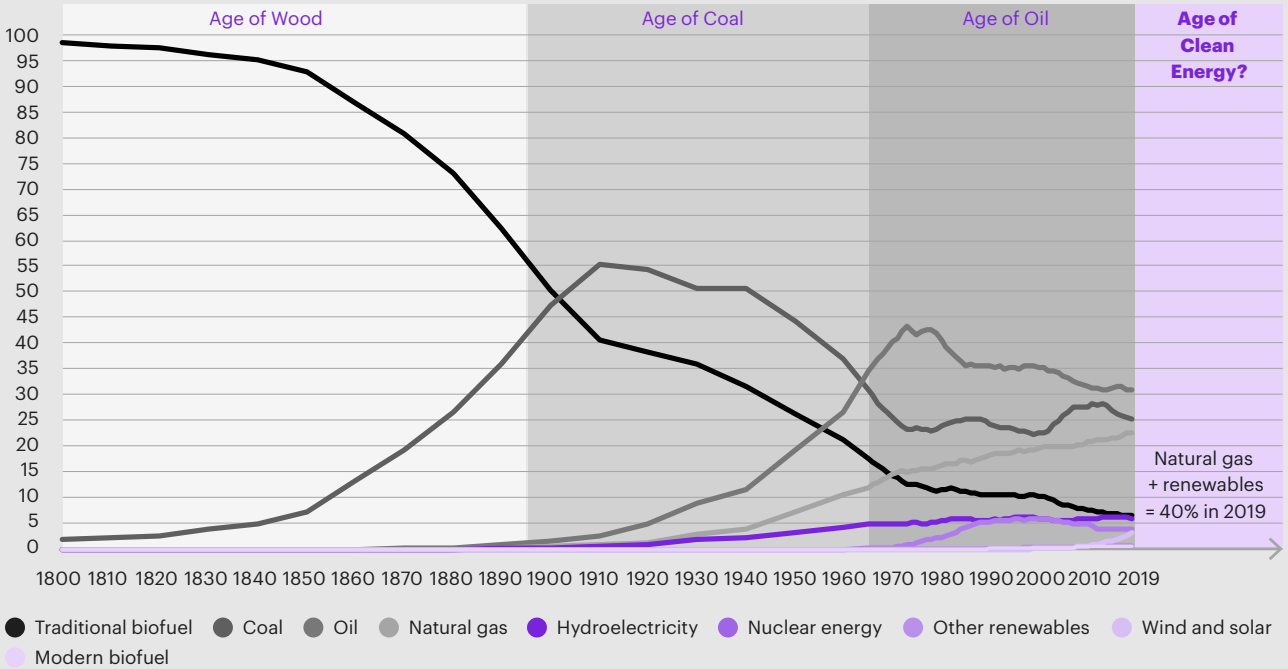


Note: NaS is sodium sulfur.

Sources: Angora; Kearney analysis

Figure 8

The world is moving toward a new age for energy



Sources: IEA World Energy Outlook 2019; Kearney analysis

The new energy world offers many advantages: it is cleaner, decentralized, and in some aspects cheaper. Africa has natural benefits in the form of solar irradiation and wind density to explore the cheaper aspect of the new age of energy. Hence, the continent could also enjoy the benefits of a cleaner and decentralized energy world. Decentralization is particularly worthwhile to consider in countries and economies that are plagued by corruption because decentralization is as powerful a cure for corruption as is the perfect competition for economic inefficiencies.

So how can Africa do that? Give utilities the right incentives and tools. Unbundling is just one component of the solution. A vertically integrated monopoly would normally have the capacity to take a powerful defensive stance to protect its business lines from threats from the new energy world, such as distributed generation eating away at its centralized capacity load factor and the respective take-or-pay capacity costs. But the unbundled power landscape would have different incentives for the various players. For an independent distribution grid operator, it will be as commercially attractive to offtake power from the transmission grid as it would be from a community solar PV installation in order to increase grid utilization. Hence, the operator will be incentivized to connect distributed sources rather than prevent them from ramping up their capacities.

