

Nigeria's Gas-to-Power Ambitions: Limits, Opportunities and Alternatives

TENGI GEORGE-IKOLI AND AARON SAYNE

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Natural Resource Governance Institute

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Key messages

- Gas power has contributed significantly to the growth of electricity supply in Nigeria, but with gas power plants reaching their peak in 2016, gas is now falling short of meeting the country's rapidly expanding electricity needs.
- Looking ahead, major systemic problems with gas supply, power transmission and payments will make it hard for Nigeria to achieve its enhanced electricity access ambitions solely through kick-starting its existing gas power plants or building new ones.
- Nigerian solar, meanwhile, is growing by leaps and bounds, especially smaller-scale systems for communities, industry and homes.
- Off-grid and small-scale solar systems have more potential than gas to deliver affordable power to unserved Nigerians. Solar can also replace private generators which are expensive, polluting and powered by dirty fuel.
- Decentralized control of Nigeria's power sector from federal to individual states holds promise, but only if well managed. This will depend on strong coordination mechanisms, harmonized regulatory standards and state-led investment platforms to mitigate potential challenges.
- At the same time, renewables in Nigeria are not reaching their full potential or scaling fast enough to meet needs. The country still has no utility-scale projects despite years of effort, and it would benefit from innovating and adopting investment-friendly policies.
- The challenge now is to revise ambitions for gas power while making plans, policies and public investments that help renewables scale in more efficient, equitable ways.

Introduction

Nigeria has long had ambitious plans to turn gas into more energy for its fast-growing population.

For decades, Nigeria has articulated ambitious plans to leverage its gas resources to deliver energy access, industrialization, electricity for homes and businesses, transportation and more. Its latest plan—the Decade of Gas initiative, running from 2021 to 2030—reveals similar aims, including around gas-to-power. Despite these efforts, more people without access to electricity live in Nigeria than anywhere else in the world (Box 1). Tens of millions more endure poor-quality service, with daily power cuts, and rely on costly private generators. Without new power delivery systems, poverty will remain endemic and the economy will continue to struggle (Box 2). Nigeria has over 200 trillion cubic feet of gas reserves—Africa's largest and the eighth largest in the world. However, reserve size alone does not guarantee domestic availability. Converting reserves into commercially producible gas requires substantial investment in gathering systems, processing facilities, transportation infrastructure and security arrangements. Since military rule ended in 1999, successive governments have invested in gas-to-power, rolling out new plans and policies; privatizing plants; and spending billions of dollars on infrastructure, industry bailouts and subsidies. Three-quarters of on-grid power supply now comes from gas, up from less than half in 2000. The country's plans for gas do not stop at electricity, either. Policy-makers and businesses want to: turn gas into heat and feedstock for heavy industries like cement, fertilizer and petrochemicals; replace dirty, dangerous household fuels like kerosene or charcoal with liquified petroleum gas; and earn more revenue from selling liquified natural gas (LNG) as oil exports decline.



Workers on an oil and gas facility - photo by Williamson Ijeh via Shutterstock

→ Box 1.

Who lacks access to electricity in Nigeria?

- 86 million people
- 630,000 settlements
- 40% of healthcare facilities
- 48% of schools

Sources: ESMAP, SE4All data

→ Box 2.

How does the electricity gap harm Nigerians?

- Unreliable power shrinks the economy by $25 billion/year.
- Energy represents up to 40% of manufacturers' operating costs, hindering industrialization.
- Households and businesses spend up to $14 billion/year on private generators.
- Generator use in industry makes domestic goods cost 30% more than imports.
- Power outages at health facilities spoil vaccines, delay surgeries and shut off life-saving machines.
- CO2 from generators increase lung cancer risk and kill roughly 1500 Nigerians a year

Policymaking and investment in the electricity sector are very dynamic right now, especially around renewables.

After years of slow growth, renewable power—especially small-scale solar—is starting to take off in Nigeria. The federal government is offering various kinds of policy support for minigrids, solar home systems (SHS) as well as commercial and industrial (C&I) installations. Critically, some states are also starting to create their own power markets and delivery systems, as permitted by the 2023 Electricity Act. This decentralization of control over electricity has the promise—if well managed—to ease long-standing barriers to growth in the power sector and find more diverse, reliable and affordable solutions to the many electricity-related struggles Nigerians are facing. Strong coordination with harmonized regulatory standards and state-led investment platforms could enhance the potential for success of this decentralized approach.

This report assesses the historic performance and prospects for gas power in Nigeria, as well as the potential for renewables to serve as a complement and alternative to gas. It does not advocate for wholly eliminating gas from Nigeria's energy mix. Rather, it examines whether current gas-to-power ambitions are realistic given the sector constraints. The report explores whether greater emphasis on renewable energy could more effectively advance Nigeria's electricity access, affordability and development objectives where gas supply, financing and infrastructure remain unattained.

Findings are based on analysis of relevant data sets and past reports; consultations with industry experts; engagements with civil society actors; and the results of a one-day validation session held by the Natural Resource Governance Institute (NRGI) in Abuja, with partners Nextier and The Electricity Hub. The publication forms part of NRGI's broader work on gas in Nigeria, which seeks to examine how the country can maximize development benefits from its gas resources while avoiding costly investments that may not deliver expected economic, fiscal or energy outcomes. The aim of this report is to help decision-makers as they shape the future of energy in Nigeria.

Nigeria's gas-to-power and renewables targets

On paper, Nigeria has a decent-sized on-grid power generation fleet, but the system functions well below capacity. The country's 28 grid-connected power plants had a total installed generation capacity of 13,625 megawatts (MW) at the end of 2025, according to the Nigerian Electricity Regulatory Commission (NERC). Gas-fired thermal plants account for around four-fifths of this capacity (about 10,950 MW across 23 plants), with five hydro plants making up the remaining fifth (about 2,680 MW). Nigeria has no operating utility-scale solar or wind on the grid. The grid generated roughly 39,194 gigawatt hours (GWh) in 2025; gas supplied about 67 percent and hydro about 33 percent (Table 1). The country's installed capacity says little about how much electricity Nigerians actually receive.

Table 1. Nigeria's on-grid power mix, 2025

Generation type	Installed capacity (MW)	Percentage of total	Power generated (GWh)	Percentage of total
Gas-fired thermal	10,947	80.3%	26,386	67.3%
Hydro	2,678	19.7%	12,808	32.7%
Solar/wind (on-grid)	0	0%	0	0%
Total	**13,625**	**100%**	**39,194**	**100%**

Source: NERC quarterly reports, 2025 (installed and available capacity); author calculation from NERC 2025/Q1–Q4 reports (generation). Excludes off-grid, embedded and captive solar, which NERC grid statistics do not capture. "Solar/wind (on-grid)" is zero: no utility-scale solar farm operates on the grid, and the only grid-connected wind project (10 MW, Katsina) is non-operational.

→ Box 3.

The capacity gap: Installed is not delivered (2025)

- **Installed capacity (nameplate):** 13,625 MW
- **Average available capacity:** ~5,400 MW (≈40% of installed; ~60% unavailable at any moment)
- **Average power delivered to the grid:** ~4,475 MW (≈one-third of installed)

On average in 2025, only about 5,400 MW—roughly 40 percent of installed capacity—was available for dispatch, and the grid delivered an average of about 4,475 MW, around one-third of the installed total. Little had changed from a decade earlier. This gap, summarized in Box 3, is the defining feature of Nigeria's power system. At any point in 2025, around 60 percent of installed capacity could not be used because of gas shortages, breakdowns, deferred maintenance, transmission limits and unpaid bills. Nigeria's binding constraint is not how much capacity it has built, but how little of such capacity is usable.

Gas-to-power targets

Nigeria's official plans still envision a major expansion of gas-fired power. The federal government's flagship power-sector document, the Nigeria Integrated Resource Plan (NIRP), projects peak electricity demand of about 12 GW by 2030 (down from earlier official projections of 40 GW). The Nigerian National Petroleum Corporation (NNPC) Ltd. foresees power-sector gas demand approaching 5,500 million standard cubic feet per day (mmscf/d) by 2030, including 1,000 mmscf/d from ten new plants. The Decade of Gas initiative likewise targets more gas for power, though most new gas production is destined for LNG export.

Table 2. Gas-to-power targets vs. 2025 baseline

Indicator	Official targets	2025 baseline
Peak demand served	~12 GW by 2030 (NIRP)	~4.5 GW delivered on average
Gas supplied to power	~5,500 mmscf/d by 2030 (NNPC)	Thermal fleet receives less than half the gas it needs
New gas plants	10 new plants (NNPC)	Last new-plant final investment decision (FID): Azura, 2016

Renewables targets

Federal targets call for renewables to provide 30 percent of generation by 2030, part of the government's "30:30:30" vision (30 GW of installed capacity, 30 percent of it renewable, by 2030). Contrast this with the 2022 Energy Transition Plan (ETP), which set a net-zero goal for 2060 and envisioned renewables supplying roughly 40 percent of installed capacity, about 17 GW, by 2030. Off-grid and small-scale solar is growing rapidly in the country, as detailed below.

Yet Nigeria still has no utility-scale solar farms, and its only grid-connected wind project (a 10 MW installation in Katsina) was built but never ran reliably. The absence of renewables on the grid has kept Nigeria from meeting key targets (Table 3) and left it lagging behind other African economic powerhouses. In 2024, for instance, Egypt and South Africa installed three-quarters of all new solar photovoltaic (PV). Nigeria was responsible for just 3 percent.

