Fitch Solutions

Q3 2019

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Nigeria

Power Report

Includes 10-year forecasts to 2028

Contents

Key View

Key View: *The Nigerian power sector will remain reliant on gas-fired electricity for over 70% of its power output over the 10-year forecast period, which will leave the country vulnerable to power cuts as a result of feedstock shortages at power plants and inadequate gas infrastructure. A consumer culture of non-payment, security issues and problems with financing will be key risks facing the power sector despite strong economic and population growth.*

HEADLINE POWER FORECASTS (NIGERIA 2017-2023)

Indicator	2017e	2018e	2019f	2020f	2021f	2022f	2023f
Generation, Total, TWh	25.7	23.3	24.0	26.2	27.9	29.0	30.0
Consumption, Net Consumption, TWh	20.8	18.0	18.5	19.2	20.6	21.2	21.5
Capacity, Net, MW	10,792.2	11,291.2	13,218.7	13,571.4	14,165.3	14,659.7	14,788.7

e/f = Fitch Solutions estimate/forecast. Source: EIA, IEA, IRENA, Fitch Solutions

Latest Updates And Structural Trends

- Our forecasts remain for gas to be the dominant source of electricity output in the country's power sector over our 10-year forecast period. We expect that gas will account for an annual average of just under 72% of total power generation in Nigeria.
- **Kingline Development Nigeria Limited** was announced in March to have entered into a partnership with **Themis**, a firm backed by **Denham Capital**. The partnership will involve the development of a 550MW gas-fired power plant in Nigeria's Ondo State, planned for completion by 2022. While we do not yet factor the project into our forecasts, we will include the project if we see evidence of construction and the power plant progressing.
- The Nigerian government, in March, gave approval for the development of five small hydropower projects with a combined capacity of 16.49MW as well as a 30MW hydropower project in Gurara. We do not forecast that these projects will come online as of yet, as we await construction to start. However, we expect this will form part of a wider trend of small-to-medium scale hydroelectric projects being developed instead of more costly large-scale projects.
- The EU, in conjunction with Nigerian firm, **All On**, will reportedly provide EUR30mn for the development of small-scale off-grid renewable power projects in Nigeria. This will be done in order to promote sustainable electrification while also being aimed at grid modernisation.
- We are maintaining our bearish forecasts for the development of large-scale non-hydropower renewable projects in Nigeria, owing to a lack of progress on planned projects as well as financing concerns. We expect that renewable electricity generation will account for less than 0.5% of the country's power output over our 10-year forecast period.

SWOT

SWOT Analysis

Strengths

- Large discovered hydrocarbon resource base.
- With a forecasted population of over 200mn in 2019, Nigeria's long-term economic trajectory is underpinned by strong fundamentals.
- A Multi-Year Tariff Order, designed to revive the power sector.
- The federal government has made improving Nigeria's infrastructure a top priority for national development across all sectors, but particularly in transport and energy.
- Nigeria is Sub Saharan Africa's largest economy and offers huge demand for expansion of transport and power infrastructure in order to facilitate growth and development.

Weaknesses

- The economy is over-reliant on the oil sector, as are government revenues.
- The World Economic Forum ranks the country's power infrastructure as one of the most neglected globally.
- Gas supply disruption in the Niger Delta is a threat to power generation.
- Low local gas prices mean producers favour exports, while further tariff reform will be needed to make investment more attractive.
- The business environment is in dire need of reform, with heavy bureaucracy and high levels of corruption a key obstacle to private sector development.

Opportunities

- The successful dispersal of Nigeria's expansionary budget and greater exchange rate flexibility could boost investment in the power sector.
- Nigeria has the potential for solar, biomass, wind and geothermal power, as well as off-grid generation.
- Breaking the Petroleum Industry Bill into its constituent parts and attempting to pass them individually could prove successful.
- Strong real GDP growth over the coming quarters, benefitting from an uptick in crude oil production and rising government spending (afforded by higher commodity prices).
- Privatisation of the power sector will potentially attract investment and boost efficiency across the economy.

Threats

- Independent Power Producers are likely to be deterred from entering the market due to neglected grid infrastructure and gas supply disruptions.
- A lack of cash liquidity in the distribution segment and the declaration of force majeure by DISCOs are major threats to the whole supply system.
- Increases in tariffs will continue to meet widespread public resistance.
- Entrenched interests and security concerns may derail some reforms.
- Economic policy remains personality-focused, and this poses a threat to investor certainty.

Industry Forecast

Nigeria Snapshot

COUNTRY SNAPSHOT: ECONOMIC AND DEMOGRAPHIC DATA (NIGERIA 2017-2022)						
Indicator	**2017e**	**2018e**	**2019f**	**2020f**	**2021f**	**2022f**
Nominal GDP, USDbn	364.3	429.7	497.1	517.0	525.1	565.4
Real GDP growth, % y-o-y	0.8	1.9	2.1	3.3	3.7	3.5
GDP per capita, USD	1,908	2,193	2,473	2,508	2,483	2,607
Population, mn	190.89	195.88	200.96	206.15	211.45	216.84

e/f = Fitch Solutions estimate/forecast. Source: National sources, Fitch Solutions

COUNTRY SNAPSHOT: ECONOMIC AND DEMOGRAPHIC DATA (NIGERIA 2023-2028)						
Indicator	**2023f**	**2024f**	**2025f**	**2026f**	**2027f**	**2028f**
Nominal GDP, USDbn	597.3	638.5	702.3	774.4	850.6	929.2
Real GDP growth, % y-o-y	4.4	3.6	5.7	4.3	4.1	3.9
GDP per capita, USD	2,686	2,800	3,005	3,232	3,464	3,693
Population, mn	222.35	227.96	233.69	239.54	245.49	251.57

f = Fitch Solutions forecast. Source: National sources, Fitch Solutions

COUNTRY SNAPSHOT: POWER SECTOR	
Access to electricity, % of population	55.6
Quality of electricity supply (value)	1.4/7
Quality of electricity supply (rank)	136/137

Source: World Economic Forum - Global Competitiveness Report 2017-2018, World Bank, Fitch Solutions

Nigeria Power Forecast Scenario

Inadequate power supply and structural problems across the electricity and gas supply chains are major inhibitors of faster economic growth in Nigeria, and there are few signs that this will change dramatically over our 10-year forecast period. Despite a series of pledges to fix the faltering electricity sector, President Muhammadu Buhari's administration has registered little success in boosting capacity and generation. The incumbent government has struggled to articulate and deliver its policies amid a broader economic malaise, weak investor sentiment and an uptick in violence that has hit supply from the hydrocarbons-rich Niger Delta.

Some of these problems will ease in 2019, as a gradual recovery in Nigeria's oil sector causes economic growth to accelerate. The return to growth will occur in line with rising crude oil prices and higher domestic output, as well as the Nigerian Central Bank's decision to allow for more flexibility in its multiple exchange rate regime via the introduction of a free-floating exchange rate window for portfolio investors and exporters. We forecast that the economy will expand at 2.0% and 3.3% in 2019 and 2020 respectively, up from 0.8% in 2017. However, this will depend on further exchange rate reform and continued stability in the Delta region.

As the economy rebounds very gradually, some of our key views in the Nigerian power sector over 2019 include:

1. Investment Will Start To Trickle Back Into Power Infrastructure

The government's ambitious plans to add new power capacity will continue to disappoint as both public and private investment are constrained by the macroeconomic headwinds over the next few years. Nevertheless, higher crude prices will give the government a little more scope to invest in the power sector in 2019 and 2020 - and offer a stimulus to growth as liquidity improves in the foreign exchange markets. The latter point is particularly important because low oil prices and concerns about a devaluation of the naira led to a drying up of hard currency in 2016 and a souring of investor sentiment. Many companies that operate in the power sector supply chain struggled to access the dollars needed to buy imported equipment and sat on the sidelines amid fears of a devaluation and inability to access the currency needed to repatriate profits. This essentially led to a hiatus in international investment in the power sector.

2. Distribution Segment To Remain In Crisis Mode

Structural problems across the power sector supply chain will remain a feature of the Nigerian power sector over our 10-year forecast period. The power distribution sector will continue to be hit hard in 2019, as distribution companies (DISCOs) struggle to access power (due to gas shortages at generation companies) and collect payment for what little electricity they can provide due in part to a culture of non-payment for electricity. This dynamic, which has left the companies with huge revenue shortfalls, has been exacerbated by the fact that tariff reviews have not kept pace with rising dollar costs (which have been worsened by weakness in the naira) and have been challenged in the Nigeria courts. Despite government cash injections, these circumstances will continue to starve the sector of the cash liquidity needed to operate efficiently - with the sector in crisis.

Furthermore, it is far from clear that recent changes to government policies relating to the DISCOs will solve any of these liquidity problems. The DISCOs have reportedly declared force majeure after the Nigerian Electricity Regulatory Commission (NERC) stated that eligible electricity customers will now be able to bypass the distribution companies completely and buy electricity directly from the generation companies themselves. The government has pursued this legal change in an effort to open up the electricity supply market to greater numbers of third parties and create competition to the underperforming DISCOs. The DISCOs have, however, argued that the change prevents them from fulfilling their obligations under the performance agreements they have signed with the Bureau of Public Enterprises. Amid confusion about how exactly consumers will bypass the DISCOS and the Transmission Company of Nigeria, the government will have to allay concerns that the policy will not lead to the collapse of the electricity grid - something that will remain a central issue over 2019.

3. Delta Attacks: Under Control But Risks To Gas Supply Will Linger

The threat of attacks to critical energy infrastructure by groups such as the Niger Delta Avengers (NDA) has diminished since they reached their peak in 2016, but will remain a significant risk to our economic outlook and power generation forecasts over 2019 and beyond. The NDA claimed responsibility for the majority of the attacks on energy infrastructure in 2016 in response to the Buhari administration's decision to scale back the Niger Delta Amnesty Programme. The large number of attacks underpinned our forecast for a 15% y-o-y contraction in gas-fired electricity generation in 2016, as damage to gas pipelines made it impossible to evacuate associated gas from production fields to power plants across the country.

The threat to supplies has, however, increased after the NDA announced on November 3 2017 that they would end a ceasefire brokered by the Pan-Niger Delta Forum on behalf of the NDA and the Nigerian government. The NDA's motivation for quitting the ceasefire remains unclear, although the group appears to have lost patience with the pace of progress on a 16-point agenda to support the Delta region. Pledges of investment and promises related to the plan have failed to materialise, breaking the trust in the delicate relationship between the Delta region and the federal government. This rekindles a serious threat to oil and associated gas production and by extension gas supply to power plants. Any return to violence could lead us to revise down our forecasts for gas-fired power generation, which are already bearish in the face of gas power plants being idled due to issues of gas supply, with the generating companies (GENCOs) reportedly owing gas suppliers 70% of their total NRN1trn in debt. Some power plants have been idled due to lacking in spare parts and not being operable as of July 2018.

Little To Like In Our Forecasts

The aforementioned problems in the power sector underpin our forecast for limited growth in electricity generation, capacity and consumption. We currently forecast that Nigeria will have just over 15.0GW of capacity by 2028, from an estimated installed capacity base of just under 11.3GW in 2018.

The major problems that will have to be overcome to secure reliable power supply in Nigeria include:

- Ageing and vandalised generation infrastructure, as well as inadequate and inefficient transmission and distribution (T&D) networks - which in turn contribute to high power losses.
- Overdependence on gas-fired power generation has resulted in supply disruptions as a result of gas shortages. The government-mandated, domestic gas prices for generators are low, meaning that producers favour exports, while cheap electricity (with the government holding tariffs at low levels) makes investment in new capacity unattractive.
- Skewed pricing policies and an inefficient billing and metering system have put a significant strain on revenue collection.
- Vested interests have played a part in slowing the reform process, especially as the generator and diesel market in the country is worth an estimated USD13.35bn per annum.
- The tendering process is often opaque, with losing bidders reportedly claiming that a relationship with important figures in government is more of a deciding factor than technical skill or cost.
- Violent attacks by Boko Haram militants continue to rock northern Nigeria, deterring investment in power generation and transmission assets across vast swathes of the north.

Crucially, we believe that a failure to address these challenges has undermined Nigeria's long-term plans to plug the vast power deficit by attracting private capital into the sector. The privatisation drive that was pushed through under the previous People's Democratic Party, and efforts to increase the number of Independent Power Producers (IPPs) in the market will be hit hard amidst the ongoing financial crisis. As such, we believe that much of the private sector momentum that gathered pace, following the unbundling of the **Power Holding Company of Nigeria** (PHCN) in 2013 under former President Goodluck Jonathan - has dissipated.

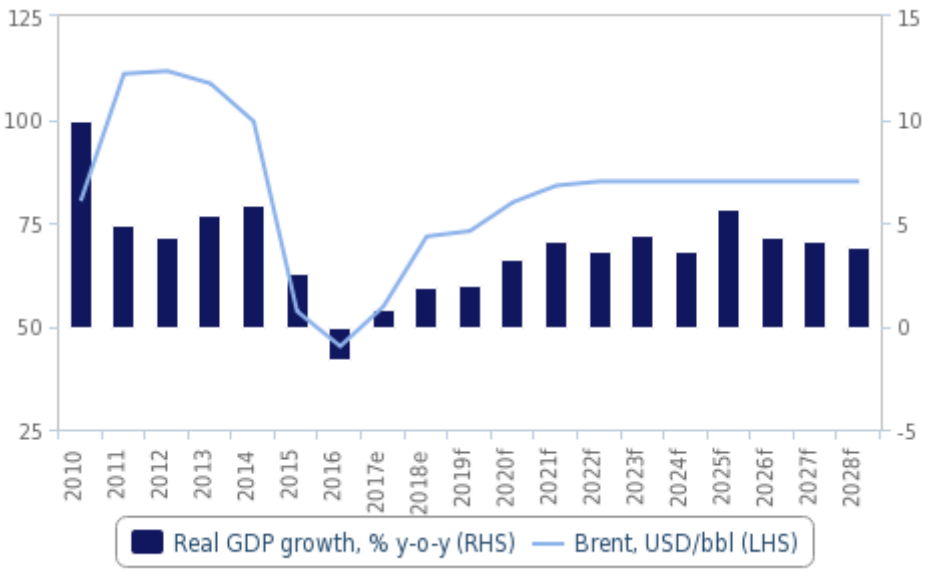
In addition to Nigeria's economic problems, we note that there is still little concrete power sector policy beyond the points outlined in the All Progressives Congress (APC) party manifesto - although statements and reports on power policy appear to be premised on improving transparency, strengthening regulation and making incremental improvements across all areas of the power sector

supply chain in an effort to achieve uninterrupted supply.

In the meantime, electricity shortages will continue to take a heavy toll on the Nigerian economy - with the country's power grid collapsing on March 31 2016 due to a 'zero power' event. The event, which has been blamed on vandalism to gas pipelines and infrastructure, meant that no grid-based electricity supply was available for around three hours. In line with this aforementioned development, the World Economic Forum's Global Competitiveness Report 2017-2018 ranks the country's power infrastructure as one of the most neglected and inefficient globally - with Nigeria ranking 136 out of 137 countries for quality of electricity supply. Manufacturers and businesses regularly cite unreliable power supply as the biggest constraint to doing business in Nigeria and there are an estimated 75mn people in Nigeria without access to electricity.

Economic Recovery Remains Fragile

Nigeria - Real GDP Growth & Fitch Solutions Oil Price Forecast



e/f Fitch Solutions estimate/forecast. Source: National sources, Fitch Solutions

Gas Generation And Capacity Forecast

Key View: *Gas-fired power will remain the dominant source of Nigeria's electricity output over our 10-year forecast period owing to its substantial capacity already online and domestic gas reserves. As a result of this high reliance on gas for power, electricity deficits will remain a threat as a result of supply disruptions, lack of payments and inadequate gas infrastructure. Security threats in the Niger Delta region will also remain a risk to electricity supply.*

Latest Updates

- Our forecasts remain in place for gas to remain the dominant source of electricity output in the country's power sector over our 10-year forecast period. We expect that gas will account for an annual average of just under 72% of total power generation in Nigeria.
- **Kingline Development Nigeria Limited** was announced in March to have entered into a partnership with **Themis**, a firm backed by **Denham Capital**. The partnership will involve the development of a 550MW gas-fired power plant in Nigeria's Ondo State, planned for completion by 2022. While we do not yet factor the project into our forecasts, we will include the project if we see evidence of construction and the power plant progressing.