Concepts from the new energy world are not restricted to one segment of the value chain, nor are they necessarily substitutes for traditional utilities. Would a mining company be willing to rely entirely on distributed renewable sources for its power supply? Probably not. Would it be more cost-effective to set up renewable source-based mini-grids to electrify remote rural areas? Probably yes. What does each solution require? A large upfront investment, technical expertise to operate and maintain the infrastructure, and customer management expertise to connect and serve customers and commercially run the business to recover the investment. Which organizations have this combination of expertise and capital? The utilities: traditional, new, or private. The traditional utilities have the opportunity to embrace the new energy world by capitalizing on their expertise and resources to expand their product and service portfolio in a customer-centric way.

Traditional utilities have the opportunity to embrace the new energy world by expanding their product and service portfolio in a customer-centric way.

Adopt a hybrid model that combines traditional utility robustness with new energy agility

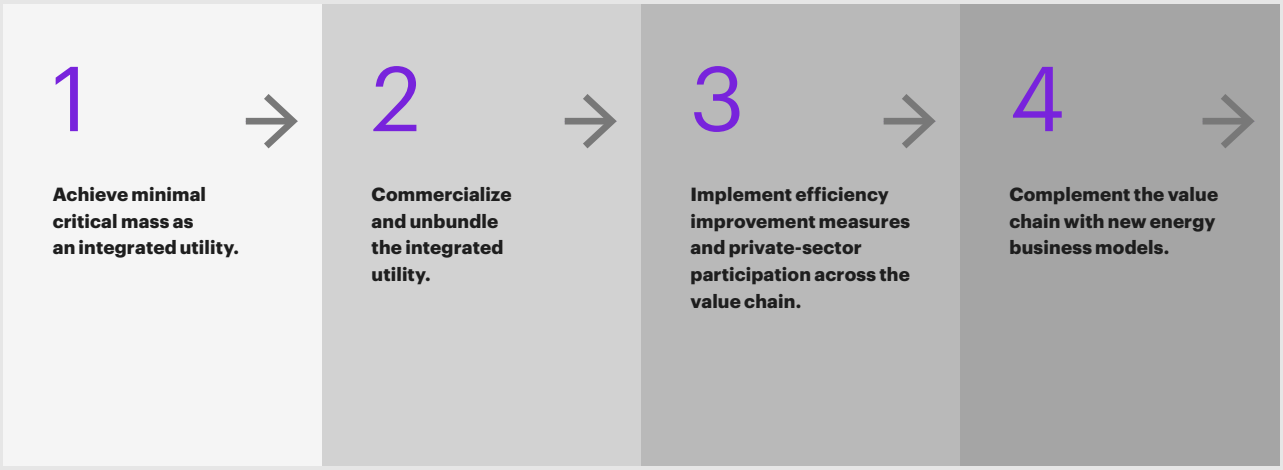
African utilities will need creative ways to use their traditional robust unbundled business model with the new opportunities of the energy transition trends of decentralization, decarbonization, and digitalization to serve their dual mandate of effectively and affordably supplying power to industry and society.

We recommend a four-step approach (see figure 9):

Achieve minimal critical mass as an integrated utility. Critical mass is achieved when the combined criteria have been met: 30 percent of the population has access to electricity, and local generation sources are meeting at least half of demand. This will typically require substantial government intervention and funding as well as recurring subsidies. Critical mass needs to be achieved before unbundling an integrated utility.

Commercialize and unbundle the integrated utility. After critical mass has been achieved, commercialize operations and unbundle the value chains. First, establish a sound legislative and regulatory framework to grant utilities the right to charge for their services and regulate how they measure and price their services. Second, legally and functionally separate transmission and distribution from generation, wholesale, and retail, and establish an independent and competent regulator to monitor the performance of the unbundled utilities and set cost-reflective tariffs. This requires establishing an independent system and market operator (ISMO) that is responsible for planning the supply by generators along with buying electricity from generators and selling electricity to distributors. The ISMO must remain independent of industry participants.