Table 3: Renewables targets vs. 2025 baseline

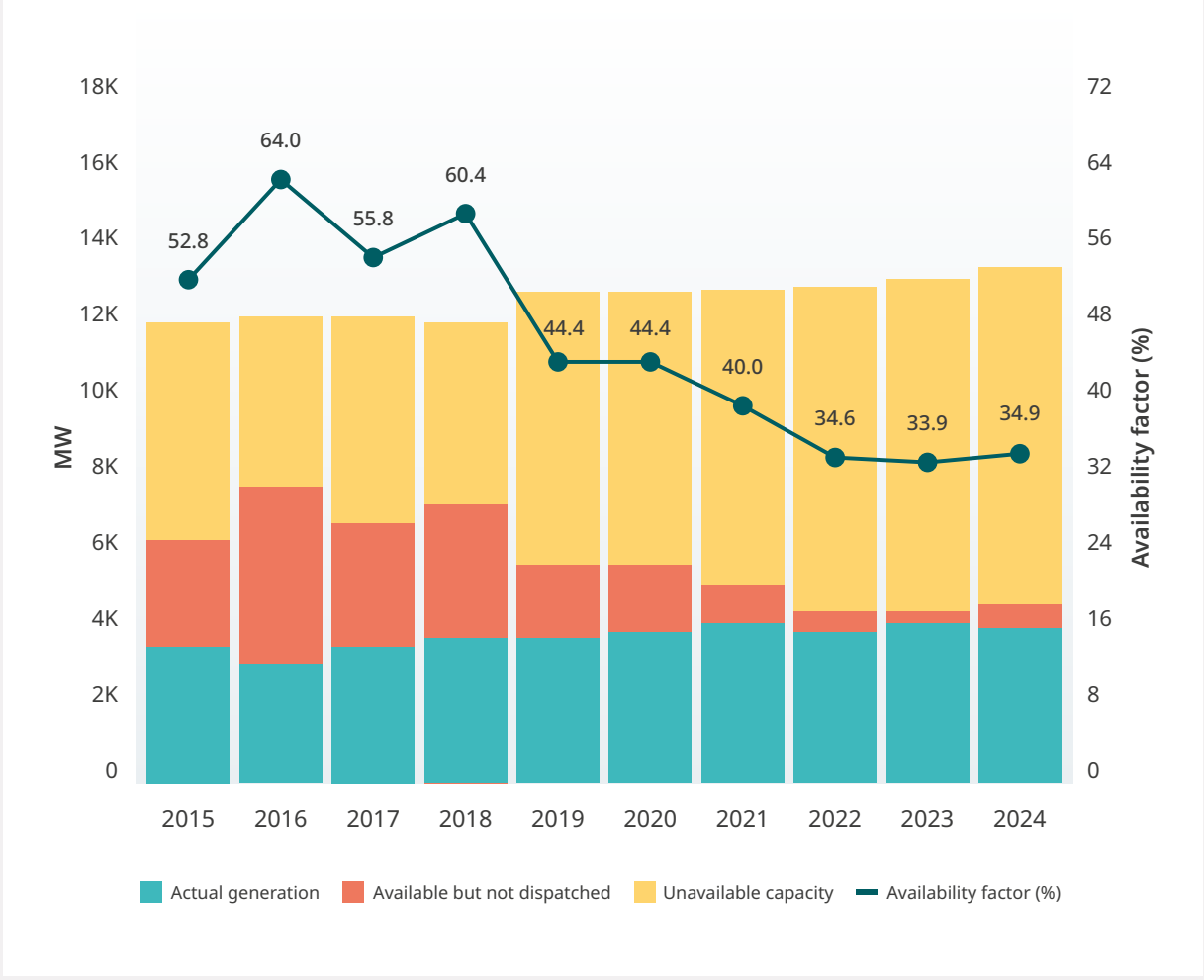
Indicator	Official targets	2025 baseline
Share of renewables in the power mix	23% by 2025 (Renewable Energy Master Plan) 30% by 2030 (30:30:30) 17 GW by 2030 (ETP)	No operational utility-scale projects; comprehensive off-grid and small-scale data is unavailable, but total renewable generation is well below target
Number of active minigrids nationwide	10,000 by 2023 (Rural Electrification Agency (REA) off-grid electrification strategy)	Approx. 375 deployed

The declining performance of gas power in Nigeria

Nigeria's gas-dominated power system has not been able to close the country's massive electricity gap.

Power sector data shows that output from gas plants peaked a decade ago, in 2016, and has since been in serious decline. The amount of generation capacity that is available for use has also plummeted, mainly due to dysfunction around gas plants (Figure 1). The national grid rarely delivers more than 4,000 MW at a time—the same as a decade ago. This is ten times less than the city of Tokyo and eight times less than the whole of South Africa, whose population is a third of Nigeria's. Per capita electricity consumption is less than five percent of the global average.

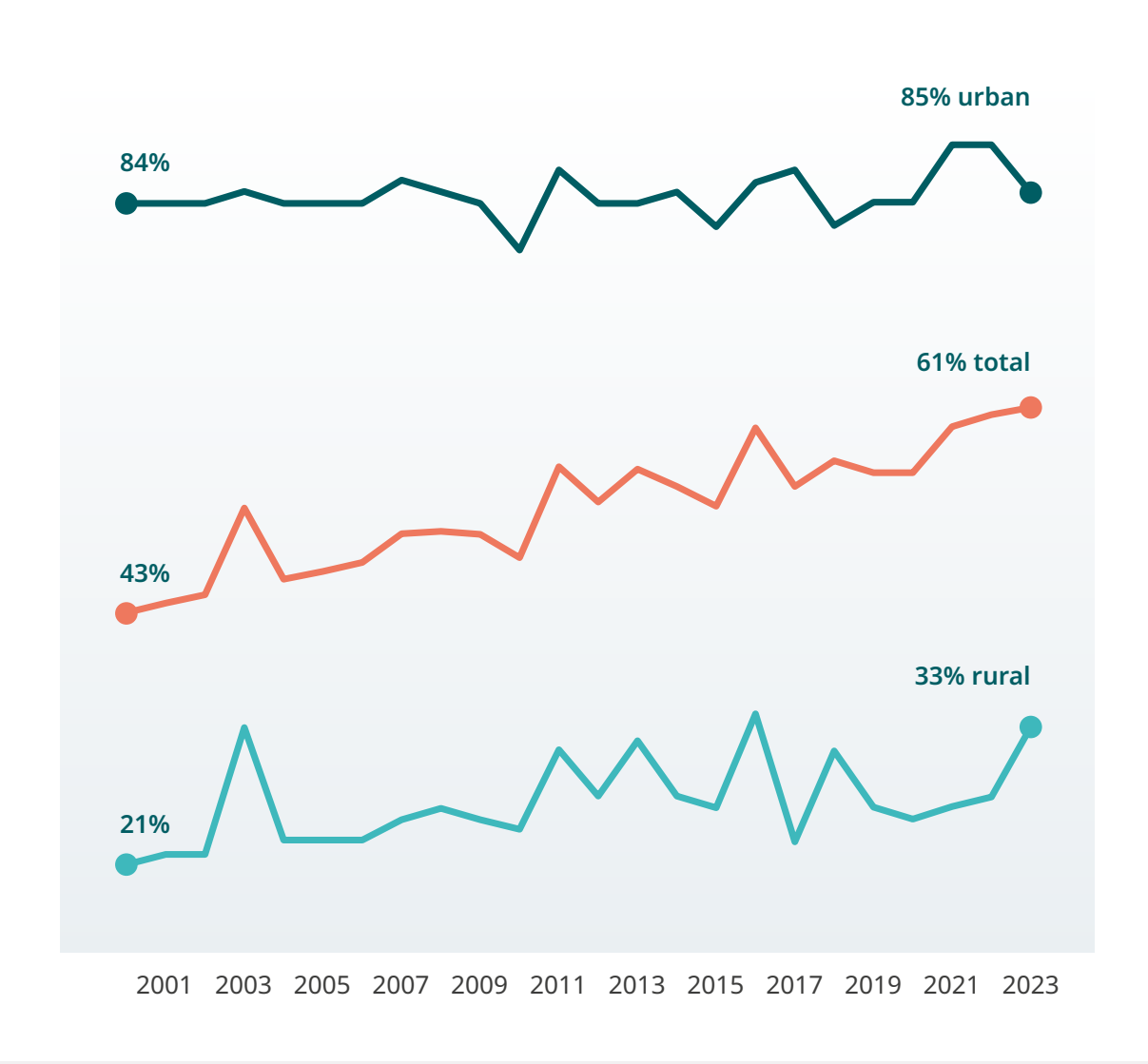
Figure 1. Nigeria power plant performance, 2015–2024 (MW)



Source: NERC data. Stacked bars show total installed capacity. Actual generation = power dispatched to the grid. Available but not dispatched = operational capacity that could generate but was not called upon (available capacity minus actual generation). Unavailable capacity = plants offline due to maintenance, gas shortages, or other constraints (installed capacity minus available capacity).