Structural Trends

In line with Nigeria's privatisation and capacity expansion plans, the majority of electricity generation in the country comes from, and will continue to come from, gas power plants (which we estimate accounted for approximately 75% of the generation mix in 2018). Nigeria has the world's ninth-largest proven natural gas reserves. Theoretically, this provides a good base for increasing the use of gas in power generation, with all of the new National Integrated Power Project (NIPP) projects utilising simple or combined gas-fired turbines.

However, despite abundant gas resources, inadequate supply and a lack of gas transport infrastructure will remain the biggest risks to boosting gas-fired electricity output. A lack of gas pipelines (even when they are all operational) and the threat of theft and vandalism have plagued the power generation sector. Insufficient gas supply has long been an issue, with the **Nigeria Gas Company** unable to guarantee deliveries - starving power companies of fuel stock.

Defining Features Of The Gas Sector

Widespread Insecurity: Widespread instability in the Niger Delta has led to a high incidence of attacks on industry workers and infrastructure, triggering frequent supply disruptions. This remains a major deterrent to investment and we have seen a number of international oil companies (IOCs) exit the onshore hydrocarbons sector in recent years, to focus on offshore oil assets. Damage to the Escravos-Lagos Pipeline System, which was vandalised many times in 2016, caused interruptions in supply to power plants including Geregu I and II, Omotosho I and II, Olorunsogo I and II and Egbin. As a consequence, we expect associated gas from offshore operations to be the main long-term source of gas supply in Nigeria.

Regulatory Uncertainty And The Petroleum Industry Bill: The government had been debating the petroleum industry bill (PIB), which set out the fiscal terms for oil and gas companies operating in the Nigerian hydrocarbons sector, since 2008. The bill is expected to materially alter the procedural and fiscal terms governing the sector, and investors remain reluctant to commit funds under so much uncertainty. A Nigerian Senate committee estimated that since 2010, around USD28bn of investment decisions have been delayed as a result. At the end of May 2017, however, there were some positive steps towards a resolution as the Nigerian Senate passed the petroleum industry governance bill (PIGB). However, it was later reported that President Buhari declined to assent the bill into law.

The bill was the first of five bills, which will comprise the broken down PIB. After nine years of failing to pass the PIB into law, the Nigerian oil minister, Ibe Kachikwu, decided to break the bill down into five separate bills in order to make the process more manageable. The PIGB focuses on reforming the structure of the **Nigerian National Petroleum Corporation** and the entities that regulate it. The passing of the bill is positive news as it suggests that breaking the bill up makes for smoother passing. However, the more controversial sections are yet to come. The regulation regarding the financial terms will be more contentious and will have a more material impact on the company's long-term investment plans. The Senate will have to balance the need to secure revenues from their oil reserves but also keep the fiscal terms competitive in order to attract international capital. The balance is delicate and the possibility of much-needed capital from IOCs not materialising is a risk. As of the start of 2019, the PIB has still not been passed into law.

Weak Domestic Gas Market: With gas prices kept artificially low, the industry is struggling to meet production and processing costs. Capacity upgrades and expansions remain largely uneconomical, despite the recent rise in gas prices.

Cumulatively, these factors have led to chronic underinvestment in the country's gas sector. As a consequence, Nigeria lacks the infrastructure to effectively monetise its gas resources. Notably, the government is looking to limit gas flaring, which is estimated to account for the loss of around 20-25% of associated gas production, and raised gas prices from USD1.50 per million cubic feet (mcf) to USD2.50/mcf in early August 2014 in order to encourage producers to capture output.

In our view, however, this was a small concession on price in a difficult operating environment and plans to cut flaring remain highly ambitious. Low domestic prices are only one factor contributing to underinvestment, we believe security risks and the high degree

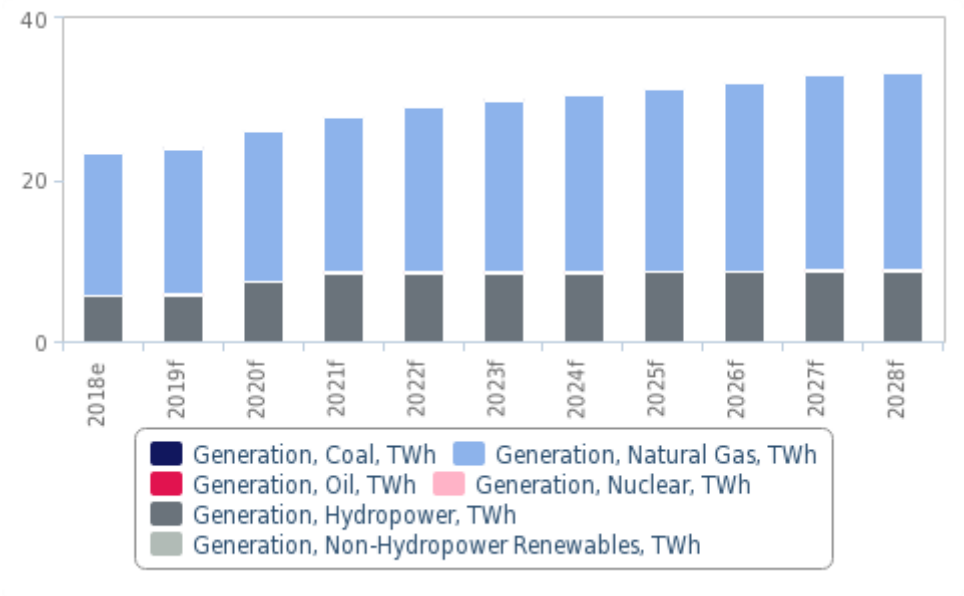
of regulatory uncertainty are likely to remain unchanged over the short-to-mid term.

Other government initiatives that were announced prior to the election of President Buhari included the introduction of mechanisms to reduce financial risks for investors and piecemeal reforms to the gas power supply chain. In November 2016, for example, the World Bank and the **Niger Delta Power Holding Company** (NDPHC) signed a deal known as a partial risk guarantee (PRG) agreement under which gas company **Seven Energy** will supply gas to the Calabar gas plant. The PRG gives a guarantee, backed by the World Bank, which protects investors against a default by a power company. This is in order to encourage IPPs into the sector and mitigate the risks posed by gas shortages. Nigeria has used these mechanisms before. In April 2013, a PRG was agreed for the Egbin state power authority, and in August 2015 the Federal Government and the World Bank also signed NGN47.4bn (USD37mn) of risk guarantees to support the 450MW Azura-Edo Independent Power Plant.

We emphasise, however, that we view these policies as interim measures and they have had a limited impact on power generation amid major structural problems across the gas supply chain. We maintain that raising gas prices to levels that incentivise production will remain the best way to stimulate investment in Nigerian gas production, from both IOCs and domestic players. This will ultimately require the government to pass the PIB in some format.

The NERC stated in November 2018 that during the first quarter of 2018, 74% of electricity constraints in Nigeria were due to problems with gas supply at the GENCOs. This highlights the risk faced by the Nigerian power sector as it is highly reliant on gas-fired power, which we forecast will account for more than 70% of the country's total electricity generation over our forecast period to 2028.

Total Net Generation By Type
Nigeria (2018-2028)



e/f = Fitch Solutions estimate/forecast. Source: EIA, IEA, Fitch Solutions

Coal Generation And Capacity Forecast

Key View: *Coal-fired power generation will contribute a negligible amount of electricity to Nigeria's power sector over our 10-year forecast period. We only forecast the AshakaCem 16MW Gombe power plant to come online in 2019, with only its excess electricity being fed into the national grid. Key issues hampering coal project development will be related to logistics and financing as well as legislation limiting the approval of mining operations.*

Latest Updates

- We maintain our outlook that coal-fired power will contribute a negligible amount to the Nigerian power sector over our 10-year forecast period. This is because we only forecast the 16MW Gombe power plant to come online in 2019. With most of the generation planned for use by **AshakaCem** at their facilities, only excess will be provided to the power grid. We do not expect any other coal power plants will come online during this time.

Structural Trends

The risks to the time frames and financing of coal power projects in Nigeria will ensure that our coal-fired electricity generation forecasts undershoot government targets, especially taking into account the considerable financial and economic challenges that are currently deterring investment into the Nigerian power sector.

These dynamics will hit plans to build three coal-fired power plants in the states of Enugu, Kogi and Gombe - a plan that was first outlined under the government of former President Goodluck Jonathan as a means of diversifying away from gas. We have since seen the minister for Power, Works and Housing state in August 2016 that coal will play a bigger role in the country's future electricity mix and there are a number of reports that memorandums of understanding and one power-purchase agreement (PPA) has been signed. Nigerian Bulk Electricity Trading (NBET) was reported to have signed a 20-year coal PPA with **Zuma Global** in September 2015, the first Nigerian PPA for a coal-to-power scheme, but we have found little evidence of these projects are entering construction or reaching financial close.

We have included the 16MW Gombe coal-fired power plant into our forecasts, with reports indicating that the project's construction is underway and will be completed by 2019. However, we estimate that the total generation from the plant will be less than 0.1TWh and that the project will supply electricity to AshakaCem for their own use. As the power plant will only send off excess electricity to the grid, we expect that coal-fired power will only make up a negligible amount of total power output in Nigeria.

Risks to Outlook

In our view, there appears to be a number of risks to plans to bring coal capacity online. We reiterate, for example, that there is an absence of infrastructure in both the power and mining sectors and a lack of adequate, skilled local manpower, which will constrain expansion of the coal sector. Another problem is that the Buhari administration is reportedly only allowing companies that have licences to generate power to apply for licences to mine the required coal. This raises questions about whether power generation companies have the expertise and competencies to carry out mining, in addition to their core power generation activities. If they do not, then sourcing coal to fuel power plants will prove inhibitive or extremely costly.

With regard to costs and making a return on investment in coal power in Nigeria, there is also considerable uncertainty. In August 2016, the minister for Power, Works and Housing told the Conference of the National Association of Energy Correspondents in Lagos state that the NBET was working on a tariff for coal-to-power generation that would underpin future PPAs. The minister was, however, also quoted as saying that there was a deadlock in negotiations over the price paid to power providers under the PPA. Coal power generators reportedly wanted to set prices at NGN36/KWh, which is above levels set under Nigeria's Multi-Year Tariff Order (MYTO). Hiking the MYTO has already proven to be hugely controversial and the government will want to protect consumers from paying higher bills to cover the cost of coal generation, weighing down investor sentiment in the coal sector.

Nuclear Generation And Capacity Forecast

Key View: *We do not forecast Nigeria to have any nuclear capacity online over our 10-year forecast period as a result of the high costs and long construction times associated with nuclear power projects. As a result, we remain bearish on the prospects of power plants being built despite agreements having been signed with Russian nuclear firm, Rosatom.*

Latest Updates

- We maintain our forecasts that there will be no nuclear capacity online in Nigeria over our 10-year forecast period. This is owing to the very high costs and long construction times associated with nuclear power builds. While nuclear agreements have been signed with Russian firm, **Rosatom**, we expect that deficiencies in the Nigerian business environment and limited local nuclear expertise will delay plans to complete projects in the country.

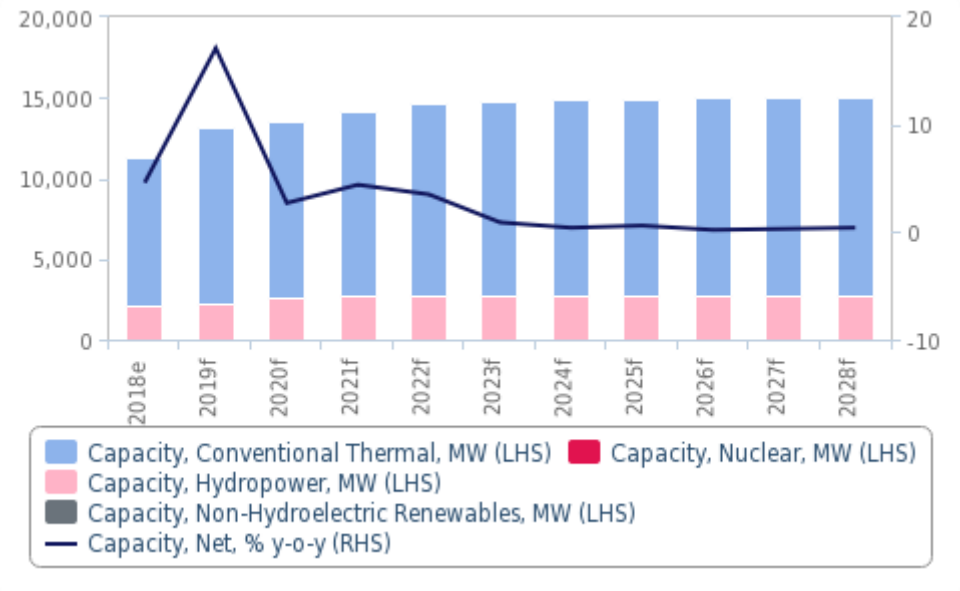
Structural Trends

Our core view is that Nigeria's plans to construct new nuclear power plants are unlikely to be realised within our 10-year forecast period, despite the signing of deals for the construction of new plants with Russia. While nuclear generation would be very useful in overcoming the country's dependence on natural gas and hydropower, we expect the cost and complexity of building new nuclear capacity, deficiencies in the country's business environment, safety concerns and a lack of domestic nuclear expertise to delay construction for many years.

With regard to Russian activity in the nuclear market, Russia signed its first intergovernmental nuclear cooperation agreement with Nigeria in 2009. This was followed by agreements on the design, construction, operation and decommissioning of an initial nuclear power plant - with a view to building up to four plants at a cost of USD20bn each. The plants will be financed by Rosatom, which will construct them under a build, operate and transfer agreement. They are planned to be built in pairs in Akwa Igbom and Kogi states (with the first in Kogi state to be finished by 2025) with a combined capacity of 4,800GW when all four are completed by 2035. Local media reports indicate that the deal gives Rosatom a majority controlling stake in the plants and a veto that it can use to stop the Nigerian government from signing any other nuclear deals with alternative vendors.

Taking the Russia deal into account, our view that new nuclear capacity is unlikely to be realised within our 10-year forecast period clearly is contrary to statements made by the Nigerian government, which wants nuclear power to be a key component of Nigeria's long-term plan to meet its energy targets for 2030. To this end, some progress has been made, with locations identified in Lagos, Ondo, Cross River and Adamawa states. Various institutional frameworks have also been put in place to help enable nuclear power in Nigeria to become a reality. The Nigerian Nuclear Regulatory Authority was, for example, set up by the Nuclear Safety and Radiation Protection Act No. 19 of 1995, with responsibility for nuclear safety and radiological protection regulation in Nigeria.

Total Capacity By Type
Nigeria (2018-2028)



e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

Hydropower Generation And Capacity Forecast

Key View: *Hydropower electricity output growth in Nigeria will come primarily from the 700MW Zungeru dam, which we expect to be completed by 2021. As a result of the high costs of large-scale hydropower developments and persistent delays, we believe the Nigerian government will focus on developing small-to-medium scale projects instead.*

Latest Updates

- The concession for five small-scale hydropower dams with a combined capacity of 16.49MW were reported in March to have been approved by the Nigerian government.
- The 30MW Gurara hydropower project also received its concession approval from the Nigerian government.
- We do not forecast that these projects will come online as of yet, as we await construction to start. However, we expect this will form part of a wider trend of small-to-medium scale hydroelectric projects being developed instead of more costly large-scale projects.