Figure 9
African utilities can take four steps to effectively and affordably supply power to industry and society



Source: Kearney analysis

Implement efficiency improvement measures and private-sector participation across the value chain. After unbundling the foundation of the utility sector, the road is cleared for efficiency improvements and private-sector participation. The wholesale market should be structured in a way that removes impediments to competition and stimulates efficiency improvement in generation and sales to improve retailers' collection rates and expand generators' capacity and availability factors along with reducing their operating expenditures. This creates an opportunity for regulatory frameworks to evolve from a rate of return to incentive-based regulation for transmission and distribution to reduce network losses and operating expenditures. To enable this, clearly defined and legally separated entities are needed to ensure there is no cross-subsidization of the tariff vertically along the value chain

Complement the value chain with new energy business models. Once the unbundled structure of the power sector has been finalized and a sustainable degree of efficiency improvement has been achieved, create the legal infrastructure and enablers for utilities to engage in alternative business models across the value chain. These do not necessarily need to be financial in nature or in the form of outright feed-in tariffs or any forms of subsidies. Instead, focus on non-financial factors that minimize the transaction's costs of operating the alternative business models. For example, rural electrification needs to have well-defined legislation that regulates the creation of mini-grids as well as enforceability for the rights of utilities to collect payments from customers once the utilities have constructed the mini-grids. Another example is in generation: governments can stimulate the development of utility-scale renewable energy sources by making it possible for such sources to offer guaranteed dispatch for industrial customers, thus making customers immune to the intermittent nature of such sources and overcoming the obstacle in being able to deliver a baseload profile to customers. This can be done by coupling state-owned fossil-fuel generation with renewable sources into baseload packages for industrial customers. This is typically done only for renewable energy sources that have otherwise achieved cost parity or even an advantage over fossil fuel generation, and their intermittence is the remaining obstacle for their marketability on competitive terms.

Close-up: sub-Saharan Africa journeys toward the new energy world

South Africa: Eskom's imminent unbundling

Eskom is a fully integrated state-owned power utility established in 1923, consisting of generation, transmission, and distribution to end customers. The utility generates 95 percent of South Africa's power and 45 percent of Africa's power and has a power station fleet capability of producing 45,000 MW. It is the largest power utility on the continent.

However, Eskom's operations have become unsustainable, requiring additional state funding to ensure ongoing operations. To safeguard the electricity system as demand exceeds supply, the utility has implemented rotational controlled power cuts. The lack of supply has been largely the result of inefficient operations due to inadequate maintenance of the generation fleet, delays in the new build program, and aging power stations. Eskom is also burdened with significant debt in its new power station build program, which has had cost and schedule overruns. In December 2020, Eskom had ZAR 488 billion of debt.

In addition, Eskom has faced several other challenges:

— Debt owed by municipalities to Eskom totaling ZAR 46.1 billion, of which ZAR 31 billion was overdue as of July 2020

— Corruption

— Higher coal costs

— Higher maintenance and operations costs

— Use of expensive feedstock, such as diesel, to avoid rotational power cuts (known as load shedding)