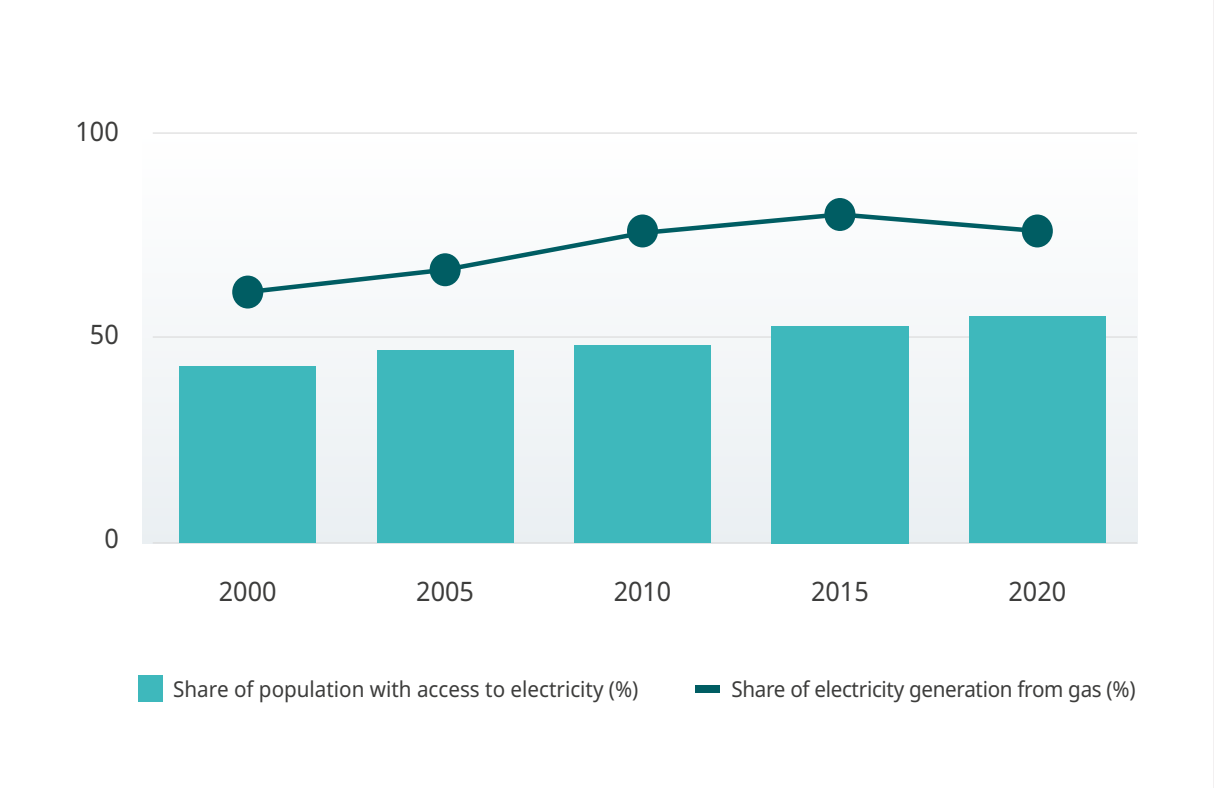
Only 60 percent of Nigerians have electricity access—an increase of only 20 percent since 2000. Rural areas have improved the most, though their overall access rates are still much lower than in urban areas (Figure 2). Gas is an important part of the story. Across the 2000s and early 2010s, electricity access rates rose almost in parallel with the amount of power coming from gas (Figure 3), yet today more Nigerians are living without power than ever. The country had 17 million more unserved electricity customers in 2023 than it did in 2000. Without taking significant action, 100 million Nigerians in 19 million households could be in the dark by 2030. There are sharp divides between rich and poor: four-fifths of the wealthiest households (top quintile) are connected to the grid, versus one-fifth of the poorest (bottom quintile).

Figure 2. Share of Nigeria's population with access to electricity, 2001–2023



Source: ESMAP data

Figure 3. Share of electricity generation from gas vs. share of population with access to electricity, 2000–2020



Nigeria's fleet of gas power plants is aging and underperforming.

Most of Nigeria's gas power plants are at least halfway through their designed lifespan. Similar plants in other countries can last one to two decades longer, but only with costly maintenance and overhauls that Nigeria's power generation companies (GenCos) cannot afford (Table 4).

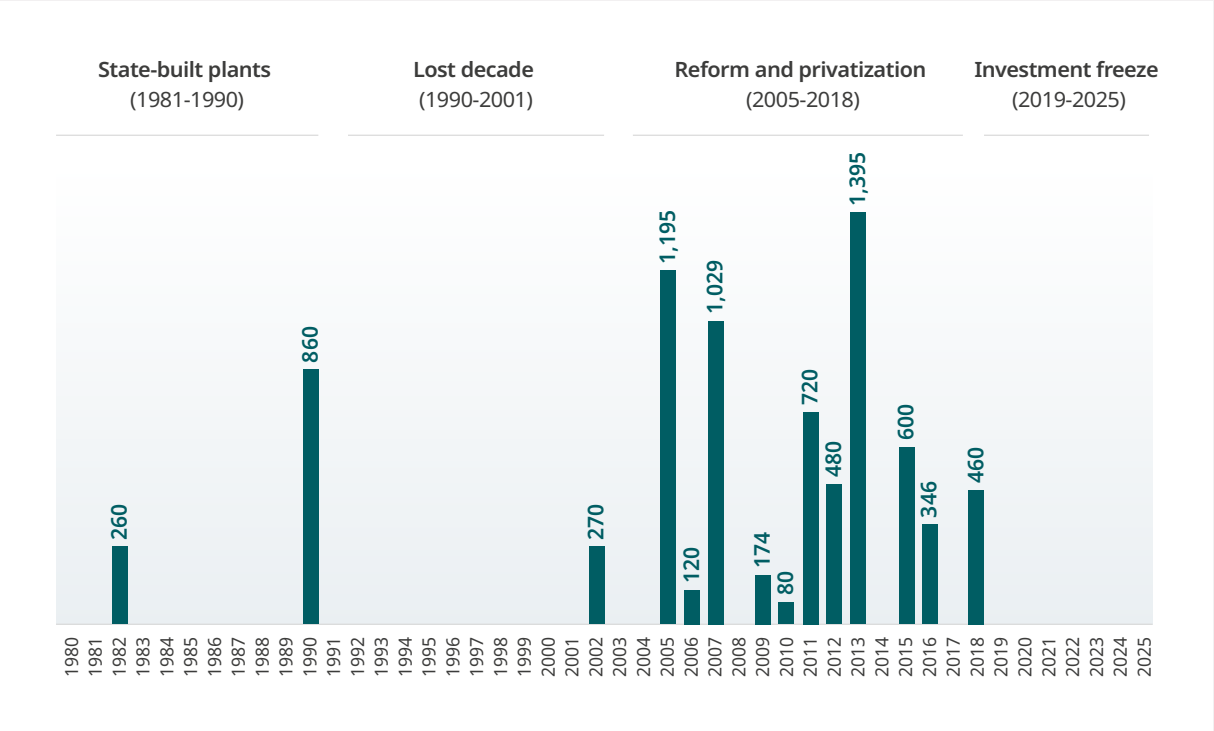
Table 4: Nigeria's aging gas power plants

Type of plant	Avg. age of Nigerian plants	Typical design/useful lifespan for plant type	Max. lifespan with maintenance and overhauls
Steam turbine	44 years	30–40 years	50+ years
Open cycle	15 years	20–25 years	30–40 years
Combined cycle	20 years	25–30 years	35–45 years

Source: Author calculations based on government and company data

Three-quarters of the country's gas-fired capacity came online in the early 2000s, when optimism over privatization and reform was high. The last new project was the Azura Independent Power Plant (IPP) in Edo State, which reached FID in 2016 (Figure 4).

Figure 4. MW of new gas power generation coming online, 1980–2025



Source: Author calculations based on NERC data

Operating conditions at most plants are difficult. System faults, failures and trips are common, as are collapsed cooling towers, overheating and fires. Shutdowns from deferred maintenance can last weeks, months or even years. In 2024, only three out of the nation's 21 gas-fired thermal or steam plants used over half of their installed capacity. Most ran at a third or lower; several did not run at all. There are many reasons for this (which are expanded on in the next section), including lack of gas. Arguably the worst cases are the National Integrated Power Projects (NIPPs), a series of large, mostly open-cycle plants built with government money in the 2000s and early 2010s. Today, most of these plants are barely running or are mothballed. Some shut down almost as soon as construction ended (Table 5). The poor use of existing assets raises important questions about whether future investments should prioritize new generation capacity or improving the performance of existing infrastructure.

Table 5: Performance of NIPPs, 2024

Share of total installed capacity	Avg. available capacity	Contribution to total actual generation	Plants running below 10% capacity	Plants generating no power at all
41%	21%	18%	4 out of 8	3 out of 8

Source: NERC data

Systemic problems with gas power

Looking ahead, major systemic problems will make it hard for Nigeria to kick-start its existing gas power plants or build new ones.