Structural Trends

Gas-fired power generation capacity has grown at the expense of new investment into hydropower in recent years, but the government is advancing plans to bring a significant amount of new power capacity online. The second phase of the NIPP is set to focus on hydropower (as well as transmission infrastructure) and this has the potential to lead to the construction of more hydropower capacity, although the only major project we are factoring into our forecasts is the 700MW Zungeru hydropower plant.

Flagship hydropower projects include:

- The 700MW Zungeru plant, which is to be constructed for USD1.29bn by the Chinese consortium of **Sinohydro** and **China National Electrical Engineering Corporation**. Construction started in July 2013 and the target completion date was initially end-2017, but we have accounted for delays and incorporated it into our forecasts from 2019 to 2021 (the project will come online in four phases of 175MW each). Notably, in November 2017, Niger state governor, Alhaji Abubakar Sani Bello, said he was optimistic that the plant will be completed for commissioning in 2019, following an unscheduled inspection of the power plant. The Export-Import Bank of China will finance 75% of the project, while the remainder will be funded by the Nigerian Power Sector Intervention Fund. **Alstom Hydro China** was awarded a USD78mn contract to provide electro-mechanical equipment and technical services. In March 2017, it was reported that the Federal Government had commenced the payment of compensation to the 98 communities affected by the project.
- The 3,050MW Mambilla hydroelectric plant in Taraba State, which will be built by **China Gezhouba Group**, Sinohydro and **CGCOC Group Co.**, with stakes of 45%, 35% and 20% respectively. The scope of work includes building four dams and 700km of transmission lines. If completed, Mambilla will become the largest hydropower project in Nigeria. However, to put existing delays to the project in context, initial feasibility studies on the Mambilla plant were first carried out in the 1980s.

The reason some of these projects are not incorporated into our forecasts is that there are numerous risks to the realisation, particularly environmental risks and problems when raising financing (although China's involvement mitigates some of the risks in this respect). To this end, the Zungeru and Mambilla projects were both originally due to come online in 2014.

We remain more optimistic about the development of small-scale hydropower facilities, which negate many of the problems associated with hydro megaprojects and have much shorter lead times. The United Nations Industrial Development Organisation (UNIDO) announced in September 2015 that it has budgeted USD2.6bn for the development of small hydropower plants in Nigeria. The UNIDO Country Representative in Nigeria disclosed that UNIDO had identified around 300 potential small hydropower sites in the country and had studied detailed project reports for over 20 of these sites, meaning they are ready for investment.

The Nigerian government stated in November 2018 that the country has a potential 12.2GW of total hydropower potential. Of this total, we estimate that the country has only developed 2GW, though the government has stated it is planning to make further use of this potential through new hydropower projects.

This points to a potentially positive development for new hydropower projects in Nigeria, though we are maintaining our forecasts for hydropower capacity growth in Nigeria until we see evidence of new projects being planned and constructed. Over our forecast period to 2028, we currently expect that only the 700MW from the Zungeru hydropower plant will come online in four phases from 2019 to 2021.

We also note that there are moves toward developing small-to-medium scale hydropower projects in Nigeria instead. It was reported that the Nigerian government in March 2019 had given concession approval for five separate small-scale hydropower projects with a combined capacity of 16.49MW, as well as the slightly larger 30MW Gurara project. While we do not yet factor these projects into our forecasts, we note that it does point to an upside in our forecasts as we see developments being focused on smaller projects instead to avoid the high costs of large-scale hydroelectric power plants.

Renewables Generation And Capacity Forecast

Key View: *The contribution of non-hydropower renewables to Nigeria's total electricity output will remain below 1% over our 10-year forecast period owing to previous delays on projects, disagreements over tariffs and financing issues.*

Latest Updates

- The EU, in conjunction with Nigerian firm, **All On**, will reportedly provide EUR30mn for the development of small-scale off-grid renewable power projects in Nigeria. This will be done in order to promote sustainable electrification while also being aimed at grid modernisation.
- We are maintaining our bearish forecasts for the development of large-scale non-hydropower renewable projects in Nigeria owing to a lack of progress on planned projects as well as financing concerns. We expect that renewable electricity generation will account for less than 0.5% of the country's power output over our 10-year forecast period.

Structural Trends

Despite some early signs that the Buhari administration will push solar expansion so as to reduce the impact of gas shortages on electricity supply, the country is starting from a very low base in terms of renewables expansion. We expect ongoing efforts to establish a renewables policy and implement a robust regulatory and institutional framework to take time, limiting appeal among investors. Investor interest is also likely to be curtailed due to the difficult operating environment across all areas of the Nigerian power sector and the country's ongoing economic challenges.

As such, we have not factored any planned large-scale renewables capacity into our power sector forecasts at this stage, and we will not do so until we see signs that projects are moving towards realisation. Under our conservative scenario, we forecast that Nigeria will have less than 50MW of renewable-based capacity by the end of our forecast period in 2028 - which will account for less than 0.5% of the country's total electricity generation. We maintain that gas and hydropower will play a much bigger role than renewables in the power mix, although there is clearly significant upside risk to our solar power forecasts - in line with some project announcements.

Momentum Building In The Solar Sector

To this end, we are seeing signs that the solar sector is garnering more interest from investors, meaning that the segment has the potential to emerge as a relative bright spot in a market where electricity shortages remain a huge constraint to faster economic growth. In line with this uptick in investor interest in solar, Dubai-based solar power developer and asset manager, **Phanes Group**,

announced in November 2016 that it had acquired and will co-develop three 100MW grid-connected solar power plants in Nigeria. Similarly, in August 2016, **Scatec Solar** signed an agreement with Canadian renewable energy group **CDIL** and Nigerian consulting firm **BPS** to build, own and operate the 100MW Nova Scotia Power project in Jigawa.

These developments build on reports that a number of private companies had signed a combined total of 14 PPAs with state-backed NBET in July 2016. The combined capacity of the projects that will be developed under the PPAs is in the region of 1,200MW, and if delivered would go some way to hitting the government's target for 2,000MW of installed renewables capacity by 2020.

Although we have adopted a cautious outlook for solar capacity expansion, we highlight that the uptick in pledged investment does create upside risks to our forecasts for Nigeria to have less than 40MW of solar capacity in place by 2028. We expect investor interest to continue to grow due to a combination of political support and ongoing problems in the gas sector. To this end, the announcement of planned solar projects aligns with the APC party's election manifesto, which stated that Nigeria needs to rely more heavily on renewable energy in order to boost electrification rates and bolster energy security.

In our view, the latter point is particularly pertinent and underpins the rationale for greater investment in solar projects, which have relatively short lead times and a different risk profile to gas power plants. Nigeria's gas-heavy power sector has, for example, been severely compromised by militant attacks to pipeline infrastructure in the Niger Delta over 2016 and this will certainly have focused minds with regard to energy mix diversification. In this environment, solar assets are an attractive alternative and will become more attractive as development and technology costs continue to fall.

In addition, we have also seen the government move to incentivise investment and expect continued policy support to generate more investor interest as the Nigerian economy has moved out of recession. We highlight, for example, that the NERC approved FiT regulations in 2015 and the government is also reported to be exploring the potential for a competitive tendering process. It also put in place provisions whereby distribution companies will ultimately be required to source 50% of the electricity they buy from renewable sources, with the remainder to be bought by NBET. Our long-term view is that the current government is slowly putting in place some of the mechanisms that are needed to spur growth in solar capacity, although ongoing efforts to establish a renewables policy and implement a robust regulatory and institutional framework will take time.

Risks Remain Despite Improving Sentiment

At this stage, we reiterate that limited domestic expertise, the broader economic malaise and insufficient grid infrastructure will stop a widespread investment trend from taking root. From an economic perspective, a lack of liquidity and the ongoing foreign exchange crisis are likely to hamper the growth of a domestic solar industry as investors find it harder to access financing and pay for imported equipment respectively. Furthermore, we highlight that the PPAs are priced in US dollars, while consumers pay for electricity in naira. Exchange rate volatility could be a problem and further depreciation against the dollar could raise the cost of electricity for end users, with the tariffs already proving contentious among the Nigerian population.

As such, we are maintaining our downbeat forecasts but do highlight that we will revisit them if we see signs that the projects outlined in this analysis start progressing towards realisation. This could be spearheaded by investors like Phanes Group and Scatec Solar, with some Nigerian players to follow as the economic problems reduce gradually over 2019.

Electricity Generation And Power Generating Capacity

TOTAL ELECTRICITY GENERATION DATA AND FORECASTS (NIGERIA 2017-2022)						
Indicator	**2017e**	**2018e**	**2019f**	**2020f**	**2021f**	**2022f**
Generation, Total, TWh	25.7	23.3	24.0	26.2	27.9	29.0
Generation, Thermal, % of total generation	77.455	75.050	75.769	71.767	69.676	70.452
Generation, Coal, TWh	0.000	0.000	0.020	0.021	0.022	0.022
Generation, Coal, % y-o-y				7.210	2.510	0.040
Generation, Coal, % of total electricity generation	0.000	0.000	0.083	0.082	0.079	0.076
Generation, Natural Gas, TWh	19.89	17.48	18.02	18.65	19.25	20.27
Generation, Natural Gas, % change y-o-y	-3.5	-12.1	3.1	3.5	3.2	5.3
Generation, Natural Gas, % of total electricity generation	77.455	75.050	75.143	71.181	69.115	69.906
Generation, Oil, TWh	0.000	0.000	0.130	0.132	0.134	0.137
Generation, Oil, % change y-o-y				1.8	1.5	1.7
Generation, Oil, % of total electricity generation	0.000	0.000	0.542	0.505	0.482	0.471
Generation, Nuclear, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Nuclear, % of total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Hydropower, TWh	5.746	5.763	5.765	7.349	8.396	8.518
Generation, Hydropower, % change y-o-y	0.800	0.300	0.020	27.490	14.240	1.450
Generation, Hydropower, % of total electricity generation	22.382	24.752	24.033	28.045	30.145	29.372
Hydro-Electric Pumped Storage, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Hydro-Electric Pumped Storage, % total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Non-Hydropower Renewables, TWh	0.042	0.046	0.047	0.049	0.050	0.051
Generation, Non-Hydropower Renewables, % change y-o-y	7.1	10.1	2.8	3.3	2.0	1.9
Generation, Non-Hydropower Renewables, % of total electricity generation	0.2	0.2	0.2	0.2	0.2	0.2

e/f = Fitch Solutions estimate/forecast. Source: EIA, IEA, Fitch Solutions

TOTAL ELECTRICITY GENERATION DATA AND FORECASTS (NIGERIA 2023-2028)						
Indicator	**2023f**	**2024f**	**2025f**	**2026f**	**2027f**	**2028f**
Generation, Total, TWh	30.0	30.5	31.3	32.1	33.0	33.3
Generation, Thermal, % of total generation	71.420	72.038	72.521	73.120	73.617	73.819
Generation, Coal, TWh	0.022	0.022	0.022	0.022	0.022	0.022
Generation, Coal, % y-o-y	0.070	0.020	0.010	0.020	0.070	0.120
Generation, Coal, % of total electricity generation	0.073	0.072	0.070	0.069	0.067	0.066
Generation, Natural Gas, TWh	21.23	21.82	22.52	23.31	24.10	24.41
Generation, Natural Gas, % change y-o-y	4.8	2.8	4.0	4.1	4.2	4.4
Generation, Natural Gas, % of total electricity generation	70.894	71.515	72.016	72.631	73.142	73.353
Generation, Oil, TWh	0.136	0.137	0.136	0.135	0.134	0.133
Generation, Oil, % change y-o-y	-0.7	1.2	-1.0	1.2	-0.3	2.2
Generation, Oil, % of total electricity generation	0.453	0.450	0.435	0.420	0.408	0.399

Indicator	2023f	2024f	2025f	2026f	2027f	2028f
Generation, Nuclear, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Nuclear, % of total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Hydropower, TWh	8.507	8.478	8.538	8.568	8.634	8.650
Generation, Hydropower, % change y-o-y	-0.120	-0.350	0.710	0.350	0.770	0.190
Generation, Hydropower, % of total electricity generation	28.402	27.781	27.298	26.694	26.200	25.993
Hydro-Electric Pumped Storage, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Hydro-Electric Pumped Storage, % total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Non-Hydropower Renewables, TWh	0.053	0.055	0.057	0.060	0.060	0.062
Generation, Non-Hydropower Renewables, % change y-o-y	4.5	3.7	2.4	5.9	0.8	3.5
Generation, Non-Hydropower Renewables, % of total electricity generation	0.2	0.2	0.2	0.2	0.2	0.2

f = Fitch Solutions forecast. Source: EIA, Fitch Solutions

ELECTRICITY GENERATING CAPACITY DATA AND FORECASTS (NIGERIA 2017-2022)

Indicator	2017e	2018e	2019f	2020f	2021f	2022f
Capacity, Net, MW	10,792.2	11,291.2	13,218.7	13,571.4	14,165.3	14,659.7
Capacity, Net, % y-o-y	0.8	4.6	17.1	2.7	4.4	3.5
Capacity, Conventional Thermal, MW	8,728.0	9,216.0	10,985.0	10,985.0	11,385.0	11,878.3
Capacity, Conventional Thermal, % y-o-y	1.0	5.6	19.2	0.0	3.6	4.3
Capacity, Conventional Thermal, % of total capacity	80.9	81.6	83.1	80.9	80.4	81.0
Capacity, Nuclear, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % of total capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Hydropower, MW	2,042.2	2,042.2	2,199.2	2,549.2	2,742.2	2,742.2
Capacity, Hydropower, % y-o-y	0.0	0.0	7.7	15.9	7.6	0.0
Capacity, Hydropower, % of total capacity	18.9	18.1	16.6	18.8	19.4	18.7
Capacity, Non-Hydroelectric Renewables, MW	22.0	33.0	34.5	37.2	38.1	39.2
Capacity, Non-Hydroelectric Renewables, % y-o-y	1.9	50.0	4.5	7.9	2.4	2.9
Capacity, Non-Hydroelectric Renewables, % of total capacity	0.2	0.3	0.3	0.3	0.3	0.3

e/f = Fitch Solutions estimate/forecast. Sources: EIA, IRENA, Fitch Solutions

ELECTRICITY GENERATING CAPACITY DATA AND FORECASTS (NIGERIA 2023-2028)

Indicator	2023f	2024f	2025f	2026f	2027f	2028f
Capacity, Net, MW	14,788.7	14,849.0	14,942.9	14,970.9	15,014.1	15,075.6
Capacity, Net, % y-o-y	0.9	0.4	0.6	0.2	0.3	0.4
Capacity, Conventional Thermal, MW	12,005.4	12,064.2	12,157.1	12,182.6	12,225.3	12,285.2
Capacity, Conventional Thermal, % y-o-y	1.1	0.5	0.8	0.2	0.4	0.5
Capacity, Conventional Thermal, % of total capacity	81.2	81.2	81.4	81.4	81.4	81.5
Capacity, Nuclear, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % of total capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Hydropower, MW	2,742.2	2,742.2	2,742.2	2,742.2	2,742.2	2,742.2
Capacity, Hydropower, % y-o-y	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Hydropower, % of total capacity	18.5	18.5	18.4	18.3	18.3	18.2

Indicator	2023f	2024f	2025f	2026f	2027f	2028f
Capacity, Non-Hydroelectric Renewables, MW	41.1	42.6	43.6	46.1	46.7	48.2
Capacity, Non-Hydroelectric Renewables, % y-o-y	4.9	3.5	2.3	5.7	1.3	3.3
Capacity, Non-Hydroelectric Renewables, % of total capacity	0.3	0.3	0.3	0.3	0.3	0.3

f = Fitch Solutions forecast. Source: EIA, IRENA, Fitch Solutions

Electricity Consumption

Gas supply constraints, inefficient T&D infrastructure and delays to the construction of new capacity will weigh on generation growth and, by extension, curb consumption. We forecast average annual growth of 3.8% in electricity consumption between 2019 and 2028. While this growth rate might seem high, we expect that it will be an increase from previously lower, and even declining rates. The rate at which consumption will grow is dependent on Nigeria's ability to develop, maintain and fuel its installed capacity.