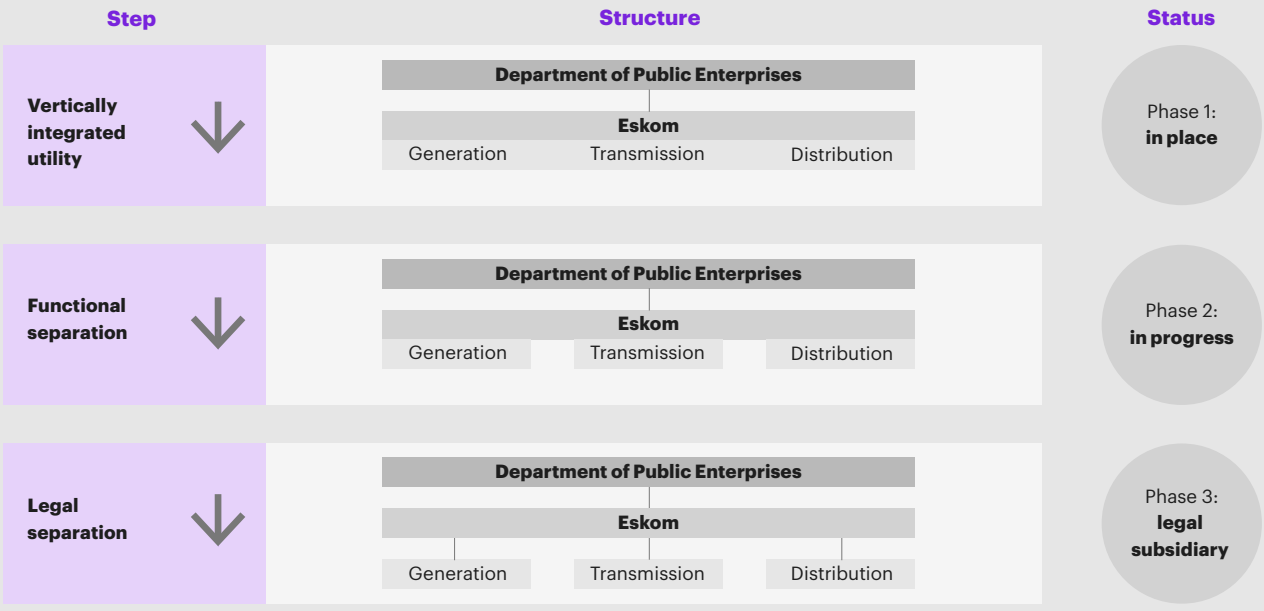
— Skills and capacity erosion at technical and governance levels

In 2019, the South African government announced it would restructure Eskom and the electricity supply industry to ensure reliable and affordable power. Step one of Kearney's four-step approach to transforming traditional utilities has been accomplished: Eskom has achieved critical mass as an integrated utility. This moves the company toward step 2—commercialization and unbundling of the integrated utility—and puts Eskom on a path of transforming from a traditional state-owned integrated power utility toward a more sustainable model.

The government decided to unbundle Eskom in response to the vertically integrated utility declining to a state where it was at a significant disadvantage. In more developed markets, utilities are typically unbundled from a position of strength, which among other benefits allows for a shorter timeline for this challenging process. However, it is not possible to stabilize Eskom in its current state. Although unbundling is not necessarily the full solution, structural changes to both Eskom and the market are needed to begin solving the utility's issues (see figure 10).

Although legal separation allows for a better focus for each function, each subsidiary is still under Eskom's influence. Maintaining each subsidiary's independence will require having independently run boards that govern each one with no conflicts of interest. Eskom aims to make the market more attractive for independent power producers (IPPs) to increase generation and competition by allowing access to the national grid. Ideally, the flow of energy generated by Eskom Generation and IPPs should be purchased at arm's length by an ISMO and then sold to distributors with Eskom Transmission paid a tariff and only purchasing energy to cover system losses.

Figure 10
Eskom plans to unbundle over a two-year period



Sources: Eskom media reports; Kearney analysis

How does Eskom's planned approach compare with unbundling in mature markets?

Eskom's approach is similar to how the energy sector transformed in Europe several decades ago. Unbundling was implemented in two stages: functional unbundling and legal unbundling. Then, the transmission segment of the value chain embarked on a third stage: ownership unbundling. To avoid confusion in terminology, we use a broader meaning for functional unbundling to encompass accounting, organizational, and IT system unbundling, which are normally performed during pre-legal unbundling, as well as management separation, independent decision-making, compliance, and separate identity and confidentiality for commercially sensitive information aspects, which are typically implemented during post-legal unbundling.