Problem 1. GenCos cannot buy enough fuel to generate power: As a group, Nigeria's thermal power plants receive less than half of the gas required to operate at full capacity, leaving most plants significantly underused. Some plants have received no gas in years, and only a handful have functioning, reliable gas supply agreements (GSAs) with upstream companies. Most GSAs work on a "best endeavor" basis, where the seller has the option—not a firm obligation—to deliver gas. Gas producers prefer to sell to Nigerian Liquified Natural Gas (NLNG), which pays on time at higher prices or export rates than domestic buyers, where rates are more competitive. Five times more goes to NLNG than to power, leaving many GenCos stranded.

Government targets for gas supply to the electricity sector are difficult to reconcile with current trends. NNPC's new gas master plan foresees demand from the power sector approaching 5,500 mmscf/day by 2030, including 1,000 mmscf/day from ten new plants. Yet actual gas supply currently hovers around 500 to 600 mmscf/day. Years of underinvestment in upstream gas development, combined with regulatory uncertainty and payment risks in the domestic market, have limited the volume of gas available for power generation. The Decade of Gas Initiative, which started in 2021, targeted more gas for the power sector, but NRGI research has found that most new production will be exported as LNG.

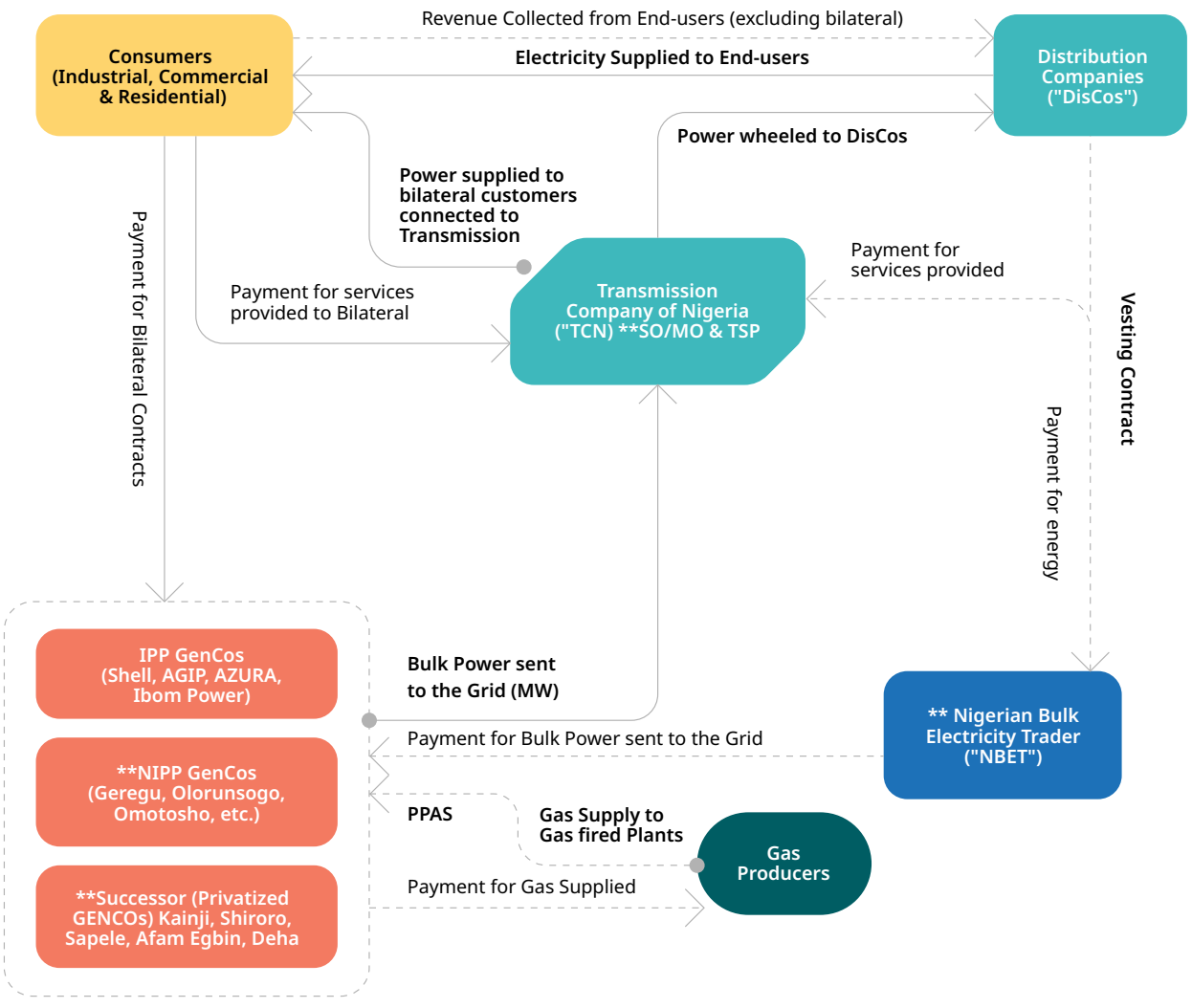
Problem 2. GenCos cannot dispatch all the power they generate: Even if a power plant gets enough fuel to generate power, the national grid may not be able to receive it. In the current system, GenCos dispatch power to the Transmission Company of Nigeria (TCN), which then transmits it either to the country's eleven distribution companies (DisCos) or to large customers who sign separate bilateral agreements with a GenCo. DisCos are then supposed to distribute everything they receive to customers over lower-voltage lines (Figure 5). But in reality, the transmission system can only wheel about 5,000 MW at a time—a third of existing capacity—and the DisCos lose huge amounts of electricity through load shedding, illegal connections and other issues. The grid collapsed over 500 times in two decades, and in an average month, Nigeria's power plants make around 20 percent more electricity than the grid loads. Transmission constraints are becoming increasingly important as generation capacity expands. In many cases, the marginal value of additional generation may be lower than investments that improve transmission and distribution performance.

Problem 3. GenCos cannot get paid for dispatched power: For years, a sector-wide liquidity crisis has caused chaos across the electricity value chain. GenCos sell power either to Nigerian Bulk Electricity Trading (NBET) or through bilateral contracts with large businesses. DisCos collect revenue from customers, excluding the bilaterals, then make payments to NBET, which settles the GenCos (Figure 5). In practice, though, no one in this chain pays on time or in full. GenCos paid only 40 percent of their gas bills in 2024, despite a World Bank partial risk guarantee that covers debts to gas suppliers.

NBET owes the GenCos somewhere between NGN 4 and 7 trillion for power dispatched to the grid, in part because the DisCos owe it trillions more. Some debts are over a decade old and, despite recent attempts by the Nigerian government to finance those debts through the capital market, they continue to loom large. Many DisCos do not bill for a fifth or more of the power they distribute; bill collections are even lower. Over half of customers nationwide are unmetered, and there is rampant fraud around meter reading and calibration, as well as untold numbers of illegal connections.

Aggregate technical commercial and collection losses (a measure that combines all types of losses a DisCo can suffer) average 38 percent, with some as high as two thirds. Corruption throughout the sector only compounds Nigeria's structural power sector challenges, leading to high system losses, underinvestment and stranded generation capacity. The persistence of liquidity shortfalls suggests that the sector's challenges are structural and long-lasting rather than temporary, making periodic bailout programs unlikely to provide durable solutions.

Figure 5. How on-grid power supply works in Nigeria



Source: NERC

To be clear, these are not the only obstacles gas power plants face in Nigeria. Forex shortages and the instability of the naira also add a range of costs—for example, when GenCos repay creditors or buy gas in dollars. Some proposed projects would need new gas supply pipelines and processing facilities, but who would build them? Poor cash flows throughout the system also create big maintenance backlogs, which worsen the three problems described above.

Yet the news is not all bad: several GenCos are signing better GSAs and using more of their available capacity; bill collection and metering at some DisCos have improved. But overall, around three-fifths of all on-grid generation capacity remains shut down at any given time. This is forcing the country to lean more on its aging hydro plants—which, by the end of 2025, were responsible for almost two-fifths of supply on the grid despite having only one-fifth of installed capacity.



An engineer working on a small electricity generator in an engineering workshop - photo by Kehinde Olufemi Akinbo via Shutterstock

Unfortunately, gas power's systemic problems have no easy fixes.

Many talented, hard-working people have spent their careers searching for a way forward. Yet after two decades of power sector reform, Nigeria has not managed to build a functioning, market-based system for delivering reliable, affordable on-grid electricity to its people. Across Nigeria's power value chain, from suppliers to end-users, the sector relies heavily on subsidies, bailouts and donor financing. Annual subsidy costs approach ₦2 trillion, while accumulated liabilities and periodic bailout programs run into trillions of naira, with international lenders such as the World Bank providing additional support. Over time, these outlays have become fiscally unsustainable, and they have not addressed the sector's deeper technical and commercial woes. The cost of subsidizing consumer tariffs has ballooned, yet for many, service has not meaningfully improved. Guarantees for power plants have consumed huge sums, but how much additional electricity have they delivered? New debts to GenCos pile up as soon as old ones are settled.

To ramp up power generation from gas, Nigeria would need to solve all three of the problems described above. How likely is this? The table below breaks down the challenges.