TOTAL ELECTRICITY CONSUMPTION DATA AND FORECASTS (NIGERIA 2017-2022)

Indicator	2017e	2018e	2019f	2020f	2021f	2022f
Consumption, Net Consumption, TWh	20.8	18.0	18.5	19.2	20.6	21.2
Consumption, Net Consumption, % y-o-y	-3.2	-13.5	2.9	3.6	7.5	3.0
Consumption, Net Consumption, KWh per capita	108.8	91.8	92.0	92.9	97.4	97.7

e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

TOTAL ELECTRICITY CONSUMPTION DATA AND FORECASTS (NIGERIA 2023-2028)

Indicator	2023f	2024f	2025f	2026f	2027f	2028f
Consumption, Net Consumption, TWh	21.5	21.8	22.9	23.4	24.4	25.3
Consumption, Net Consumption, % y-o-y	1.6	1.3	4.2	4.3	4.5	4.6
Consumption, Net Consumption, KWh per capita	96.8	95.6	98.0	97.9	99.5	100.5

f = Fitch Solutions forecast. Source: EIA, Fitch Solutions

Transmission And Distribution, Imports And Exports

Key View: *Nigeria's power sector will lose an annual average of over 15% of electricity generated over our 10-year forecast period, owing to an inefficient grid network. Artificially low electricity tariffs and a culture of non-payment will further complicate efforts to generate revenue and fund efforts to maintain and upgrade the grid.*

Latest Updates

- We forecast Nigeria's total T&D losses to be at an annual average of over 15% of the country's electricity output. These losses reflect the need for increased investment and maintenance of the country's electricity network.
- Our view is further underlined by reports in March that the Transmission Company of Nigeria (TCN)'s managing director stated that investment attention needs to be focused on expanding the country's electricity distribution capacity in order to accommodate increases in generation.

Structural Trends

Nigeria's state-owned TCN is responsible for the national power transmission segment. One of the biggest challenges facing the government's attempts to secure a reliable power supply will be ensuring that TCN is transformed into a reliable grid company, and incorporate it successfully into the power sector supply chain. Ultimately, we expect TCN to be opened up to private players, due to

the huge amount of investment required. However, we highlight that TCN's attractiveness will depend on astute management in a difficult operating environment.

TCN was formerly part of PHCN, but unlike other successor companies has remained under government control - with management overseen by Canadian firm **Manitoba Hydro International** (MHI) between 2012 and July 2016. MHI was brought in to improve training and introduce management processes, as well as to undertake knowledge transfer, all of which are needed to boost the Nigerian transmission segment and ensure it functions in a way that supports private investment across the broader power sector. The MHI management contract was, however, controversial due to limited progress in improving electricity supply amid reports of disagreements between MHI employees and their Nigerian counterparts within TCN, and wider concerns that strategic infrastructure was being placed under foreign control.

Against this backdrop, the Nigerian government terminated its contract with MHI in August 2016. Despite MHI having lobbied for contract extensions, management of TCN is now back in government hands amid reports that the state will manage the firm as an interim measure - until it can release it under a concession agreement with private investors at a later date. There has been no official statement as to why the government did not renew the deal, but Nigeria's House of Representatives said in June 2016 that it intended to launch a probe into the continued poor performance of TCN.

The managing director of TCN said on August 22 2016 that TCN's ongoing five-year expansion plan, under which the company aims to expand transmission capacity to 11,500MW by 2019, will require a USD7.5bn investment. The federal government has committed to providing USD1.5bn to help realise the plan and improve electricity supply infrastructure.

It was reported in July 2018 that Nigeria's power sector had lost a total of 3,019MW of capacity during the same month as a result of gas shortages at eight GENCOs and frequency variations causing issues with load demand on the grid. This further highlights the challenges faced by the electricity T&D sector, where both issues on the generation side as well as the capacity to handle different loads on the grid affect the overall stability of electricity supply.

It was reported in January 2019 that, under the NIPP, NDPHC had completed over 2,100km of 330KV and 800km of 132KV transmission lines. While we note that this is a positive sign for improvements in the grid network as a whole, we still expect overall electricity losses to be high (at an annual average rate of over 15% from 2019 to 2028). The Nigerian national grid was reported to have suffered 12 shutdowns over 2018 in total, which highlights the current vulnerable nature of the sector. We note that problems such as liquidity issues, artificially low electricity prices and a culture of non-payment among many consumers will have to be addressed for further improvements to be realised in the country's electricity sector.

Transmission Company Of Nigeria Remains A Major Hindrance To Greater Electrification

In the meantime, the poor state of TCN infrastructure remains a weak link in the power sector, with financing and implementing major improvements one of the biggest tasks facing President Buhari in the power sector. With public finances to remain constrained due to the fall in global oil prices (the petroleum sector accounts for 70% of Nigeria's fiscal revenue), the government will be limited with regard to the amount it can invest in the grid - and is currently unclear as to where TCN will source the funding it needs.

In the longer term, we believe the deployment of the PPP model, which was mooted in September 2015, or even the break-up and privatisation of TCN remain likely - as greater involvement of the private sector will enable TCN to gain access to much-needed private capital. To this end, reports emerged in August 2016 that indicated **State Grid Corporation of China** might be interested in working with TCN.

DISCOs Under Strain

Meanwhile, the problems facing DISCOs in Nigeria continue to mount with debts rising as the companies struggle to access power due to gas shortages at generation companies, and struggle collect payment for what little electricity they can provide. DISCOs are

also suffering financially due to a culture of non-payment for electricity.

DISCOs claim that government ministries, agencies and departments owe unpaid debts, and that 40-70% of Nigerians do not pay their electricity bills depending on the region. An audit report of debt by Federal Government ministries, departments and agencies revealed that the top 100 buyers of electricity in Nigeria owed a combined NGN59.3bn (USD164mn) - with defence, military and security agencies owing NGN51bn (USD140mn).

This dynamic has had a significant impact on Nigeria's government-owned power sector clearinghouse, NBET. NBET is responsible for buying power from IPPs and then reselling the power to distribution companies and other eligible customers, acting as an intermediary that can ensure contracts are fairly priced when electricity is sold on to the distribution companies. However, cash liquidity problems have meant that the DISCOs have been unable to pay NBET enough to allow it to meet its contractual obligations with Nigeria's GENCOs. The GENCOs cannot then pay their gas suppliers, equipment suppliers, banks and other partners - leading to payment shortfalls.

Making matters worse, it is far from clear that recent changes to government policies relating to the DISCOs will solve any of these liquidity problems. The DISCOs have reportedly declared force majeure after the NERC stated that eligible electricity customers will now be able to bypass the distribution companies completely and buy electricity directly from the generation companies themselves. The government has pursued this legal change in an effort to open up the electricity supply market to greater numbers of third parties and create competition for the underperforming DISCOs. The DISCOs have, however, argued that the change prevents them from fulfilling their obligations under the performance agreements they have signed with the Bureau of Public Enterprises. Amid confusion about how exactly consumers will bypass the DISCOS and the TCN, the government will have to allay concerns that the policy will not lead to the collapse of the electricity grid.

ELECTRIC POWER T&D LOSSES DATA AND FORECASTS (NIGERIA 2017-2022)

Indicator	2017e	2018e	2019f	2020f	2021f	2022f
Electric power distribution losses, TWh	4.7	4.6	4.6	4.6	4.5	4.8
Electric power distribution losses, % of output	18.4	19.7	19.0	17.6	16.3	16.5

e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

ELECTRIC POWER T&D LOSSES DATA AND FORECASTS (NIGERIA 2023-2028)

Indicator	2023f	2024f	2025f	2026f	2027f	2028f
Electric power distribution losses, TWh	4.7	4.6	4.3	4.5	4.5	4.3
Electric power distribution losses, % of output	15.8	15.0	13.9	14.1	13.6	12.9

f = Fitch Solutions forecast. Source: EIA, Fitch Solutions

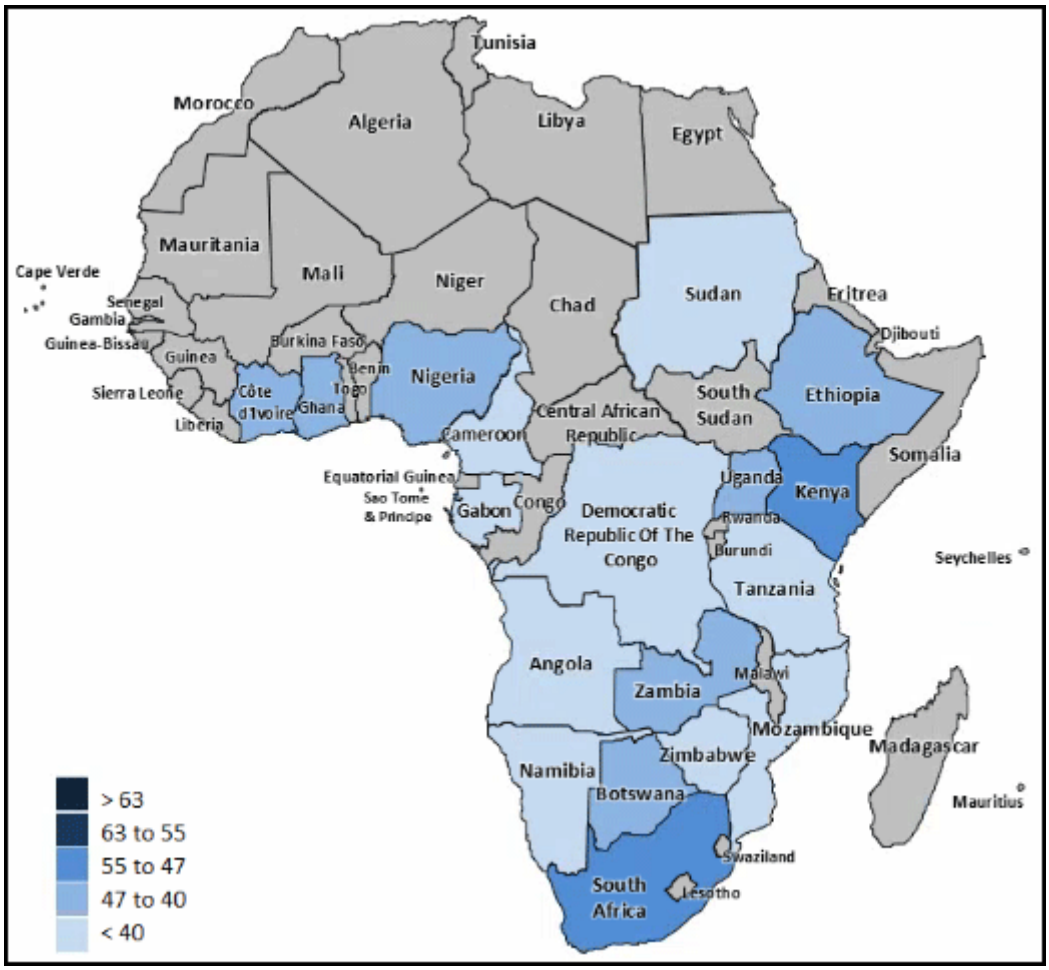
Industry Risk/Reward Index

SSA Power Risk/Reward Index: Limited Power Capacity Dampens Rewards Across Region

***Key View**: With the exception of South Africa, the countries in the SSA region have overall RRI profiles ranked below the global average as a result of poor political and economic risk outlooks and low Industry Rewards from limited domestic power capacity. We highlight how the small nature of most SSA power markets means that forecast changes result in notable in ranking shifts. This quarter we focus on Nigeria, Botswana and Tanzania.*

Regional Rewards Hampered By Limited Power Capacity Growth

Sub-Saharan Africa Power Risk/Reward Index Heat Map



Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Risk/Reward Index

Main Regional Features And Latest Updates

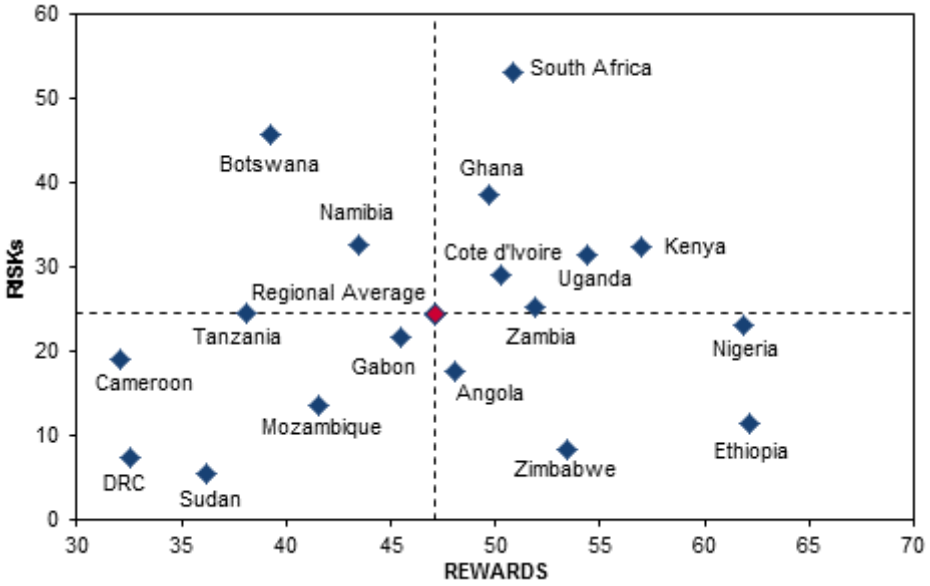
- Owing to the developing status of most countries in the region, all of the Sub-Saharan African (SSA) countries in our Power Risk/Reward Index (RRI) coverage of the region, with the exception of South Africa, have an overall RRI ranking below the global average. This is as a result of poor political and economic risk profiles, high levels of state dominance in the economy and a need for further infrastructure investment.
- **South Africa** remains the only country in SSA with power generation output above 25TWh as of end-2018, with its 232TWh

output over the year, and we highlight that the limited power generating capacity elsewhere in the region means that small changes in power forecasts can cause shifts in the regional rankings as Industry Rewards are affected.

- **Nigeria** has improved its regional ranking by three spots as we expect increased output from gas-fired power capacity over the 2019-2023 period, while the 700MW Zungeru hydropower project will also add to generation growth.
- Meanwhile, both **Ghana** and **Botswana**, while both regarded as politically stable, have seen a drop in their RRI rankings as a result of a reduction in Industry Rewards. In Ghana's case, we have reduced our forecasts for power output owing to contract cancellations at the 340MW Kpone power plant while we do not expect any significant growth in Botswana's power capacity at all for the 2019-2023 period.
- **Tanzania** has dropped five places in the regional rankings as we do not expect any new power capacity to come online over the next five years, while the country's Risks profile has been deteriorating owing to the government introducing policies that have been seen as more authoritarian. We expect that thermal power project developers being asked to resubmit previously approved bids, only to have been rejected, will further weigh down investor confidence.