During Eskom's functional separation phase, accounting and IT system unbundling will only be the starting points to create transparency into the economics of various segments of the value chain. However, for legal unbundling to be successful, the internal organizational separation of the complete operations between value chain segments must already be prepared at this second phase, albeit within the single entity but internally operating as if completely independent. This can be achieved by creating the requisite separate organizational verticals with allocated management competencies, staff, and resources as well as clearly defined processes to ensure their autonomy and common governance converging only at the top of the board level.

The legal unbundling phase has two challenges that Eskom will need to address. One is the complexity of the transaction in terms of establishing different companies and transferring assets, staff, and customer and supplier contracts to the respective entities. The second challenge, which is perhaps even more important, is to ensure that the resulting legal entities are fully operational and will not threaten the continuity of delivery services to customers. Successfully tackling this second challenge will be underpinned by preparation during the functional separation phase, namely that the different value chain segments are already functioning independently within the single entity. Once the legal unbundling is implemented, the governance rules will be modified to be performed via the statutory bodies of the separate legal entities. But in terms of operational functionality, very few changes will ensure the continuity of delivery services to customers.

Which lessons and good practices can Eskom leverage from mature markets to ensure effective unbundling?

The essence of successful unbundling is to achieve the targeted independence of value chain segments in substance regardless of the chosen form. Even though legal unbundling may be perceived as a way to end the unbundling process, lessons from mature markets indicate that additional steps are required to achieve the targeted benefits. Those steps can be grouped into two blocks: competition in generation, wholesale, and potentially retail along with functional unbundling of transmission and distribution.

Starting with competition in generation, wholesale, and retail, which is the ultimate goal of unbundling, legally separating the value chain will not guarantee competition. The regulatory framework needs to evolve in parallel to ensure that the key enablers for effective competition are in place, including the following:

Wholesale market infrastructure. In parallel with Eskom's transformation, South Africa's energy regulator needs to establish a framework for a competitive wholesale market, including the necessary players and their licenses (such as market operators, generators, traders, balancing responsible parties, and bulk customers) as well as various components of the chosen model for the wholesale market, which could evolve, such as bilateral contracting versus organized, day-ahead, intraday, and balancing markets.

Transition plan. Considering that transitioning to a competitive wholesale—and potentially retail—market will not happen overnight, there needs to be a well-designed transition plan for both the customer side and the supplier side. On the customer side, a typical approach has been to adopt a minimum threshold in the form of capacity or annual consumption, which would define the group of customers that will transition to the liberalized market and this capacity to gradually decrease until customers transition. On the supplier side, it will be important to consider any constraints, such as how long-term power purchase agreements can be mitigated to ensure the functioning of the wholesale market.

Private-sector participation. Last but not least, competition requires multiple players, so it will be crucial to ensure private-sector participation on the supplier side, such as in the form of IPPs, to achieve the benefits of unbundling.

Continuing with the functional unbundling of transmission and distribution, the path to success does not end with the legal separation. The ultimate goal for those value chain segments is to provide undiscriminated access to the respective networks, especially without any preference to any legal entities that are part of Eskom's vertically integrated undertaking.

To achieve this, several best-practice tools as adopted in advanced markets such as the European Union internal energy market can be used post-legal unbundling for Eskom's transmission and distribution subsidiaries, including the following:

Management separation. The subsidiaries must have separate management that has no conflict of interest with the vertically integrated entity (VIE), such as management compensation depending on the results of the VIE or appointment procedures with representatives from other entities in the VIE participating.

Independent decision-making. The subsidiaries must have independent decision-making, with the VIE's role limited to very high-level steering in terms of approving the annual financial plan, the level of indebtedness, and any dividend payout without any involvement in the subsidiary's operational decision-making.

Compliance. The subsidiaries should adopt compliance programs and appoint compliance officers who are authorized to monitor the compliance with unbundling requirements in detail.