Table 6: Three systemic problems with Nigerian gas power

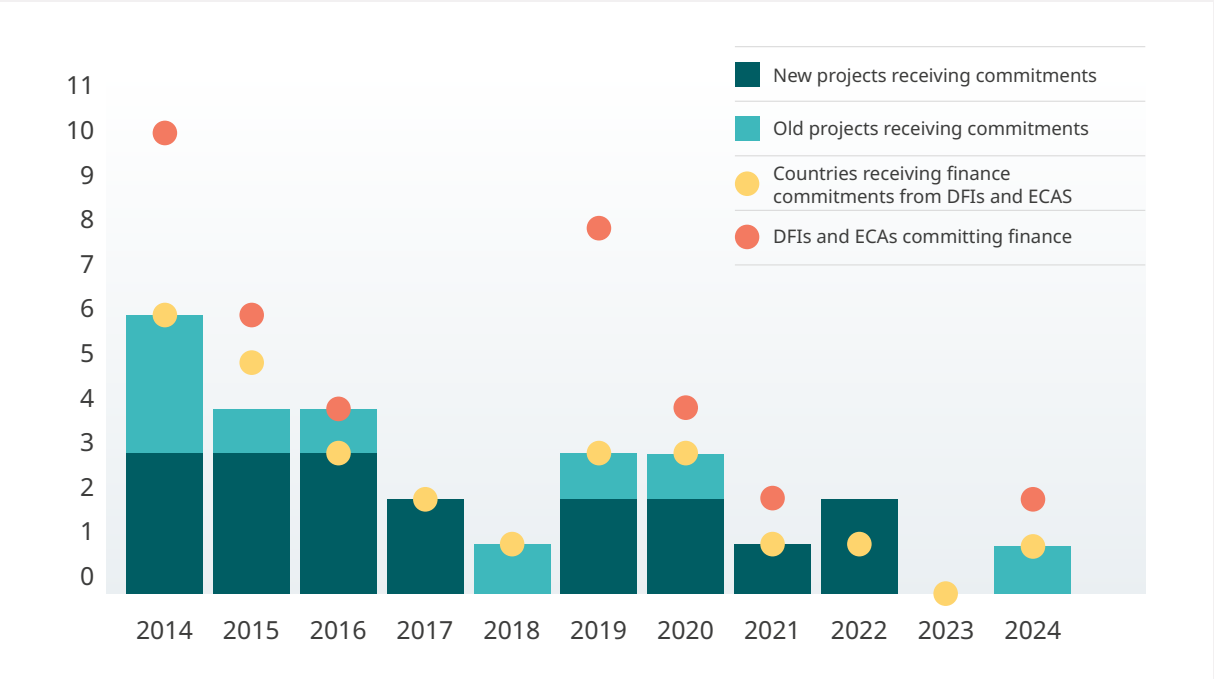
Problem	Causes	Examples of possible solutions	Why the solutions won't work
1. GenCos cannot buy enough gas to generate power	Regulated gas sale prices are too low	Deregulate to allow cost-reflective pricing	Requires much higher electricity tariffs, which are politically unpopular; affects World Bank partial risk guarantee
	New gas processing and transportation infrastructure needed	Build the infrastructure	Government cannot afford; private investors not interested
	Pipeline vandalism disrupts supply	Mix of payouts and security responses	Incidents go down only temporarily
2. GenCos cannot dispatch power	Weak transmission grid with frequent collapses	Rehabilitate and modernize the grid	Government cannot afford most of the costs; private sector not interested because of power sector liquidity issues
3. GenCos do not get paid for dispatched power	Low customer tariffs do not cover costs	Raise tariffs to cost-reflective levels	Tariff hikes are politically unpopular; government relies on subsidies, but then cannot pay in full
	Poor bill collection by DisCos	Improve efficiency of DisCos	DisCos still face large metering gaps, billing and collection issues, despite improvements; government cannot afford the investments needed
	NBET does not have the funds to pay GenCos	Government ensures NBET has funds to pay GenCos	Government cannot afford to settle large legacy debts and subsidize NBET; periodic bailouts do not solve the problem

Lack of finance for gas-to-power infrastructure

Nigeria has no easy source of capital to build more gas power plants.

African governments, including Nigeria, sometimes float plans to build plants with their own public money, but this typically does not succeed, whether due to lack of funds or because private investors do not want the government as a partner. One-hundred-percent equity financing for African power plants is also rare since shareholders usually demand at least some debt finance to help balance their risks. China is sometimes mentioned as a back-up source of capital, but across the whole of Africa, Chinese public lenders have committed less than USD 1 billion for two new gas-fired thermal plants in recent years, neither of which were in Nigeria. Given this lack of options, new Nigerian gas power plants would almost certainly require international public finance (IPF) from multi- and bilateral development finance institutions (DFIs) and/or export credit agencies (ECAs). For past projects, this took the form of so-called "blended project finance," a package of debt, equity, free technical support and small grants where at least some of the debt was concessional (usually because it has longer repayment times and/or lower interest rates and costs). Blending project finance is also supposed to attract foreign private capital by shifting risks to public or philanthropic investors, though this often is not successful. The reality is, IPF for African gas power peaked in the mid-2010s and has always been small: less than half a billion dollars/year on average between 2014 and 2024. Overall funding levels have been in decline for years, and the only case of new financing happened in the last five years, for a plant in Sierra Leone (Figure 6).

Figure 6. International public finance for gas power in Sub-Saharan Africa, 2014–2024



Source: NRGI calculations based on Global Energy Monitor and Oil Change International data.

In the 2000s and 2010s, most IPF for Nigerian gas power came from DFIs and ECAs based in Europe and North America. The last successful financing happened a decade ago, however, when the Azura IPP in Benin City raised close to $900 million in loans and guarantees from the World Bank, France, Sweden, United Kingdom, the United States and others. Since then, public investors in the global north have been backing away from African gas power. This is partly for climate reasons: at COP 16, thirty-eight countries, including all those that had previously provided IPF for Nigerian gas power, signed a pledge to stop offering public finance for foreign fossil fuel projects. Since then, these countries have dramatically decreased their funding. Public lenders also see gas-to-power in Nigeria as a bad business decision because of the systemic problems described above. No reasonable investor, public or private, will bring capital to build new infrastructure if the value proposition is not there. Potential investors must also consider the risk that new gas-fired assets could become economically underused before the end of their operating lives as renewable energy and storage technologies continue to decline in cost.

It may be possible to build a few small-scale gas power plants serving industrial customers. But these would not meet the country's bigger goals and needs.

Nigeria already has a few embedded gas-fired systems that power only one large industrial plant (as with the Dangote refinery and cement plants), as well as smaller, grid-connected IPPs delivering electricity to a cluster of businesses (for example, the cases of Paras Energy and TAOPEX Energy). To replicate the latter, any new grid-linked plant would, at a minimum, need a functioning GSA with a willing seller; creditworthy customers who sign take-or-pay PPAs to unlock investment; and a good working relationship with TCN, which would send power to the customers. Even if it succeeds, this model would not reach the millions of households and smaller businesses that remain unserved. Increasingly, solar plus storage may be a more affordable, reliable option for industry.



High-voltage tower near a transmission - photo by Alucardion via Shutterstock

The recent growth of Nigerian solar

As hopes for gas power dim, Nigerian solar is growing by leaps and bounds.

Renewables make up around 27 percent of Nigeria's power generation, with hydropower contributing significantly more than solar. However, solar energy is expanding rapidly in Nigeria. It has the third-highest number of minigrids worldwide today—the REA deployed 200 in 2025 alone. Over 25,000 SHS have been installed in 183 communities across all 36 states and the Federal Capital Territory. C&I users could add 550 MW of new solar between 2025 and 2029. Chinese solar panel imports grew 15 times in the last four years, and Nigeria was Africa's second largest solar market in 2025.