Botswana Drops Because Of Limited Rewards

Sub-Saharan Africa Power Risk/Reward Index

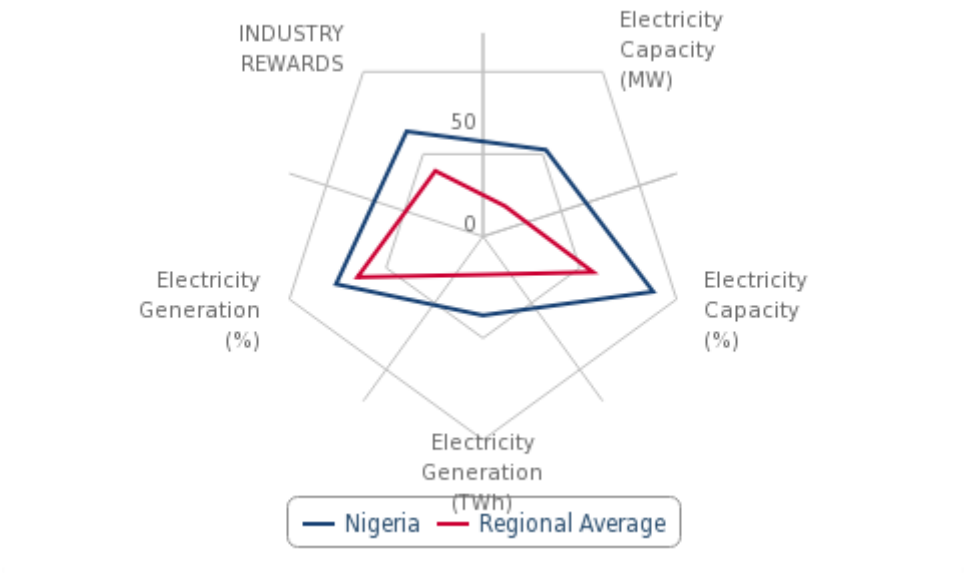


Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Risk/Reward Index

This quarter we highlight how the nature of most SSA power markets, with limited power generating capacity, means that small changes in our power forecasts can result in quick changes in the ranking as Industry Rewards are affected. The majority of SSA countries, as developing markets, are characterised by poor Risk profiles owing to both political and economic risks present while state-intervention in most markets remains high. Most countries also suffer from high levels of transmission and distribution losses, both because of ageing and inefficient grid networks and insufficient domestic electricity output. Strong real GDP and population growth rates in most markets point to an upside for power project developers as there is likely to be a lot of unmet power demand in the region going forward.

Nigeria Outperforms Regional Average For Industry Rewards

Nigeria & Regional Average Industry Rewards & Sub-Component Rankings



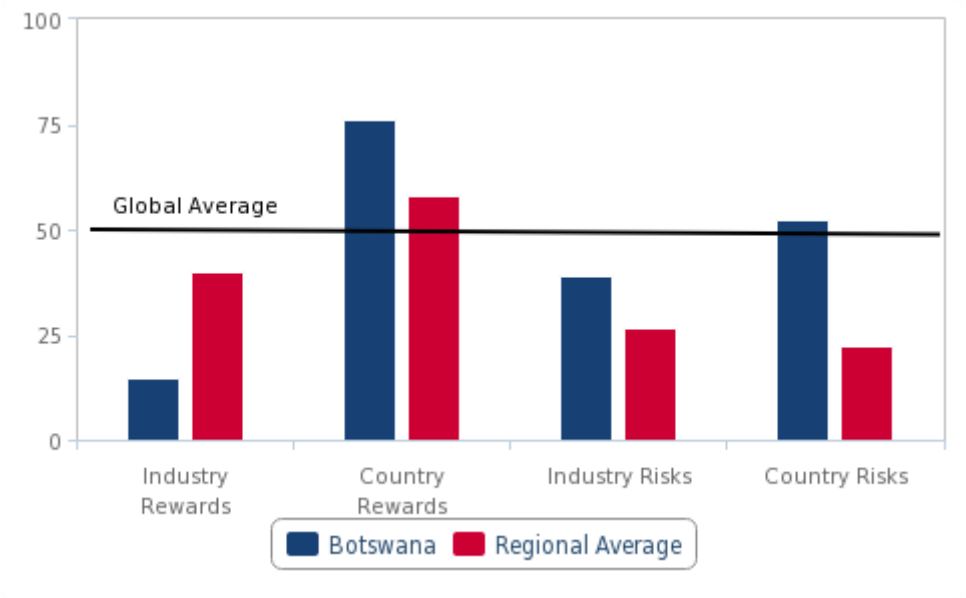
Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index.

Nigeria has moved up three spots in the regional RRI this quarter, now in third place behind only **South Africa** and **Kenya**, due to an improvement in its Industry Rewards ranking. This boost comes increased electricity generation, which we expect to come from the 700MW Zungeru hydropower plant and improvements in gas-fired power output over the 2019-2023 period.

Meanwhile, although maintaining its regional position just behind Nigeria, **Ghana** has dropped 10 spots in the global RRI, now ranking 74th. This is because we have reduced our forecasts for its electricity generation following the cancellation of the construction contract for the 340MW Kpone combined cycle power plant (*see 'Kpone Contract Cancellation Raises Short-Term Risks For Ghana Gas Power', January 31*). Although the ensuing legal dispute over the power project as well as delays to other projects would cause some concern to investors, Ghana has the best Political Risk profile in SSA with strong democratic credentials and is tied with **Côte d'Ivoire** for the most open competitive landscape in the region. We expect that this will result in the country remaining an attractive destination for investment.

Botswana Industry Profile Lagging Behind Country Profile

Botswana & SSA Power RRI



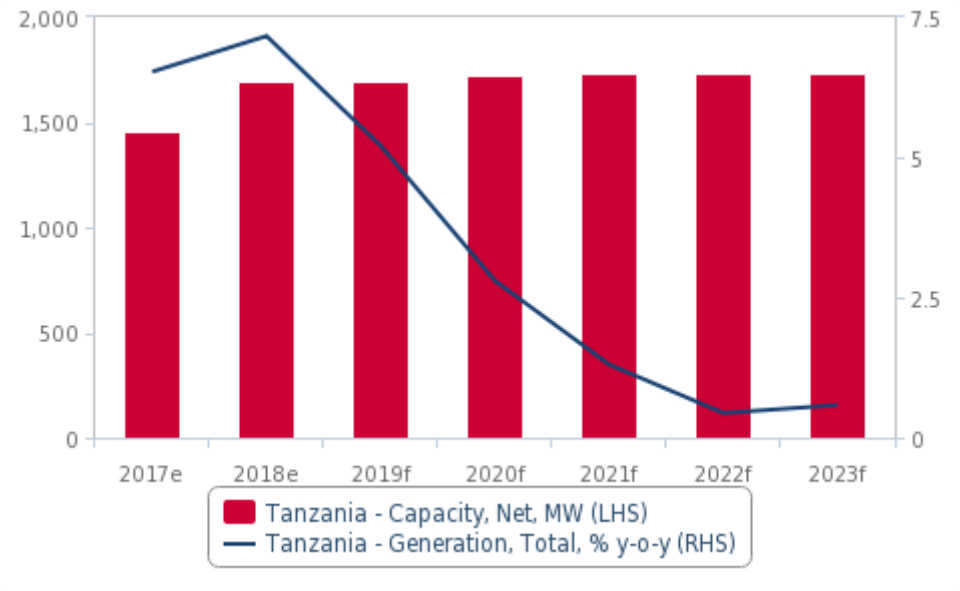
Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index.

Botswana has dropped six spots in the regional RRI as a result of a lack of power sector growth in the country. In the previous quarter's analysis we highlighted that Botswana will fall in the rankings because, while the country had the best overall Country Risk and Country Rewards profiles in the region, a lack of power projects coming online in a market with an already small domestic capacity will result in a poor Industry Rewards showing (*see 'SSA Power RRI: Low-Risk Botswana Top Despite Limited Power Sector Growth', January 14*). The country is now ranked 7th, below **Ethiopia** for the SSA region this quarter.

South Africa has, in turn, moved back up to the top of the regional rankings since last quarter owing to its large power generating capacity and relatively strong performing Industry Risks (South Africa is the only country in SSA that ranks above the global average for electricity generation and its overall Risks profile).

Lack Of Power Sector Growth In Tanzania Post-2018 Impacts Rewards Profile

Tanzania Electricity Capacity MW (LHS) & Power Generation Growth y-o-y (RHS)



e/f = Fitch Solutions estimate/forecast. Source: EIA, IEA, IRENA, Fitch Solutions

As we are not forecasting any new capacity to come online in **Tanzania** for the 2019 to 2023 period after the completion of the 240MW Kinyerezi II gas-fired power plant, the country dropped five spots to 14th in the regional ranking. In recent quarters, our Country Risk team highlights that policies that have been regarded as increasingly authoritarian from the government have seen some deterioration in relations with Western donors and multilateral financial institutions, particularly the World Bank (*see 'Authoritarian Policies In Tanzania Will Harm Donor Flows And Investment', February 25*). Reports of thermal power project developers having their bids rejected after being asked to resubmit their originally approved bids will also negatively impact investor confidence.

SUB-SAHARAN AFRICA POWER RISK/REWARD INDEX

Rewards	Industry Rewards	Country Rewards	REWARDS	Industry Risks	Country Risks	RISKs	RRI	Regional Rank	Global Rank
South Africa	57.8	40.5	50.9	62.2	44.0	53.1	51.8	1	55
Kenya	49.6	68.0	56.9	38.4	26.4	32.4	47.1	2	65
Nigeria	63.8	59.1	61.9	24.0	22.3	23.2	46.4	3	70
Ghana	44.8	57.1	49.7	31.1	46.0	38.6	45.3	4	74
Uganda	52.4	57.3	54.4	42.0	21.0	31.5	45.2	5	75
Ethiopia	64.4	58.8	62.2	12.4	10.3	11.4	41.9	6	85
Botswana	14.7	76.1	39.2	39.1	52.5	45.8	41.8	7	86
Cote d'Ivoire	51.5	48.5	50.3	33.2	24.6	28.9	41.7	8	87
Zambia	56.0	45.7	51.9	35.5	14.8	25.2	41.2	9	88
Namibia	33.2	58.9	43.5	32.9	32.3	32.6	39.1	10	92
Gabon	39.7	54.3	45.5	20.1	23.1	21.6	36.0	11	98
Angola	53.9	39.4	48.1	14.7	20.5	17.6	35.9	12	99
Zimbabwe	48.5	60.8	53.4	11.8	4.5	8.2	35.3	13	100
Tanzania	17.0	69.6	38.1	22.9	26.0	24.5	32.6	14	105
Mozambique	24.8	66.8	41.6	17.4	9.5	13.4	30.3	15	110
Cameroon	9.9	65.3	32.1	21.5	16.5	19.0	26.8	16	112
Sudan	22.2	57.1	36.2	9.1	1.4	5.3	23.8	17	116
DRC	11.4	64.2	32.5	10.9	3.6	7.2	22.4	18	117
Global Average	50.0	50.0	50.0	50.0	50.0	50.0	50.0	~	~
Regional Average	39.8	58.2	47.1	26.6	22.2	24.4	38.0	~	~

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index

SUB-SAHARAN AFRICA POWER INDUSTRY REWARDS

Rewards	Electricity Capacity (MW)	Electricity Capacity (%)	Electricity Generation (TWh)	Electricity Generation (%)	Industry Rewards	REWARDS
South Africa	81.0	56.0	81.9	12.1	57.8	50.9
Kenya	13.8	77.6	13.8	93.1	49.6	56.9
Nigeria	52.6	87.9	38.8	75.9	63.8	61.9
Ghana	20.7	65.5	22.4	70.7	44.8	49.7
Uganda	5.2	100.0	4.3	100.0	52.4	54.4
Ethiopia	30.2	99.1	29.3	99.1	64.4	62.2
Botswana	1.7	6.0	1.7	49.1	14.7	39.2
Cote d'Ivoire	16.4	94.8	14.7	80.2	51.5	50.3
Zambia	18.1	88.8	20.7	96.6	56.0	51.9
Namibia	0.0	63.8	0.0	69.0	33.2	43.5
Gabon	0.9	74.1	0.9	82.8	39.7	45.5
Angola	28.4	66.4	23.3	97.4	53.9	48.1
Zimbabwe	9.5	81.9	7.8	94.8	48.5	53.4
Tanzania	2.6	19.0	8.6	37.9	17.0	38.1
Mozambique	11.2	9.5	26.7	51.7	24.8	41.6
Cameroon	4.3	16.4	10.3	8.6	9.9	32.1
Sudan	24.1	12.1	21.6	31.0	22.2	36.2
DRC	10.3	6.0	12.1	17.2	11.4	32.5
Global Average	50.0	50.0	50.0	50.0	50.0	50.0
Regional Average	18.4	56.9	18.8	64.8	39.8	47.1

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index

SUB-SAHARAN AFRICA POWER COUNTRY REWARDS

Rewards	Real GDP Growth (%)	Labour Market Risk	Electricity Import Dependence	Population Growth (%)	Country Rewards	REWARDS
South Africa	25.0	35.3	42.2	59.5	40.5	50.9
Kenya	84.5	18.5	78.4	90.5	68.0	56.9
Nigeria	67.2	60.3	15.5	93.1	59.1	61.9
Ghana	97.4	38.8	6.0	86.2	57.1	49.7
Uganda	92.2	26.7	11.2	99.1	57.3	54.4
Ethiopia	100.0	16.4	31.0	87.9	58.8	62.2
Botswana	79.3	48.3	97.4	79.3	76.1	39.2
Cote d'Ivoire	94.0	4.3	4.3	91.4	48.5	50.3
Zambia	56.9	8.6	20.7	96.6	45.7	51.9

Rewards	Real GDP Growth (%)	Labour Market Risk	Electricity Import Dependence	Population Growth (%)	Country Rewards	REWARDS
Namibia	20.7	29.7	100.0	85.3	58.9	43.5
Gabon	37.1	1.7	94.0	84.5	54.3	45.5
Angola	25.9	7.8	24.1	100.0	39.4	48.1
Zimbabwe	61.2	3.4	91.4	87.1	60.8	53.4
Tanzania	91.4	13.8	75.9	97.4	69.6	38.1
Mozambique	89.7	0.9	81.9	94.8	66.8	41.6
Cameroon	81.9	15.5	71.6	92.2	65.3	32.1
Sudan	70.7	0.0	68.1	89.7	57.1	36.2
DRC	80.2	6.0	72.4	98.3	64.2	32.5
Global Average	50.0	50.0	50.0	50.0	50.0	50.0
Regional Average	69.7	18.7	54.8	89.6	58.2	47.1

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index

SUB-SAHARAN AFRICA POWER INDUSTRY RISKS

Risks	Competitive Landscape	Financial Barriers	Energy Policy	Legal Risks	T&D Losses	Industry Risks	RISKs
South Africa	74.6	76.7	62.1	45.7	51.7	62.2	53.1
Kenya	64.2	44.0	45.7	29.3	8.6	38.4	32.4
Nigeria	47.4	19.0	20.7	7.8	25.0	24.0	23.2
Ghana	83.2	16.4	9.5	32.8	13.8	31.1	38.6
Uganda	74.6	13.8	31.9	19.8	69.8	42.0	31.5
Ethiopia	13.8	2.6	20.7	19.0	6.0	12.4	11.4
Botswana	74.6	40.5	9.5	52.6	18.1	39.1	45.8
Cote d'Ivoire	83.2	10.3	9.5	36.2	26.7	33.2	28.9
Zambia	47.4	15.5	20.7	31.9	62.1	35.5	25.2
Namibia	47.4	51.7	9.5	40.5	15.5	32.9	32.6
Gabon	74.6	6.0	9.5	6.0	4.3	20.1	21.6
Angola	26.7	12.1	2.2	1.7	31.0	14.7	17.6
Zimbabwe	26.7	17.2	2.2	2.6	10.3	11.8	8.2
Tanzania	47.4	7.8	20.7	22.4	16.4	22.9	24.5
Mozambique	26.7	9.5	20.7	12.9	17.2	17.4	13.4
Cameroon	74.6	4.3	9.5	13.8	5.2	21.5	19.0
Sudan	5.6	3.4	2.2	6.9	27.6	9.1	5.3
DRC	5.6	0.9	2.2	0.9	44.8	10.9	7.2
Global Average	50.0	50.0	50.0	50.0	50.0	50.0	50.0

Risks	Competitive Landscape	Financial Barriers	Energy Policy	Legal Risks	T&D Losses	Industry Risks	RISKs
Regional Average	49.9	19.5	17.1	21.3	25.2	26.6	24.4