Separate identity. The subsidiaries will need to adopt separate identities in their communications with customers and third parties, making clear their distinction from the VIE.

Confidentiality of commercially sensitive information. The subsidiaries will need to share with other entities of the group only the commercially sensitive information that they are entitled to, based on their commercial interactions between the subsidiaries in the context of their licensed activities and not based on common ownership within the VIE.

How can Eskom adapt its transformation path to take advantage of the new energy world?

In mature markets, unbundling was implemented at a time when the traditional energy world was prevailing: fossil-fuel centralized generation and unidirectional networks. But we are now living in a new energy world. So how can Eskom channel this for its transformation?

Looking back at our four-step approach for adopting a hybrid business model, we see that Eskom is on the edge between steps two and three, having embarked on the path of value chain unbundling and introducing private-sector participation in generation through IPPs. Additional opportunities may lie in the areas of transmission and distribution from the point of view of adapting them to the needs of the new energy world. Distributed generation can benefit immensely from smart grids—smart both in terms of hardware and operations as well as available business models and counterparties. Eskom can position itself as a systemic counterparty to enable and facilitate the adoption of distributed generation by complementing any market or tariff mechanisms with structural enablers, such as integrating storage capacities into the grids and designing and offering the service of flexibility to mitigate the profile and intermittency aspects of renewable energy sources.

In conclusion, Eskom has taken on a very challenging but fundamentally right transformation path that will enable South Africa's power sector to move to the next level. Eskom's transformation path is not new to the energy world; many mature markets have followed it over the past decades. Now Eskom can take advantage of their lessons to mitigate the inherent risks, embrace the opportunities of the new energy world, and become a strategic enabler for an accelerated path to capture benefits.

Ghana: moving into a sustainable future with a track record of power-sector innovation

Ghana has been a pioneer in advanced power-market reforms, tackling major changes in the second half of the 1990s to improve the sector's efficiency and attract private investments. Ghana unbundled the vertically integrated entity the Volta River Authority into separate generation and transmission utilities. In parallel, the country created two regulatory bodies: one for technical regulation and licensing and one for economic regulation and tariff setting. Ever since, Ghana has stayed at the forefront of reform and innovation in the power sector, including introducing private-sector participation in electricity distribution. Even though this initiative has not yet succeeded because of deficiencies in the private partner's financial credentials, this particular transaction's lack of success does not undermine the fundamental rightness of the course the country is pursuing.

Ghana established its wholesale electricity market with the adoption of the Electricity Regulations 2008 (LI 1937) to facilitate wholesale trading of electricity and the provision of ancillary services in the National Interconnected Transmission System. The wholesale market is operated by the electricity transmission utility on a non-discriminatory basis, and market participants include wholesale electricity suppliers (generators), electricity distribution utilities, and bulk customers. Since its introduction, the wholesale market evolution has been focused mostly on allowing more customers to qualify as bulk customers and thus to participate in the deregulated market. The Energy Commission has gradually reduced the requirement for being classified as a bulk customer to the current level of a maximum demand of 500 kVA for three consecutive months or a minimum annual energy consumption of 1 GWh. (As a point of comparison, the 2008 thresholds were set at 3 MVA and 6 GWh respectively—six times higher.)

To date, the wholesale market has operated mostly through bilateral contracts, both in its regulated and deregulated segments. There is limited application of a spot market due to the legislative requirement that the country's low-cost hydro capacity is provided on an equitable basis to all customers, so it cannot be the subject of bilateral contracts. The Electricity Market Oversight Panel approves how much of the low-cost hydroelectricity is to be generated in any given year and how it should be allocated among the competing markets: regulated, deregulated, export, and the VALCO smelter. Naturally, the price discovery mechanisms used in the wholesale market are tightly linked to its prevailing forms. For bilateral contracts, average total costs (rather than marginal costs) are used to determine price; a form of short-run marginal cost is used only for low-cost hydroelectricity. In effect, Ghana's spot market is functioning as a balancing market equivalent to the mature markets with the additional country-specific factor of ensuring equitable allocation of low-cost hydroelectricity.