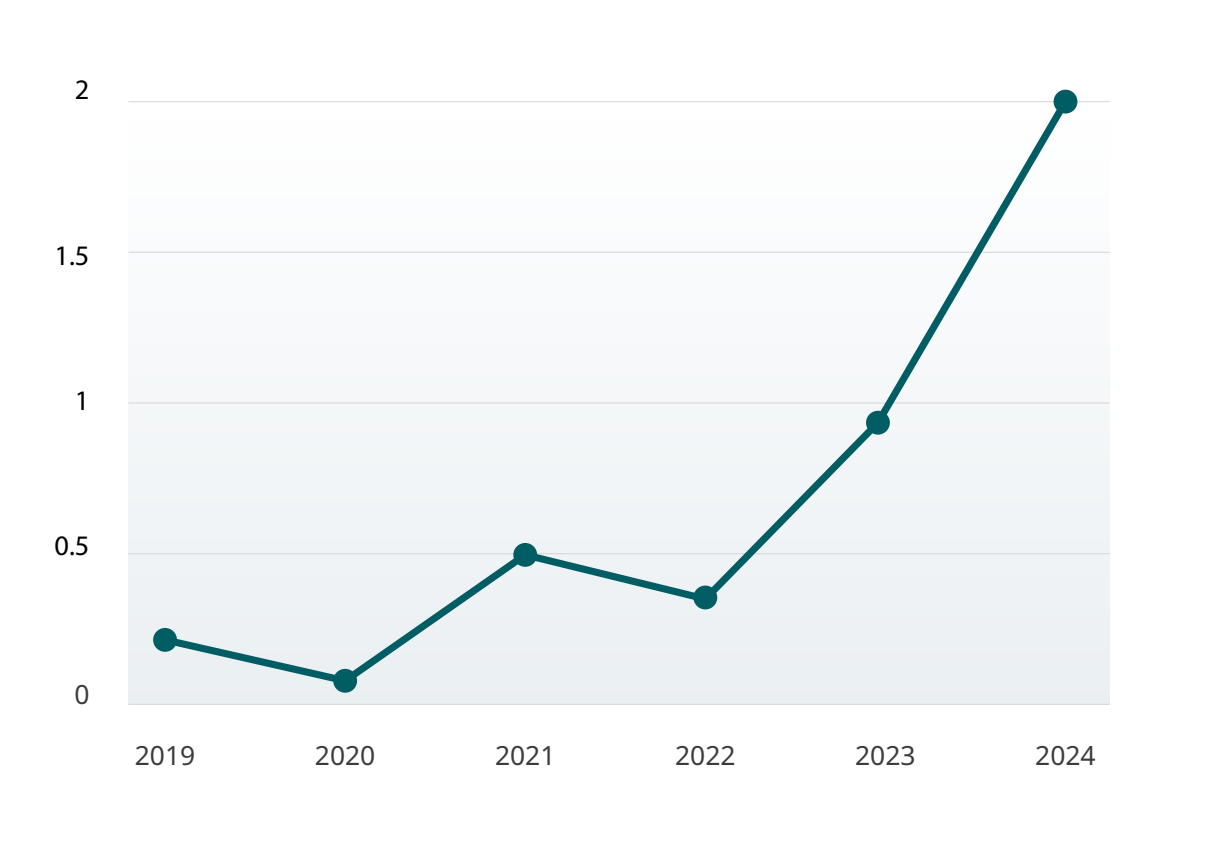
Many factors support the spread of solar. Nigeria's average daily horizontal solar irradiation is high, between 3.5 and 7.0 kWh/m^2/day (see Figure 10). Average wind speeds, by contrast, are more moderate (2.1 to 8 m/s) and biomass remains largely untapped. Many recent policies and initiatives have strengthened the enabling environment. Notable examples include the 2016/2023 minigrid regulations; federal and state tax holidays and credits; VAT exemptions; feed-in tariffs; state government guarantees for small Power Purchase Agreements (PPAs); the project-based grants and pipeline administered by the REA; and the ongoing work on power sector decentralization. Continuing technological innovations—e.g., mesh grids; more efficient, affordable solar panels and inverters; and interconnected minigrids—are also driving down costs. Despite rapid growth rates, solar currently starts from a relatively small base and remains far below the scale required to meet Nigeria's long-term electricity needs on its own.

Finance for Nigerian clean energy is also evolving and expanding, unlike the situation with gas power.

Total investment in clean energy grew 10 times in five years (2019–2024) (Figure 7). Almost no capital, foreign or domestic, went to Nigerian gas power in the same period. Nigerian companies received a fifth of all African minigrid financing between 2019 and 2023. By 2023, Nigeria was the world's fifth-largest recipient of IPF for clean energy, netting $829 million for 42 projects, nearly all of them small-scale solar. In 2024, the country became the number ten recipient of renewables foreign investment.

Many types of investors who avoid gas are active in Nigerian renewables, notably: large international and bilateral DFIs; foreign private equity and impact investors; local banks; and institutional investors such as pension funds. This interest has led to some important innovations and firsts, for instance: DFI-backed lending in naira to reduce currency risk; performance-based grants for minigrid developers and results-based lending for solar companies; privately issued green bonds and sukuks; crowdsourced project funds; and donor-backed procurement programs for imported solar components.

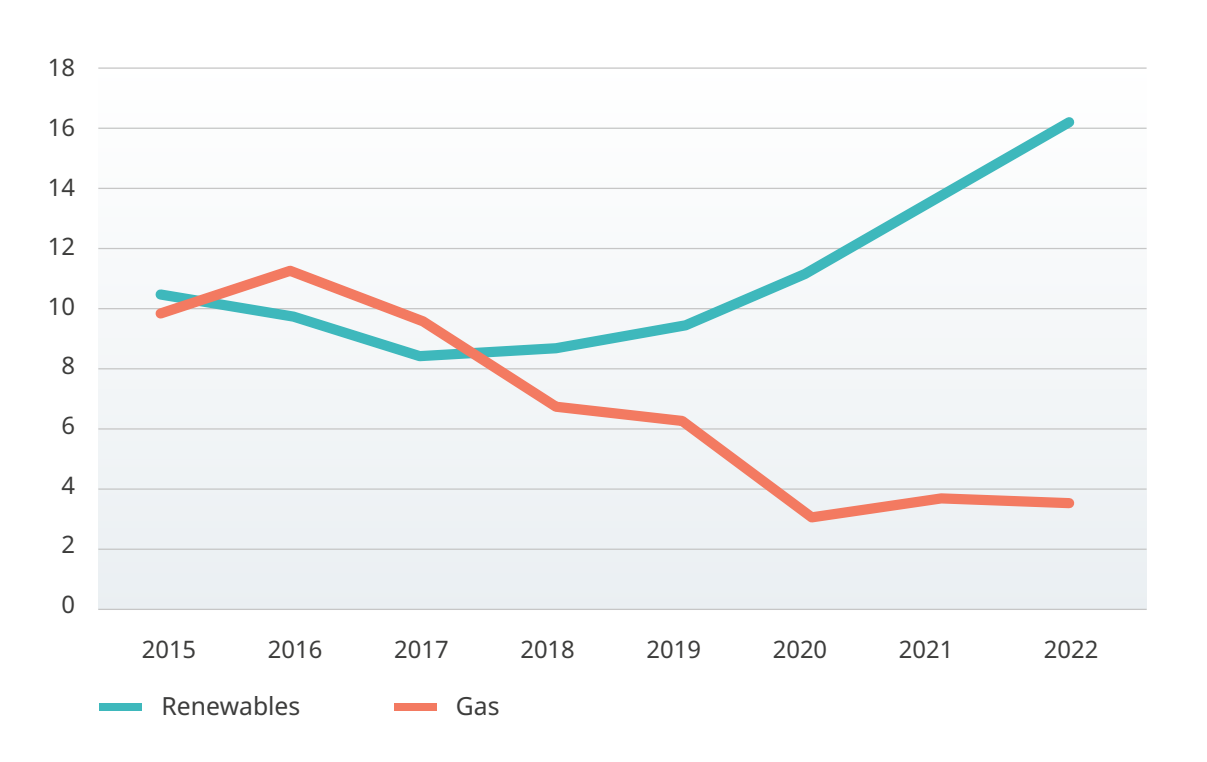
Figure 7. Investment in Nigerian clean energy, 2019–2024



Source: Bloomberg NEF

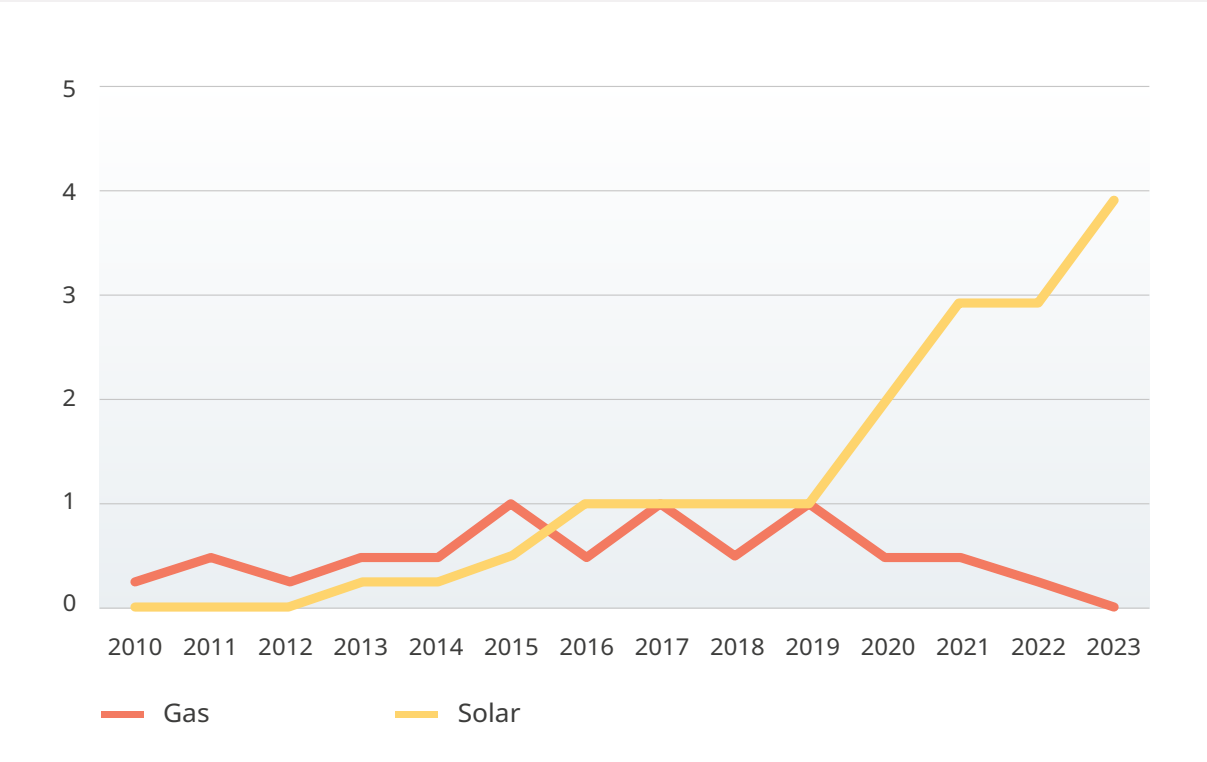
This tracks bigger changes on the continent. Total clean energy investment in Africa doubled between 2020 and 2024 alone; money for gas power contracted. Capital for renewables generation overtook gas plants in 2017; by 2022, it was four times larger than gas (Figure 8). Over four-fifths of all African power investments in recent years have been in solar or wind. The result: Africa's ability to generate electricity from the sun has been growing by gigawatts each year, while the expansion of gas power has slowed to almost nothing (Figure 9). Much of the recent growth in renewable investment has been concentrated in small-scale energy systems rather than utility-scale generation, reflecting persistent structural barriers in Nigeria's broader power sector.