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index

SUB-SAHARAN AFRICA POWER COUNTRY RISKS

Risks	Long Term Economic Risk Index	Short Term Economic Risk Index	Long Term Political Risk Index	Short Term Political Risk Index	Operational Risk Index	Country Risks	RISKs
South Africa	50.0	35.8	42.2	46.6	44.8	44.0	53.1
Kenya	30.2	29.7	35.3	16.8	23.3	26.4	32.4
Nigeria	42.2	44.8	11.2	8.2	13.8	22.3	23.2
Ghana	32.8	39.7	70.7	67.7	32.8	46.0	38.6
Uganda	29.3	27.6	19.4	28.9	10.3	21.0	31.5
Ethiopia	16.4	12.9	3.4	10.3	9.5	10.3	11.4
Botswana	40.5	59.1	65.5	65.5	42.2	52.5	45.8
Cote d'Ivoire	44.8	48.7	10.3	11.2	16.4	24.6	28.9
Zambia	9.5	7.8	16.4	15.5	19.8	14.8	25.2
Namibia	8.6	8.6	50.9	49.6	37.9	32.3	32.6
Gabon	25.0	23.3	47.4	27.6	7.8	23.1	21.6
Angola	6.0	25.4	26.7	54.3	5.2	20.5	17.6
Zimbabwe	0.9	1.7	7.8	4.7	6.0	4.5	8.2
Tanzania	26.7	20.7	40.5	42.2	12.9	26.0	24.5
Mozambique	2.6	3.4	15.5	18.1	8.6	9.5	13.4
Cameroon	31.9	34.5	5.2	20.7	3.4	16.5	19.0
Sudan	3.4	0.9	0.9	1.7	0.9	1.4	5.3
DRC	5.2	16.4	0.0	0.0	0.0	3.6	7.2
Global Average	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Regional Average	22.6	24.5	26.1	27.2	16.4	22.2	24.4

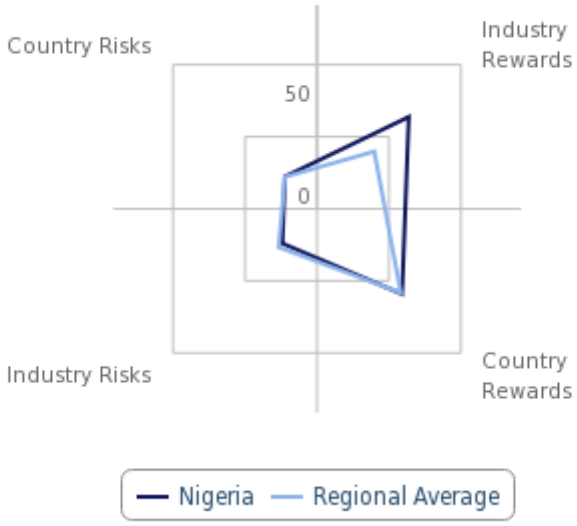
Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index

Nigeria Power Risk/Reward Index

Key View: *Nigeria is ranked 70th globally and third regionally in our Power RRI. The country has a strong Rewards profile that is offset by a poor Risks ranking. While Rewards are boosted by good economic and population growth rates as well as electricity capacity additions, Risks in the country remain a concern as a result of widespread corruption and a lack of diversification in the economy.*

Risk/Reward Snapshot

Nigeria & SSA Region - Power Risk/Reward Index



Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risks/Reward Index

Global And Regional Ranks

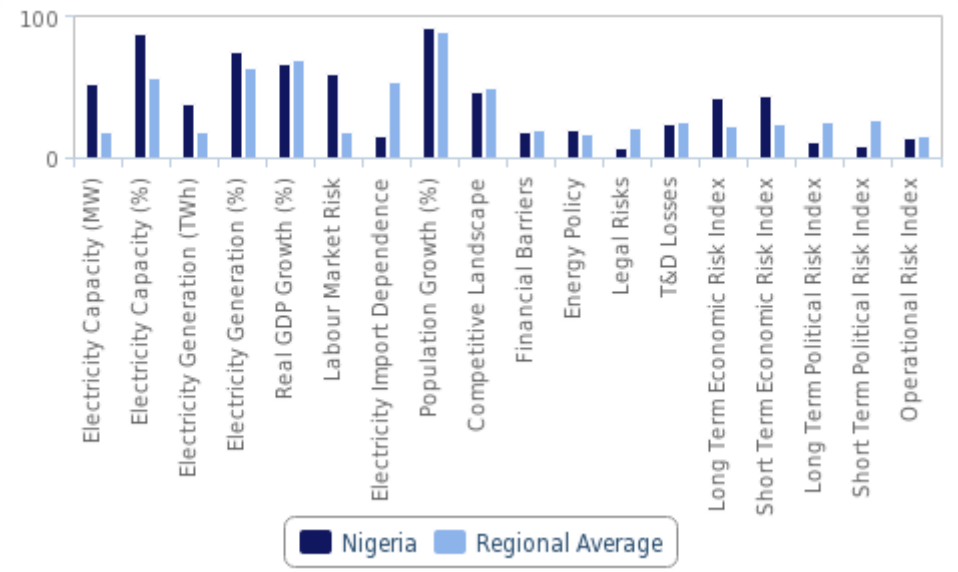
- Regional Rank (out of 18): 3rd
- Global Rank (out of 117): 70th

Key Features And Latest Updates

- Nigeria has a strong Industry Rewards profile, which is ranked second overall in the region, just behind Ethiopia. This is due to strong y-o-y growth in electricity generating capacity forecast for the next five years. However, underperformance of existing gas power plants due to feedstock, maintenance and payment problems drag down this ranking as the country's electricity generation is below its potential.
- Strong forecasted real GDP and population growth rates (which we forecast at an annual average rate of 3.5% and 2.6% respectively) for the 2019-2023 period boosts Nigeria's Country Rewards profile slightly above that of the global and regional average. However, a poor Labour Market Risk score drags down the Rewards profile somewhat.
- Widespread corruption, a lack of a robust legal system, high levels of transmission and distribution losses and limited credit access combined with high lending rates all result in Nigeria's Industry Risks profile ranking below the global average.
- Nigeria's Country Risks profile performs poorly, ranking far below the global average. This is as a result of the economy's high reliance on oil exports, while political tensions remain a factor owing to the presence of militant groups such as the Niger Delta Avengers and Boko Haram, although we do not expect that they hold an existential threat to the government.

RRI Matrix Breakdown

Nigeria & SSA Region - Power Risk/Reward Index By Component



Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index

Market Overview

Key Policies And Market Structure

Regulation And Competition

Over the last decade, Nigeria has moved to restructure its power sector and pursued a privatisation drive that is aimed at opening up the previously state-dominated sector to private investors and introducing competition. There have been a number of delays to the process, but state-owned assets have gradually been unbundled or sold to the private sector. At the time of writing, some of the promised benefits of reform have, however, yet to materialise.

Electric Power Sector Reform Act 2005

With regard to the competitive market, the Electric Power Sector Reform Act (EPSRA) 2005 established three stages of competitiveness within the privatised power market. The first stage is the Transitional Electricity Market (TEM), the second is known as the mid-term market and the third stage will lead to the establishment of a fully competitive and mature electricity market.

Nigeria launched the TEM, which is planned to ensure that the transition from a monopolistic market to a private sector-driven model is orderly, in February 2015. As an example of the impact of the TEM, the declaration that the transitional market is in operation means the **Nigerian Gas Company** will be penalised if it fails to meet its supply agreements with power generation companies - as stipulated under the 2013 Gas Supply Agreement. Similarly, any power generator that fails to meet its electricity generation commitments set under power purchase agreements with the Nigerian Bulk Trading Agency (NBET) will also be sanctioned.

Nigerian Bulk Trading Agency

NBET was established under the EPSRA 2005 and is crucial to the success of this first transitional stage of market reform because it is responsible for buying power from independent power producers (IPPs) and then reselling the power to distribution companies and other eligible customers. The NBET's role in this process is to drive power sector investment into generation activities by executing bankable power-purchase agreements (PPAs) with the winning bidders for generation assets, while at the same time using its legal mandate to act as an intermediary that can ensure contracts are fairly priced when electricity is sold on to the distribution companies.

In the long term, it is hoped these PPAs will subsequently be handed over to Nigeria's distribution companies when sale and purchase agreements become economically viable for all parties involved. However, in the meantime, it is clear that without the NBET's involvement, the privatisation process would be hindered severely. With many of the unbundled generation and distribution companies struggling to achieve profitability in the current market environment, NBET is essentially in place to help keep them all afloat (via the signing of PPAs) until the market functions in a way that allows the generation and distribution companies to become viable in their own right.

Power Holding Company of Nigeria

State-owned **Power Holding Company of Nigeria** (PHCN), formerly the National Electric Power Authority (NEPA), was founded in 2005. NEPA was unbundled into 18 successor companies that formed PHCN, which produced and distributed power through its subsidiaries. These included generators, distributors and power transmitters.

Reform momentum gathered pace in 2012/2013, with the unbundling and the privatisation of the assets that were formerly part of PHCN. In H112, 15 of the 18 unbundled PHCN assets were successfully sold in the private sector. In April 2013, the 15 preferred bidders - 10 for the power generating companies (GENCOs) and five for distribution companies (DISCOs) - received their certificate

of transaction from then President Goodluck Jonathan after paying 25% of their bid prices. This move was viewed as an important precursor to the establishment of a competitive electricity market.

Six months later in early November 2013, PHCN ceased to exist - after the federal government handed ownership of successor companies to the private sector. The completion of the unbundling of PHCN eight years after laws were passed to facilitate the process marked a significant point in the development of the Nigerian power sector. The buyers of the six generation companies and 11 distribution firms (Transmission Company of Nigeria will remain in government hands) are now responsible for operating the separate companies and making the necessary investment to improve the distribution network and customer service.

One of the biggest problems facing private investors, however, is that the cost of restoring some of the unbundled power infrastructure and assets amounts to USD4bn. Underscoring the scale of the task facing some of the private investors, some power infrastructure has been reportedly described as 'fit for demolition'. Furthermore, not only do many of the new owners of the assets have to contend with decrepit infrastructure that will require time and capital to make fit for purpose, but some have also had to idle power plants because of gas shortages - curtailing sales.

PHCN SUCCESSOR COMPANIES

Name	Licence Type	Capacity/Coverage
Abuja Electricity Distribution Company Plc	Distribution	Garki, Lafia, Lokoja, Min
Afam Power Plc	Generation	987.2MW
Benin Electricity Distribution Company Plc	Distribution	Ado-Ekiti, Akpakpava, Aku
Egbin Power Plc	Generation	1,320MW
Eko Electricity Distribution Company Plc	Distribution	Festac, Ijora, Islands, B
Enugu Electricity Distribution Company Plc	Distribution	Aba, Abakaliki, Awka, Aba
Ibadan Electricity Distribution Company Plc	Distribution	Abeokuta, Dugbe, ijebu-Od
Ikeja Electricity Distribution Company Plc	Distribution	Alimosho, Ikeja, Ikorodu,
Jos Electricity Distribution Company Plc	Distribution	Bauchi, Gombe, Jos, Makur
Kainji Hydro Electric Plc	Generation	760MW
Kano Electricity Distribution Company	Distribution	Dala, Dutse, Funtua, Kati
Port Harcourt Electricity Distribution Company Plc	Distribution	Borokiri, Calabar, Diobu
Sapele Power Plc	Generation	1,020MW
Shiroro Hydro Electric Plc	Generation	600MW
Transmission Company Of Nigeria	Transmission	TCN remains in government ownership, and is being managed by Canadian firm Manitoba Hydro under a contract
Ughelli Power Plc	Generation	942MW
Yola Electricity Distribution Company Plc	Distribution	Damaturu, Jalingo, Maidug

Source: Fitch Solutions

The National Integrated Power Project

The National Integrated Power Project (NIPP) was conceived in 2004 as a fast-track government-funded initiative to stabilise Nigeria's electricity supply system while the private-sector-led structure of the EPSRA 2005 took effect. While it was originally conceptualised to undertake mostly gas-fired generation projects, it has since widened its scope to include a broad range of transmission and distribution upgrade projects that are needed to address years of under-investment and the resultant capacity gaps. These include the construction of a new 700kV national transmission grid and attracting a number of IPPs into the sector in order to support privatisation.

With the break-up of PHCN having been completed, attention turned to the privatisation of another 10 gas-fired power plants under the NIPP. Under the programme, which was overseen by the National Council for Privatisation and the governing board of **Niger Delta Power Holding Company** (NDPHC), 80% stakes in each of the 10 gas-fired facilities were sold to private bidders. NDPHC, which is jointly owned by local, state and federal governments, will maintain the remaining 20% stakes. The completion of the NIPP facilities are planned to significantly increase Nigeria's thermal capacity by around 5,000MW.

NIPP POWER PLANTS

Power Plant	Location	Capacity (MW)
Calabar	Calabar, Cross River State	561
Egbema	Owerri, Imo State	338
Ihovbor	Benin City, Edo State	450
Gbarain	Yenagoa, Bayelsa State	225
Sapele	Sapele, Delta State	450
Omoku	Port Harcourt, Rivers State	250
Alaoji	Aba, Abia State	1,074
Olorunsogo II	Olorunsogo, Ogun State	750
Omotosho II	Okitipupa, Ondo State	500
Geregu II	Ajaokuta, Kogi State	434

Source: NDPHC, Fitch Solutions

Nigerian Electricity Regulatory Commission: The Regulator

The Nigerian Electricity Regulatory Commission (NERC) is an independent regulatory agency that was established in October 2005 under the terms of the EPSRA 2005. The commission is mandated to:

- Monitor and regulate the electricity industry.
- Issue licences to market participants.
- Ensure compliance with market rules and operating guidelines.

NERC is also working on establishing a regulatory framework for the development of power stations using renewable sources. This will help improve access to electricity sources and to diversify fuel sources for power plants, with an emphasis on cleaner energy types. In this regard, Nigeria took a significant step forward in 2015, when NERC approved feed-in tariff regulations. It also put in place a provision whereby distribution companies will be required to source 50% of the electricity they buy from renewable sources, with the remainder to be bought by NBET.

NERC is also in charge of the setting and adjustment of the Multi-Year Tariff Order (MYTO), a 15-year tariff path for the Nigerian GENCOs and DISCOs.

Force Majeure

Notably, on May 15 2017, the Minister of Power, Works and Housing issued a policy directive that indicated the NERC would designate some categories of customer who will be able to buy electricity directly from generation companies - bypassing the DISCOs altogether. The government has pursued this legal change in an effort to open up the electricity supply market to greater numbers of third parties and create competition for the underperforming DISCOs. The DISCOs have, however, declared force majeure and have argued that the change prevents them from fulfilling their obligations under the performance agreements they have signed with the Bureau of Public Enterprises.

Pricing

Nigeria has long sold its power below cost, thus discouraging investment in the sector and compounding chronic electricity shortages.

A major development in the country's electricity industry was the review of tariffs, which came into effect on June 1 2012, following consultations with various stakeholders across the country since September 2010 and after being backed by all of Nigeria's 36 state governors. The NERC overcame opposition and approved the implementation of the MYTO, or increase in electricity tariffs, designed to revive the power sector and attract outside investors.

The new tariff was calculated to reflect the real cost of supplying electricity, taking into account the losses caused by poor transmission and distribution infrastructure. The increase (ranging from 28% to 88%) was urgently needed to modernise Nigeria's ageing power sector. Despite access to state-subsidised natural gas that can fire the thermal plants, Nigeria had previously sold power below cost at an average of about NGN10/kWh.

This skewed pricing policy, one of the cheapest in Africa, and chronic negligence had been one of the primary reasons for the significant underinvestment in the country's power generating infrastructure. As a result, Nigeria has been left with inadequate generating capacity and grid infrastructure, resulting in constant power shortages.

Many Nigerians have instead acquired their own generators, creating the world's highest concentration of small-scale power supply. It is estimated that two-thirds of all electricity in the country is currently produced in basements or backyards, at a combined yearly cost of USD13bn.

Although the price hikes were initially met with widespread industrial action and violence, prices have nevertheless risen significantly since the beginning of 2012. By reflecting generation costs more accurately, the multi-year tariff structure is a major step forward in making the power generation business viable and attracting the necessary private sector investment.