Another aspect of the direction of Ghana's power sector is the excess generation capacity under take-or-pay arrangements that have accumulated in the system, the development of which can be found in the Energy Commission's annual Energy Outlook for Ghana reports. Over the past decade, Ghana suffered several severe load-shedding periods, which led to a fast ramp-up of generation via long-term take-or-pay arrangements with IPPs. By 2019, the pendulum had swung to the opposite extreme, where the capacity that is already operational and dependable is more than 50 percent higher than domestic demand. This has created a heavy financial burden on the energy sector and accumulated deficits because of the large amount of charges incurred for capacity that is neither dispatched nor used for ancillary services.

In this context, Ghana has declared its plan to move ahead with its wholesale market development toward a fully functioning organized market. Sector regulators and the independent market operator are preparing the regulatory frameworks to enable such a transition.

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Ghana has navigated the first three steps in our framework. The question now is how it can take advantage of the fourth step in establishing hybrid business models from the new energy world.

The answer can be as simple and as radical as this: the last fossil fuel power plant in Ghana has already been built. How is that possible? Ghana's ample solar and wind resources would allow sufficient renewable energy capacity to be built to meet demand for decades to come. Moreover, under take-or-pay arrangements, the country has substantial conventional capacity to balance the intermittent renewable energy sources until the combined cost of renewable energy and storage reaches parity with conventional generation and large-scale storage can be deployed. Low-rise construction also allows a significant rooftop solar PV capacity to be deployed in relation to customer demand—on the grid in areas that have access to the distribution grid and off the grid in rural areas that have not yet been electrified, such as in the Northern Region, where the solar PV yield is the highest in the country.

Ghana's solar and wind resources would allow renewable energy capacity to be built to meet demand for decades to come.

Making this vision a reality rests on the existing sector players and advanced market structures:

— **Government.** Create a new vision for a renewable-only energy future.

— **Regulators.** Create a technical and commercial framework for balancing and pricing the intermittence of renewable energy sources combined with conventional generation. Create a framework for the competitive acquisition of renewable energy capacity.

— **Generation utilities.** Lead the development of new utility-scale renewable energy capacities based on their experience in constructing and operating large-scale generation capacities—in addition to operating their fossil fuel and hydro fleets.

— **Transmission utility.** Lead the integration of renewables in the dispatch schedules through conventional and new energy means, such as storage, in addition to operating and modernizing the transmission grid.

— **Distribution utilities.** Become champions of rooftop solar PV and community micro-grids based on the utilities' experience working closely with a large number of customers, in addition to operating and modernizing the distribution grid and serving customers connected to them.

In conclusion, Ghana has all the natural endowments, policy experience, and sophistication needed to realize such a vision—even faster than many mature markets. A future based on new energy is largely a matter of choice and ambition to continue pioneering West Africa's power sector.

Making the best of both worlds with hybrid business models

Africa's power sector is poised to evolve, but this evolution needs to be supported by a fundamental change in how utilities are organized and how they operate. Africa needs electrification to boost its economy and enable its social development. At the same time, a new energy world is dawning—creating new opportunities for African utilities to make a quantum leap in their development to catch up and even surpass their counterparts in mature markets. To make this leap, utilities will need to adopt hybrid business models to make the best of both traditional utility and the new energy world.

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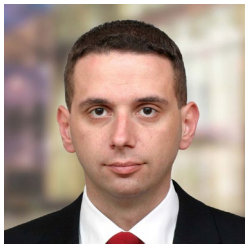

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The authors wish to thank Romain Debarre from the Kearney Energy Transition Institute, Marc Ahlers, and Graham Hyslop for their valuable contributions to this report.

As a global consulting partnership in more than 40 countries, our people make us who we are. We're individuals who take as much joy from those we work with as the work itself. Driven to be the difference between a big idea and making it happen, we help our clients break through.

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