Figure 8: Investment in gas and renewable energy generation capacity in Africa 2015–22 (USD billion, 2022)



Source: IEA

Figure 9: New power generation capacity added in Sub-Saharan Africa, solar v. gas, 2010–23 (GW)



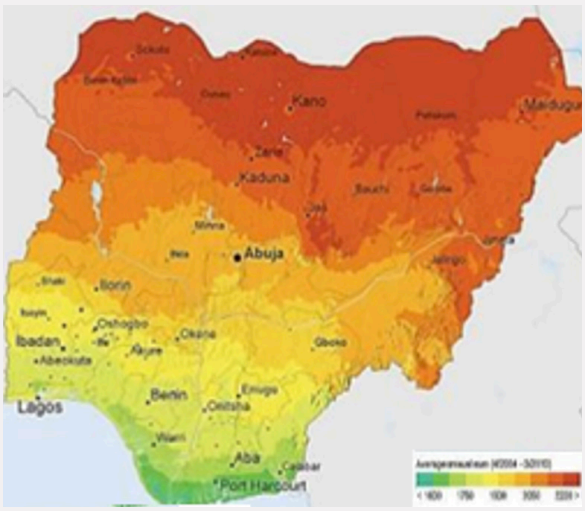
Source: Author calculations based on Bloomberg, Global Energy Monitor and IEA data

Solar as a response to Nigeria's electricity needs and goals

Solar has more potential than gas to meet some of Nigeria's biggest electricity challenges.

Achieving universal electricity access: Small-scale solar can reach large numbers of unserved or underserved electricity consumers that grid power cannot. Minigrids are likely to have the biggest potential, especially in larger, peri-urban communities with at least several hundred houses and businesses. They could be especially useful in the north, since the region has the highest irradiation (Figure 10); the lowest electricity access rates (Figure 11); and the worst-performing DisCos with high infrastructure and cash-flow problems. The number of new minigrid connections is also outpacing new grid hookups. The NIRP projects that solar and hydro will dominate future energy generation in the north and make up nearly half of the south's installed capacity by the 2040s.

Figure 10. Irradiation levels by region



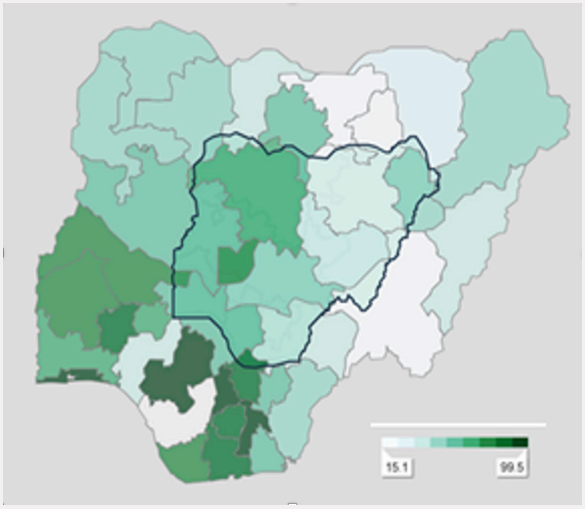


Figure 11. Electricity access rates by region

Source: SE4All

The 2023 Electricity Act also allows states to create their own power markets, which could lead to new incentives for minigrids and help project developers bypass common roadblocks around licensing, grid interconnection and land access, among others. This promise comes with important caveats. The upfront capital costs of solar remain unaffordable for many Nigerian households and businesses, and high finance charges raise the prices of solar-generated power. For minigrids, experience has shown that underuse forces operators to charge higher tariffs, creating additional affordability challenges and even causing projects to fail. Vandalism and theft of components also make systems unreliable, and DisCos often do not allow developers to build minigrids close to existing distribution lines, where demand may be higher. Nigerian minigrids also rely heavily on grants, sometimes for half of their capital costs. This means that if minigrids are to scale, the available pool of grant money (or similar funds) will also need to grow. There is also the issue of battery

storage. Although battery costs have been falling globally, the fact that Nigerians still must import battery components from China (and pay for them with foreign exchange) raises prices significantly. Lithium battery storage in Nigeria runs between ₦230,000 and ₦290,000/kWh today, well above global benchmarks. Because the country has three to five hours/day of peak solar irradiation, any small-scale solar system that delivers meaningful overnight coverage must have batteries. At current prices, it is storage, not panels, that makes up the biggest cost in Nigerian solar, and any least-cost modeling must compare gas power against solar-plus-batteries, not panels alone.

Delivering affordable power: Small-scale solar has the potential to be more affordable than grid power. Today, minigrid developers report charging tariffs that are higher than grid tariffs— ₦250–500/kWh versus ₦200 or less. In available studies—all of which are outdated—the average levelized costs of electricity from SHS have tended to be somewhat higher than grid power as well. However, the grid is only cheap because of the trillions of naira the government spends on subsidies each year, which is unlikely to be sustainable. The falling costs of solar components are also well documented and expected to continue.

Looking ahead, preliminary modeling from the 2022 Nigeria Integrated Energy Plan (NIEP) identified minigrids or SHS as the most affordable technology for three-fourths of unserved customers nationwide. Preliminary least-cost modeling for the NIRP was similar. As more states develop their own power markets under the new decentralized system, it may become easier to cut system costs as well as discover and set power prices that are more affordable for customers in different parts of the country. An energy mix built on small-scale solar may also be more affordable for the government. Most of Nigeria's incentives for solar take the form of foregone public revenue (such as company tax holidays or duty exemptions), not the huge transfers of public money that on-grid actors need (such as annual subsidies, GenCo bailouts and sovereign guarantees). Subsidies for small-scale solar are also mainly covered by other actors, such as development banks providing grant money for minigrids. As mentioned above, affordability of solar remains a challenge.

The NIEP found that 92 percent of unserved customers could not afford SHS and 53 percent could not afford a minigrid connection, though the authors also estimated that small subsidies of a few hundred dollars per connection could close this gap. The revised NIRP is supposed to include more granular least-cost generation planning.

Eliminating private generators: Small-scale solar could do more than the grid to free Nigerians from using generators. Nigeria's glut of small diesel and gasoline-powered generators is one of the largest in the world—estimates range from 15 to 60 million units nationwide. According to the ETP, these dirty, dangerous machines churn out half of all generated power and a staggering 80 percent of generation capacity.

Precisely how much solar could replace private generation is hard to gauge since good data on the topic is scarce. The answer will vary by location, technology and type of customer. Survey data showed that receiving a minigrid connection ended generator use for three-quarters of the people who previously relied on them. No similar finding exists for new grid users. Other surveys have found that four-fifths of urban households and almost 90 percent of businesses still own or share a generator, and that three-quarters of generators are deployed in grid-connected areas. On average, the grid supplies six to seven hours/day of electricity to customers. A well-functioning minigrid or SHS can deliver several more, especially with storage. Nigerian C&I customers are increasingly turning to solar arrays with storage as a cheaper alternative to private generation. Solar's daytime load profile aligns especially well with their needs.

The relative costs of solar versus private generation are also important. Nigerians spend $12 to $14 billion/year importing and fueling mostly Chinese generators, and private generation is the most expensive source of power nationwide. Anecdotal evidence says small Nigerian solar systems can pay for themselves in a few years or even months, and Africa-wide research concluded that the savings from not fueling a generator can cover the cost of a solar panel in six months or less.

Ongoing challenges to the spread of renewables

Finance for renewables in Nigeria is not growing fast enough to meet targets or needs.

On the finance side, for instance, the current $2 billion in annual investment is a fraction of what is needed. Some estimated price tags for a new Nigerian power mix include $6 billion/year for clean generation, $23 billion for last-mile electrification efforts, and $135 billion for grid build out and overhauls. Government and non-governmental organization (NGO) analysis has identified large, mostly unmet market opportunities for Nigerian solar in particular—$9 billion/year for minigrids, for instance, or $2 billion for SHS.

Many solar projects and some developers still heavily depend on foreign donors for credit, grants and guarantees. The bulk of the money comes from large bureaucratic organizations such as the African Development Bank, the European Union, the Global Energy Alliance for People and Planet and the International Development Association/World Bank, whose priorities could shift anytime. Finance for off-grid projects and companies so far has come from three main sources:

1. Government grants covered by foreign donor money, mostly administered by REA.
2. Small loans to solar companies from government agencies (Bank of Industry, Central Bank of Nigeria (CBN)) or local banks, often with foreign donor backing.
3. Equity investors taking relatively small stakes in promising local solar developers.