The tariff, which provides for minor adjustments every six months, is subject to major review every five years. To this end, we note that many private investors in the unbundled PHCN companies have been lobbying the government to raise tariffs to support greater private investment in the power sector and allow private investors to make higher returns on their capital.

In this context, one of the biggest developments in the Nigerian power sector in 2014 was the NERC's decision to raise the 'energy charge per unit' component of the MYTO by between NRN1 and NRN5. The tariff was raised on June 1 2014 following the NERC's statutory, twice-yearly review of the MYTO.

This tariff review (the MYTO2.1) took place in December 2014 and came into force on January 1 2015, in order to coincide with, and

bolster, the launch of the TEM. A number of manufacturing firms claimed the rise in electricity prices will damage Nigeria's manufacturing industry, harm competitiveness and lead to the closure of many businesses.

The MYTO2.1 was introduced as a result of the implementation of the Nigerian Electricity Market Stabilisation Facility. This is an NGN213bn (USD590mn) fund aimed at providing GENCOs and DISCOs with liquidity needed to refurbish and invest in their operations. The power companies are expected to repay the financing over 10 years at a 10% interest rate per annum through a re-adjustment of the current MYTO - to be devised by the NERC.

Nigeria Power Projects Database

NIGERIA - POWER SECTOR PROJECT PIPELINE (10 LARGEST PROJECTS BY GENERATION CAPACITY)

Project Name	Capacity (MW)	Companies	Status	Fuel Type
Mambilla Hydropower Project, Taraba	3,050	Exim Bank of China[Financier](85){China}, Government of Nigeria[Sponsor](15){Nigeria}, Sinohydro Corporation[Construction]{China}, Gezhouba Group Electric Power[Construction]{China}	At planning stage	Hydropower
Cross River West Bank Power Plant, Oferekpe/Akahuwhu Inyimegu, Ikwo	2,700	Hodges and Bakers Field[Operator](80){Australia}, Ebonyi State Government[Sponsor](20){Nigeria}, POSCO Engineering and Construction[Construction]{South Korea}	Contract awarded	Natural gas-fired
Rosatom Nuclear Power Project, Geregu, Kogi	2,400	Rosatom[Operator]{Russia}, Nigeria Atomic Energy Commission (NAEC)[Sponsor]{Nigeria}, Government of Nigeria[Sponsor]{Nigeria}	At planning stage	Nuclear
Rosatom Nuclear Power Project, Itu, Akwa Ibom	2,400	Rosatom[Operator]{Russia}, Nigeria Atomic Energy Commission (NAEC)[Sponsor]{Nigeria}, Government of Nigeria[Sponsor]{Nigeria}	At planning stage	Nuclear
NNPC Kano Natural Gas-fired Power Plant, Kano	2,350	Nigerian National Petroleum Corporation (NNPC)[Operator]{Nigeria}	At planning stage	Natural gas-fired
Anambra State Power Plant, Anambra	1,500	Global Edison Corporation[Operator]{United States}, Government of United States[Sponsor]{United States}, Government of Nigeria[Sponsor]{Nigeria}	At planning stage	Natural gas-fired
Okija Gas-Fired Power Plant, Anambra	1,500	Century Power Generation[Sponsor]{Nigeria}, General Electric[Operator]{United States}, Diamond Bank[Financier]{Nigeria}, Standard Chartered[Financier]{United Kingdom}, Daewoo Engineering & Construction Company[Construction]{South Korea}	Under construction	Natural gas-fired
NNPC Abuja Natural Gas-fired Power Plant, Abuja	1,350	Nigerian National Petroleum Corporation (NNPC)[Operator]{Nigeria}	At planning stage	Natural gas-fired
Egbin Thermal Power Plant Expansion, Lagos	1,320	Government of Nigeria[Sponsor]{Nigeria}, Korea Electric Power Corporation (KEPCO)[Sponsor]{South Korea}, Sahara Nigeria Group[Sponsor]{Nigeria}	At planning stage	Coal-fired
Itobe Coal Power Plant, Kogi	1,200	Eta-Zuma Group[Operator]{Nigeria}, Zuma Energia[Operator]{Mexico}	At planning stage	Coal-fired

Source: Fitch Solutions Key Projects Database

Competitive Landscape

The state's monopoly over the electric supply industry officially ended in 1998 when severe underperformance prompted the start of a reform process. Reform efforts accelerated in 2005, following the adoption of the Electric Power Sector Reform Act, which indicated how the National Electric Power Authority will be divided into a number of successor companies.

Power Holding Company Of Nigeria

The **Power Holding Company of Nigeria** (PHCN) was founded to produce and distribute power via its subsidiaries. Its key operating units included: **Transmission Company of Nigeria**, which is responsible for national power transmission; **Egbin Power**, which is a generator with more than 1.3GW of installed capacity; **Afam Power**, which has almost 1GW; **Kainji Hydro Electric**, which operates almost 0.8GW of hydropower generation. **Shiroro Hydro Electric** is a generator with 0.6GW of hydroelectric generating capacity, while **Ughelli Power** operates more than 0.9GW and **Sapele** just over 1GW of thermal capacity. The company was subsequently unbundled into successor companies (SCs) with a view to transferring the management and financing of the SCs to the private sector.

The unbundling of PHCN (which was successfully completed in November 2013, eight years after laws were passed to facilitate the process) marked a significant point in the development of the Nigerian power sector. Attempts to unbundle and privatise the power utilities previously owned by PHCN only started to bear fruit in 2012, following a number of postponements. In H112, 15 of the 18 unbundled PHCN assets - 10 for the power generating companies and five for distribution companies - were successfully sold.

Besides the privatisation efforts, the country has also been promoting independent power projects (IPPs) and the sale of 10 gas-fired power plants under the National Integrated Power Plan. The introduction of IPPs has been gradual, but according to the country's power roadmap, the private power component will more than double in less than five years, including via the country's sale of its generating assets. Local news sources reported that the federal government has resumed talks with three of the preferred bidders for three of the power stations, after talks stalled in 2014. The facilities are reported to include the 750MW Alaoji Power Station in Abia State, the 225MW Omoku Power Plant in Rivers State, the 338MW Egbema Power Station in Imo State and the 225MW Gbarain Ubie Power Station in Bayelsa State, which are at various stages of completion.

Nigeria has also moved to encourage private investment in its nascent renewable energy sector. In July 2016, Nigerian Bulk Electricity Trading signed its first ever power-purchase agreement (PPA) for a solar project. In March 2018, investors were threatening to quit Nigeria over the 14 PPA solar projects after Finance Minister Kemi Adeosun said that the price of NGN0.115 per kWh agreed in 2016 was far too high and she would not honour any agreement unless it was reduced to NGN0.075, stating that other countries pay lower tariffs and that the government will not be able to recoup the costs in the North of Nigeria.

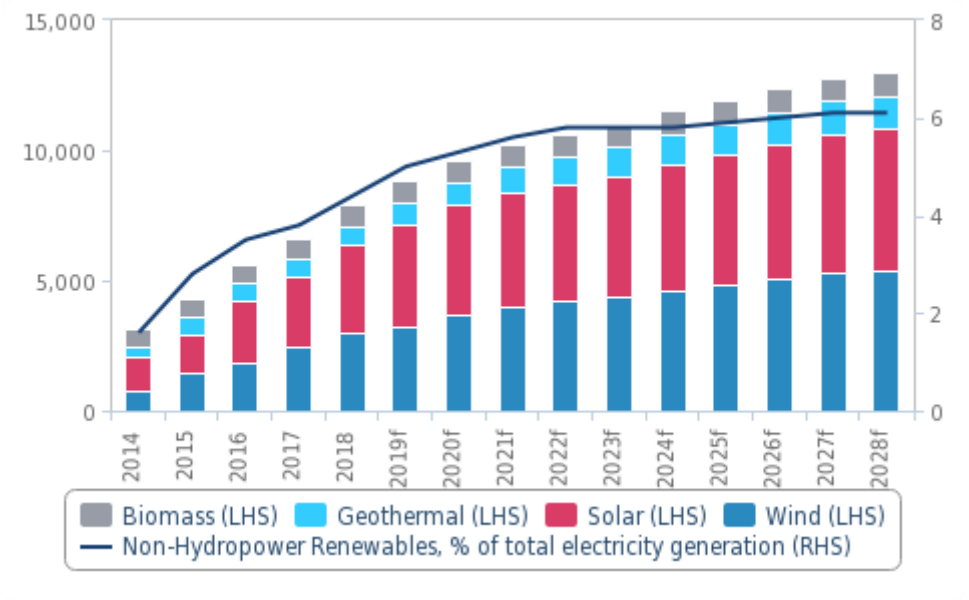
Regional Overview

Sub-Saharan African Renewables To Have Limited Impact On Hydro-Focused Region

***Key View**: We maintain a muted forecast for non-hydro renewables growth in the SSA region, as we forecast net power generation growth for the sector to total only 12TWh from 2019 to 2028. As such, renewables will make up only about 6% of regional power generation by 2028. Expanding hydropower capacity will remain the core focus of many governments in the region, given the technology's low electricity cost over multi-decade time frames. Providing electricity at the lowest cost possible will be paramount in a number of markets, due to heavily indebted utilities and low consumer purchasing power. While falling renewables costs and the roll out of competitive auction schemes will support some growth, we believe wind and solar intermittence will curb growth prospects - particularly given the need for grid upgrades across the region.*

Renewables To Have Muted Power Mix Impact

SSA - Non-Hydro Renewables Capacity By Type, MW (LHS) & Share Of Total Power Generation (RHS)



f = Fitch Solutions forecast. Source: EIA, IRENA, Fitch Solutions

Latest Updates

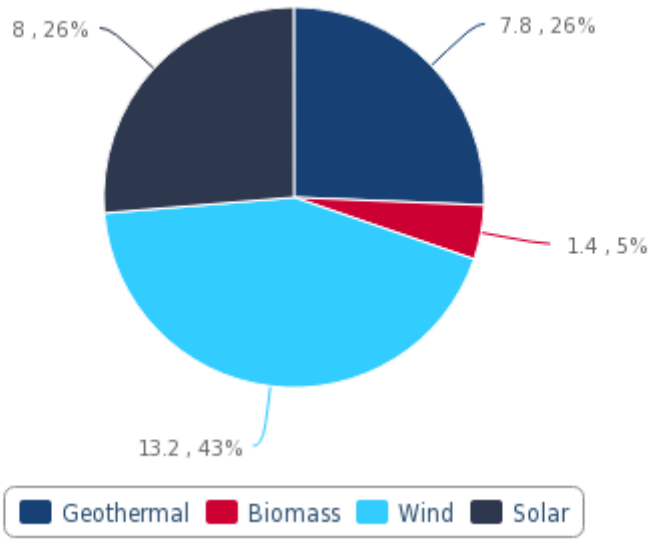
- We forecast non-hydropower renewables power generation in the Sub-Saharan African (SSA) region to register relatively limited growth over the coming decade - totalling 30TWh across the region as a whole by 2028, up from 18TWh over 2018. This will mean that SSA will comprise less than 1% of the global total by the end of our forecast period. Within the region, we forecast non-hydro renewables to make up 6% of total power generation by 2028.
- Our fairly downbeat outlook for the region is informed by the limited renewables project pipeline, which totals 20.8GW of projects under planning and construction. Furthermore, we are only factoring in 4.2GW of these projects into our forecast between 2018 and 2028, given the limited progress registered for a majority of these projects.
- Our downbeat view also aligns with our expectation that many governments in the region will continue to focus efforts on boosting hydropower capacity. This is due to the latter technology's low cost of power generation upon project amortisation, which supports debt-burdened state-owned utilities and enables the provision of cheap electricity to consumers that are unable to pay cost-reflective electricity tariffs.
- There are notable upside risks to this conservative view, in particular the usage of capacity auctions with backing from global

institutions such as the World Bank, which could improve the economic viability of a large share of the project pipeline. However, these schemes have typically been too small to make any substantial impact on the overall regional growth trajectory.

- We also stress that off-grid renewables capacity will play a key role in electrifying rural communities, while becoming an increasingly important source of electricity for mining activities across the region. That said, these projects are typically smaller in scale and will have limited impact on the overall SSA power generation mix.
- The intermittent nature of wind and solar power will be another barrier to a substantial uptick in renewables generation growth in SSA over the coming decade. In order to mitigate the challenges associated with balancing demand and supply, we believe substantial grid upgrades will be required to support supply reliability. As such, we maintain that the baseload characteristics of geothermal power technology will ensure the sector remains a key component of the regional non-hydro renewables power generation mix over the coming decade - comprising 26% of the total in 2028.
- We forecast that South Africa will add 3.8GW of renewables capacity between the end of 2018 and 2028, by far the most renewables capacity in the SSA region over this time frame. In comparison, we forecast that Kenya - the second-fastest-expanding renewables market - to add an equivalent 700MW.

Geothermal Playing Key Role In Region

SSA - Power Generation By Type In 2028f, TWh



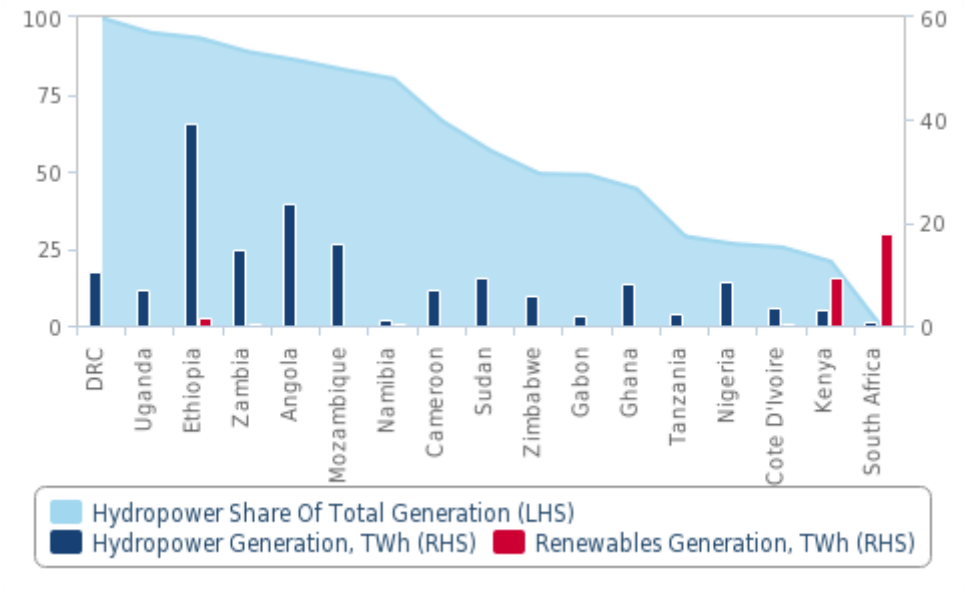
f = Fitch Solutions forecast. Source: EIA, Fitch Solutions

Structural Trends

We forecast non-hydro renewable energy to make limited impact on the overall Sub-Saharan African power generation mix over the coming decade. This will be the result of many governments in the region continuing to focus their efforts of boosting hydropower generating capacity over the coming decade - with renewable energy only set to play a relatively marginal role. Hydropower facilities provide relatively cheap power after the initial sunk investment costs are paid off - with the facilities typically generating power for many decades. As such, we forecast 12 SSA power markets to rely on hydropower generation for more than 40% of total electricity output by 2028 - with the figure surpassing 80% in **Democratic Republic of the Congo**, **Uganda**, **Ethiopia**, **Zambia**, **Angola**, **Mozambique** and **Namibia**. In comparison we only expect three SSA markets to rely on non-hydro renewables for more than 5% of power generation by 2028, namely **Kenya** (60%), **Namibia** (18%) and **South Africa** (7%).

Kenya And South Africa Renewables Outperform Hydro-Reliant Region

SSA - Hydropower Share Of Total Generation (LHS) & Generation By Technology, TWh (RHS), 2028f

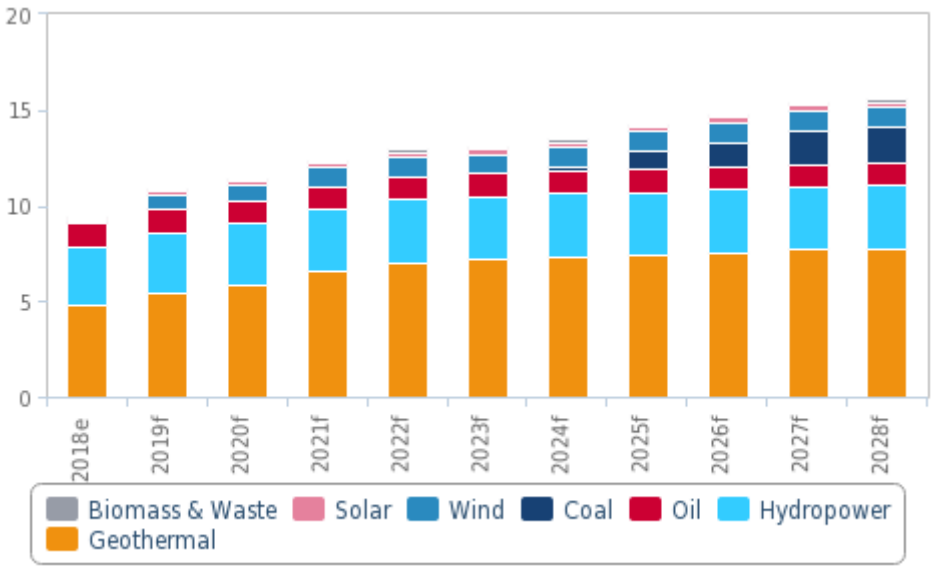


f = Fitch Solutions forecast. Source: EIA, IRENA, Fitch Solutions

While falling renewables costs will make renewable power more attractive across the region over the coming decade, particularly as countries try to mitigate the risks associated with heavy hydropower reliance, we expect that the impact of the sector on the overall power generation mix will remain muted. Given the inability of a majority of SSA governments to provide state-backed guarantees for larger-scale renewables projects as well as the high costs and broader challenges associated with the integration of intermittent power supplies from wind and solar power facilities, the renewables sector continues to play a complementary role to power sector expansion efforts across the region. The one exception to date has been Kenya, which relies on geothermal power for about 50% of generation. That said, geothermal power has baseload characteristics, making it a more reliable power generation resource that can serve as the backbone of Kenya's power generation mix.

Geothermal To Dominate Power Mix

Kenya - Total Electricity Generation By Type, TWh



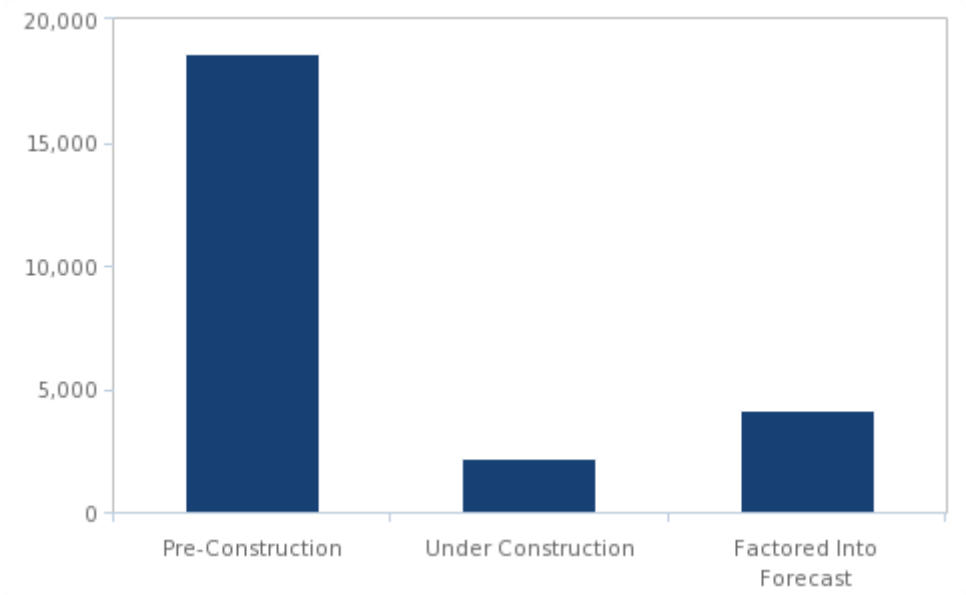
e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

We note that institutional backing for renewables capacity auctions - best exemplified through Zambia's World Bank-backed Scaling Solar initiative - will improve the economic viability of renewable power in SSA over the coming five years. In fact, the World Bank guarantees for the power-purchase agreements (PPAs) awarded under the Scaling Solar initiative, with the PPAs registered having been very competitive relative to the majority of renewables projects registered in SSA (*see 'Scaling Solar And GET FiT To Boost Zambian Renewables Investment Attractiveness', February 28*). This cost-competitiveness has been made possible by the institutional backing for the initiative, which reduces the risk associated with selling electricity to indebted utilities, by extension reducing the cost of capital. Scaling solar also reduces the bureaucratic bottlenecks that face individually-negotiated projects, thereby reducing transaction costs.

However, only a small portion of the SSA renewables project pipeline is likely to be backed by initiatives such as Scaling Solar, muting the impact of such mechanisms on growth. This is because we question the extent institutions such as the World Bank will be able to back a sufficient amount of renewables projects in the region to make any substantial impact on the power generation mix over the coming five years. This leads us to expect growth in the broader renewables sector to remain subdued. While initiatives such as Scaling Solar will be replicated outside of Zambia, boosting the economic viability of renewable energy projects across the region, we do not expect this to substantially boost the volume of renewables projects progressing through the SSA renewables project pipeline.

Cautious On Pre-Construction Renewables Project Pipeline

SSA - Non-Hydro Renewables Project Pipeline By Status & Capacity Factored Into Forecast Between 2019f & 2028f, MW



f = Fitch Solutions forecast. Source: EIA, Fitch Solutions Key Projects Database, Fitch Solutions.

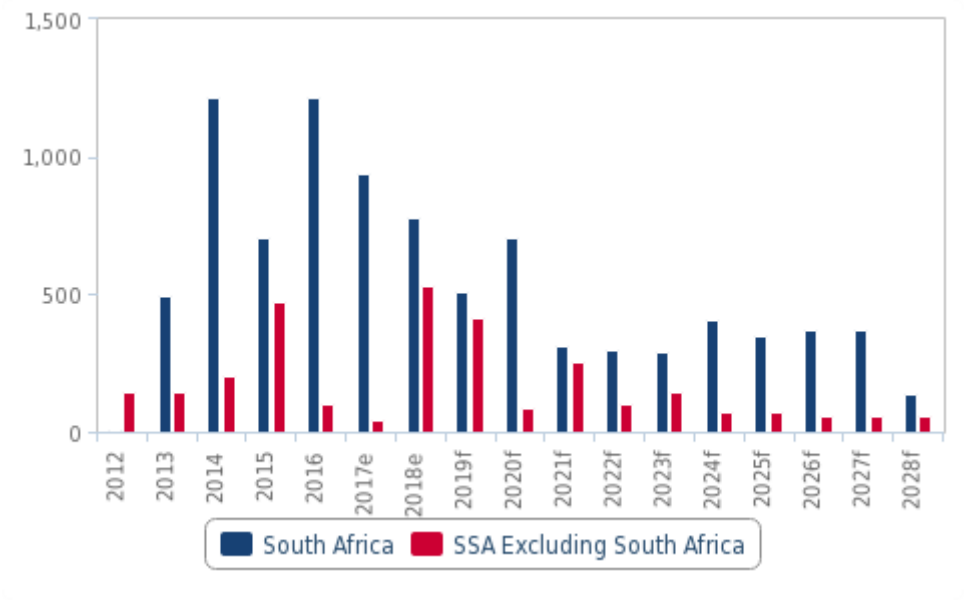
We maintain our view that South Africa will remain SSA's hotspot for renewables capacity growth amid mostly weak renewables growth in the rest of the region. As part of the South African Renewables Initiative, the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) was introduced, which through bidding rounds allocated renewables capacity to developers. The mechanism enabled the inflow of private and institutional capital into the renewables market and resulted in renewables capacity in South Africa surging from less than 150MW in 2011 to more than 5.5GW by 2018.

That said, we believe recent challenges in signing contracts for tendered projects will have hit investor sentiment, and has led us to take a cautious view on growth prospects in the market over the next decade. Notably, **Eskom** (the state-owned power utility) refused to sign contracts from bidding windows 3.5 and 4 from 2016 to 2017 due to concerns over its ability to pay the fees promised. Despite the South African government's assurances that these contracts were to be signed before

2018, the signing of the 27 independent power producer contracts were postponed again by the Department of Energy on March 13 2018, until they were finally approved on March 27 2018. **While the projects are set to progress following the signing of contracts, repeated legal challenges against the South African renewables sector will continue to weigh on investor sentiment.** For example, the country's Coal Transportation Forum was in the process of challenging the PPA deals signed by Eskom for the 4 REIPPPP round in the Gauteng High Court in mid-March 2019. We believe this challenging business environment will have a negative impact on investor confidence. As such, we only forecast South Africa to add 3.8GW between end-2018 and 2028, a slowdown compared to the 5.4GW added between 2012 and 2018.

South Africa Key To Regional Renewables Growth

Net Renewables Capacity Additions By Market, MW



e/f = Fitch Solutions estimate/forecast. Source: EIA, IRENA, national sources, Fitch Solutions.

Power Glossary

	Definition		Definition
bn	**billion**	**IPO**	**initial public offering**
capex	capital expenditure	IPP	independent power producer
CEE	Central and Eastern Europe	km	kilometres
CHP	combined heat and power plants	kW	kilowatt (10^3 watts)
DoE	US Department of Energy	kWh	kilowatt hour
e/f	estimate/forecast	LNG	liquefied natural gas
EBRD	European Bank for Reconstruction and Development	MEA	Middle East and Africa
EIA	US Energy Information Administration	mn	million
EM	emerging markets	MoU	memorandum of understanding
EU ETS	European Union Emissions Trading System	MW	megawatt (electric) (10^6 watts)
EU	European Union	MWh	megawatt hour
EWEA	European Wind Energy Association	na	not available/applicable
FDI	foreign direct investment	NGL	natural gas liquids
FiT	feed-in tariff	OECD	Organisation for Economic Co-operation and Development
FTA	free trade agreement	OPEC	Organization of the Petroleum Exporting Countries
GDP	gross domestic product	PV	solar photovoltaics
GHG	greenhouse gas	RES	renewable energy sources
GW	gigawatt (10^9 watts)	R&D	research and development
GWh	Gigawatt hour (1 GWh = 3.6 TJ)	t	metric ton = tonne (1 t = 1,000 kg)
GWEC	Global Wind Energy Council	TPES	total primary energy supply
IAEA	International Atomic Energy Agency	trn	trillion
IEA	International Energy Agency	TW	terawatt (10^{12} watts)
IMF	International Monetary Fund	TWh	terawatt hour (1 TWh = 3.6 PJ)

Power Methodology

Industry Forecast Methodology

Fitch Solutions' industry forecasts are generated using the best-practice techniques of time-series modelling and causal/econometric modelling. The precise form of model we use varies from industry to industry, in each case determined, as per standard practice, by the prevailing features of the industry data being examined.

Common to our analysis of every industry is the use of vector autoregressions. They allow us to forecast a variable using more than the variable's own history as explanatory information. For example, when forecasting oil prices, we can include information about oil consumption, supply and capacity.

When forecasting for some of our industry sub-component variables, however, using a variable's own history is often the most desirable method of analysis. Such single-variable analysis is called univariate modelling. We use the most common and versatile form of univariate models: the autoregressive moving average model (ARMA).

In some cases, ARMA techniques are inappropriate because there is insufficient historic data or data quality is poor. In such cases, we use either traditional decomposition methods or smoothing methods as a basis for analysis and forecasting.

We mainly use OLS estimators and in order to avoid relying on subjective views and encourage the use of objective views, we use a 'general-to-specific' method. We mainly use a linear model, but simple non-linear models, such as the log-linear model, are used when necessary. During periods of 'industry shock', for example poor weather conditions impeding agricultural output, dummy variables are used to determine the level of impact.

Effective forecasting depends on appropriately selected regression models. **Fitch Solutions** selects the best model according to various different criteria and tests, including but not exclusive to:

- R2 tests explanatory power; adjusted R2 takes degree of freedom into account;
- Testing the directional movement and magnitude of coefficients;
- Hypothesis testing to ensure coefficients are significant (normally t-test and/or P-value);
- All results are assessed to alleviate issues related to auto-correlation and multi-collinearity.

Fitch Solutions uses the selected best model to perform forecasting.

Human intervention plays a necessary and desirable role in all of our industry forecasting. Experience, expertise and knowledge of industry data and trends ensure analysts spot structural breaks, anomalous data, turning points and seasonal features where a purely mechanical forecasting process would not.

Sector-Specific Methodology

- **Generation And Consumption Data**

A number of principal criteria drive our forecasts for each generation and consumption variable, with the following identity forming the basis of our forecast model:

"Total consumption = total generation + total net imports - transmission and distribution losses"

- **Total Generation**

Total generation is defined as the process of producing electric energy or the amount of electric energy produced by transforming other forms of energy, commonly expressed in kilowatthours (kWh) or related units.

While gross electricity production is measured at the terminals of all alternator sets in a station, and thus includes the energy taken by station auxiliaries and losses in transformers that are considered integral parts of the station, net electricity production is defined as gross production less own use of power plants.

According to the International Energy Agency (IEA), the difference between gross and net production is generally observed to be

about 7% for conventional thermal stations, 1% for hydro stations and 6% for nuclear.

Historical figures for electricity generation are based on data published by the US Energy Information Administration (EIA) and the World Bank, and consider net electricity production. Whenever possible, we compare these data with accounts published by government/ministry sources and official data of the companies operating in each country.

Fitch Solutions' electricity generation forecasts examine the sector with a bottom-up approach, forecasting electricity production for each resource in order to calculate the value of total generation. The regression model used to calculate generation considers real GDP, industrial production, fixed capital formation, population and fiscal expenditure.

- **Total Consumption**

Total consumption is commonly expressed in kilowatt hours (kWh) or related units.

Historical figures for electricity consumption are based on data published by the EIA. Whenever possible, we compare these data with accounts published by government/ministry sources and official data of the companies operating in each country. Our electricity consumption forecasts are based on a regression similar to the model illustrated above for electricity generation.

- **Total Net Imports**

Historical figures for net imports are computed as total imports, minus total exports, based on data from the EIA. Our total net imports forecasts are calculated as total consumptions, minus total generation, plus transmission and distribution losses.

- **Transmission And Distribution Losses**

Transmission and distribution losses include electric energy lost due to the transmission and distribution of electricity. Much of the loss is thermal in nature.

Our historical figures for electricity transmission and distribution losses are computed as generation, plus net imports, minus consumptions. However, transmission and distribution losses are calculated using a regression model in the forecasts.

- **Electricity Generating Capacity Data**

Electricity generation capacity is defined as the maximum output, commonly expressed in megawatts (MW) or related units, that generating equipment can supply to system load, adjusted for ambient conditions.

Historical figures for electricity generation capacity are based on data published in UN statistical databases, as well as data from the EIA and IRENA. Whenever possible, we compare these data with accounts published by government/ministry sources and official data of the companies in each country.

Our electricity generation capacity forecasts examine the sector with a bottom-up approach, forecasting capacity for each resource to calculate the total value of capacity in each country. Our electricity generation capacity forecasts are based on a regression similar to the model illustrated above for electricity generation.

Sources

Fitch Solutions uses publicly available information to compile the country reports and collate historical data. Sources used in power industry reports include those from international bodies mentioned above, such as the EIA, the World Bank and the UN as

well as local energy ministries, officially released company figures, national and international bodies and associations and news agencies.

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ISSN: 2044-5687

Copy Deadline: April 2019