Large-scale renewables on the grid remain frustratingly out of reach.

After more than a decade of efforts, Nigeria still has no on-grid, utility-scale solar or wind farms. The government signed fourteen PPAs with solar developers in 2016, but none of them have reached FID. In wind, the only project is a small (10 MW) farm in Katsina State that shut down almost immediately because of technical, political and security problems.

Utility-grade solar and wind face many of the same systemic problems as gas power plants. The condition of the grid would make it hard to dispatch power, and the sector-wide liquidity crisis means they would not reliably get paid. Currency exchange risk makes debt finance for on-grid projects very expensive, and the government has refused to give sovereign guarantees because of bad experiences in the past. Similar to gas power, smaller (100 MW or less) grid-connected solar installations that serve particular customers have the best chances for success.

Of the two technologies, wind is the longer shot. The country's best wind speeds (up to seven miles/second) are in northern states suffering from rampant insurgency, banditry and farmer-herder conflicts. Offshore wind potential has not been studied, and unlike solar, wind has no smaller, modular options. The NIRP predicts Nigeria will build only a small amount of wind capacity, and this will not start until the 2040s.

Recommendations: Reimagining the roles of gas and renewables

The challenge for Nigeria now is to revise expectations for gas while helping renewables scale in more efficient, equitable ways.

The country will need both gas and renewables to reach its energy goals in the near term. Switching to a 100 percent renewable system will take decades as well as huge amounts of capital and human investment. In the meantime, Nigerian households and businesses will keep relying on multiple technologies and fuels to meet their electricity needs. Going forward, Nigeria needs to right-size its ambitions for gas. If policy-makers continue to see gas power as having great room to grow, or to treat gas as the backbone of a highly centralized power system, the country will not meet its energy sector needs and goals. Scarce capital and time will be lost to non-solutions, and renewables will not reach their full potential. NRGI recommends the following steps for decision-makers:

Choose a few lower-cost, higher-return initiatives to keep existing gas plants running while the transition to renewables advances.

- The Ministry of Petroleum Resources and Power, in consultation with other relevant actors, should develop a plan for improving and safeguarding gas supply to existing plants. Elements could include new security measures for gas pipelines; higher penalties for not meeting domestic supply obligations; clear priority allocation of gas to the most efficient and critical power plants; and improved coordination between gas and renewable suppliers as well as power system operators, while maintaining a right-sized approach to gradual integration and scale of renewable energy.
- The Presidency should create a multistakeholder committee charged with finding options for GenCos to purchase gas in naira instead of dollars.
- The federal government should prioritize budgetary support for the individual DisCos where achievable performance improvements (e.g., on billing and metering) will do the most to increase payments to GenCos.
- NERC should explore how to revise its tariff methodology to make these more cost-reflective for GenCos, with subsidies that better target customers with lower ability to pay.
- Federal and state authorities should strengthen integrated least-cost power planning processes that evaluate gas, solar, hydro, storage, transmission and demand-side investments using common economic, reliability and development criteria.
- The Ministry of Power, NERC and state regulators should develop a regulatory framework for utility-scale and distributed energy storage, including rules for licensing, ownership, compensation and grid integration.
- NERC, TCN, NBET and market participants should improve public disclosure of generation, transmission, dispatch, payment and reliability data to support evidence-based planning and investment decisions.
- Electrification programs should be linked to productive-use initiatives that increase demand, improve economic outcomes and strengthen the financial sustainability of power systems.

Shift unsustainable spending on gas power to renewables to protect limited public resources and signal commitment to transition.

- No government body should take on more legacy debts of GenCos to gas suppliers, especially if this would involve taking on new sovereign debt.
- The federal government should channel funds used for new gas power plants unlikely to come on stream into exploring alternative energy pathways.
- Government should critically evaluate the risks of issuing sovereign guarantees for any new or existing gas power plant compared with scaling incentives for renewables to limit the potential for infrastructure lock-in and future-proofing.

Make realistic plans that clarify the future roles of gas and renewables.

- The management team charged with revising the NIRP should describe in greater detail how gas and renewable power will interact in future. At a minimum, this should involve revising the NIRP's generation expansion scenarios and its targets for storage as an alternative to gas.
- The team developing the Strategic Investment Plan should:
  - not include new gas power generation that is unlikely to be built;
  - not recommend supporting or channeling limited public funds for existing gas infrastructure, power plants or large pipelines where performance is unlikely to substantially improve;
  - fully consider near- and longer-term alternatives to gas power as a backstop to on-grid renewables, with options including private generation as well as battery, salt, pumped hydro and other types of storage.
- TCN's final Transition Master Plan should not include new infrastructure for gas plants unlikely to be built, or for plants that will remain stranded and underperforming even with new infrastructure.
- The Ministry of Power, together with other relevant actors, should study how other countries are beginning to transition away from gas in order to identify helpful policies, models and public investments to deliver their energy access and broader development goals.
- States building their own power markets should develop energy transition plans.

Remove barriers that keep grid-connected solar from scaling.

- State ministries of power or rural electrification agencies should conduct market feasibility studies to assess consumer demand profiles; willingness and ability to pay; and the causes of financial loss in different service areas.
- State ministries of power or rural electrification agencies should conduct physical audits to identify infrastructure gaps and investment priorities.
- State governments should conduct financial audits and adopt electricity tariff methodologies that allow them to discover cost-reflective prices for all entities in the power supply chain.
- Federal and state governments should pass regulations or issue capacity waivers that allow for larger minigrids.
- All relevant parties (state governments, REA, CBN and private financiers) should collaborate across election cycles on building successful pilot projects.
- State governments should streamline processes for licensing, permitting, interconnection and land acquisition.
- States should explore the affordability and feasibility of different incentive options, including guarantees for PPAs; tax breaks; grants and low-interest loans; rural electrification funds; and guaranteed buyback rates for surplus generated power.
- The federal and state governments should clarify policies on net metering, balancing consumer returns on investment and DisCos' financial health.

- NERC and interested state governments should develop regulations for energy storage and consumer protection.
- The federal and state governments should consider options for punishing electricity theft and related types of fraud, for instance, through special tribunals or courts.
- DisCos should develop strategies, policies, procedures and model agreements for partnering with developers of grid-connected solar projects. They should include targets, key performance indicators and projects that help integrate solar in their performance improvement and investment plans.
- DisCos should develop detailed maps of potential sites for minigrids. They should allow developers to site minigrids closer to existing infrastructure and in areas with higher population density.
- DisCos and project developers should share performance data with other market participants to make project due diligence easier and less costly.
- States should standardize company registration rules and procedures so that developers can work more easily in multiple markets.
- The federal government should not pass any policy restricting imports of renewables components that are not already manufactured in the country at scale.

Adopt good practices for stakeholder consultation around renewables projects.

Project developers and relevant government agencies should, at a minimum:

- Engage with stakeholders starting in the early stages of project development and through different platforms (town halls, small-group workshops and dialogues, household surveys).
- Provide clear, accessible information about proposed plans, with regular updates.
- Reach out to a diverse range of groups, including community members, local businesses, government officials, NGOs and experts.
- Understand the divisions and tensions within groups and avoid replicating or exacerbating them in the consultation process.
- Offer stakeholder education about the benefits of access and the available types of service and financial support; provide communication and dispute resolution mechanisms.

Announce new measures to extend electricity access for hard-to-reach consumers.

- State power ministries and rural electrification agencies should develop their own policies, plans and project pipelines for improving access. Electrification plans should be linked to broader development goals and planning aimed at creating thriving, healthy local economies and people.
- The federal and state governments, together with DFIs, should explore models for funding SHS in rural areas that grid-based solutions cannot reach.
- DFIs should expand their support for renewables in Nigeria.
  - Structuring their investments in renewable energy projects and companies in ways that make local financial institutions more willing to lend in naira. Options here include loan syndication, on-lending, b-loans and portfolio guarantees.
  - Helping to attract funding from institutional investors such as pension funds, insurance companies and endowments—for instance, through financial and technical support to a new yieldco; purchasing and advising on local currency green bonds; or support for entities that guarantee local corporate bonds.
  - Finding innovative ways to package smaller projects and other funding opportunities to reduce transaction costs, spread risk and attract larger investors.
  - Looking beyond financial support for new generation capacity to invest more in critical but hard-to-fund infrastructure like grid extensions, battery storage or household meters and connections.
  - Providing more and larger grants for minigrid capital costs.

Conclusion

Nigeria's energy challenge is not simply a question of choosing between gas and renewables. Rather, it is a question of allocating scarce public resources toward the technologies and institutions most capable of delivering reliable, affordable and sustainable electricity. Gas will likely remain part of Nigeria's energy mix for decades to come. Yet the country's experience over the past two decades suggests that ambitions for large-scale gas-to-power expansion should be tempered by the realities of fuel supply, financing constraints and sector-wide governance challenges. At the same time, the rapid growth of distributed solar demonstrates that alternative pathways for expanding energy access are emerging. The most prom ising strategy may therefore be neither a gas-first nor a renewables-only approach, but a pragmatic transition that prioritizes performance, affordability and development outcomes above technology preferences.



Solar panels installed on rooftops - photo by Lukehphotos via Shutterstock

About the authors

Tengi George-Ikoli is Nigeria country manager at NRGI and Aaron Sayne is the sustainable energy supply lead at NRGI.

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