

## Research Article

# Energy Crisis in Nigeria: Causes, Impacts, and Pathways to Sustainable Reform

**Oliver Linus Sunday**<sup>1, 2, \*</sup> <sup>1</sup>Independent Researcher, University of Uyo, Uyo, Nigeria<sup>2</sup>Royal Salt Industries Limited, Port Harcourt, Nigeria

## Abstract

Nigeria's energy crisis has persisted for decades, undermining economic growth, industrial development, and social welfare despite the nation's vast energy resources. This paper critically examines the causes, socio-economic effects, and climate-related implications of Nigeria's ongoing energy challenges. It identifies key structural constraints - including inadequate generation capacity, poor transmission infrastructure, inefficient distribution networks, unstable gas supply, and weak policy governance. The study also highlights socio-economic consequences such as reduced productivity, unemployment, inequality, and loss of public confidence in the power sector. Furthermore, it discusses environmental degradation and greenhouse emissions resulting from heavy reliance on fossil fuels and generator usage. The paper argues that the crisis stems largely from institutional inefficiencies, financial instability, and policy inconsistency. To address these issues, it proposes comprehensive strategies focusing on renewable energy expansion, infrastructure modernization, cost-reflective tariffs, and decentralized power solutions. Strengthening energy governance, promoting investment, and prioritizing clean energy development are emphasized as vital steps toward a resilient, inclusive, and climate-conscious energy future. Ultimately, resolving the energy crisis is not merely a technical challenge but a national imperative - essential for achieving sustainable economic transformation and environmental stability in Nigeria.

## Keywords

Energy Crisis, Electricity Reform, Renewable Energy, Climate Change, Nigeria, Sustainable Development

## 1. Introduction

Energy remains the backbone of every modern economy, underpinning production, communication, healthcare, transportation, and education. Nations with reliable and affordable energy networks tend to experience sustained economic growth and improved living standards, while those constrained by energy shortages face stagnation and social hard-

ship [9]. In Nigeria, this contrast is striking. Despite being Africa's leading oil producer and possessing vast reserves of natural gas, coal, and renewable energy potential, the country continues to face an enduring energy crisis that has hindered development for decades [1]. The situation represents a paradox of abundance amidst scarcity; a reflection of systemic inefficiency, governance weaknesses, and policy inconsistency.

---

\*Correspondence: Oliver Linus Sunday (oliversunday22@gmail.com)

**Received:** 10 June 2026; **Accepted:** 24 September 2026; **Published:** 28 October 2026



Copyright: © The Author(s), 2026. Published by Science Publishing Group. This is an **Open Access** article, distributed under the terms of the Creative Commons Attribution 4.0 License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

Nigeria's power sector has long been characterized by instability and underperformance. The national grid, which serves more than 220 million people, rarely delivers more than 4,000 to 5,000 megawatts of electricity, despite an estimated national need exceeding 30,000 megawatts [6]. Consequently, frequent power cuts and voltage fluctuations have become an unavoidable aspect of daily life. For households and businesses alike, reliance on personal generators has become the norm, making Nigeria one of the world's largest markets for small petrol and diesel generators. Analysts estimate that Nigerians collectively spend over \$14 billion annually to generate self-supplied power, i. e., far more than government investments in the entire electricity sector [9]. This dependence on private generation not only increases production costs but also exposes the population to health and environmental hazards stemming from emissions and noise pollution.

The implications of Nigeria's unreliable energy supply are profound and far-reaching. For businesses, particularly small and medium enterprises, high energy costs significantly reduce productivity and competitiveness. Industries that could drive economic diversification, such as manufacturing, agro-processing, and technology, operate far below capacity. Many manufacturing firms have either scaled down or relocated to neighbouring countries with more stable energy systems [2]. High operational costs translate to job losses, reduced investments, and diminished export potential, ultimately reinforcing the cycle of poverty and inequality.

At the domestic level, energy shortages affect every facet of daily life. The phrase "NEPA has taken light" has become culturally emblematic of systemic failure (a colloquial shorthand for the inefficiency of public institutions). Nigerians have adapted to living with darkness as a routine experience, using candles, rechargeable lamps, or generators depending on income levels. This normalization of dysfunction illustrates not only material deprivation but also the deep erosion of public trust in state capacity.

The paradox of the Nigerian energy crisis extends beyond electricity generation. The petroleum industry, historically the backbone of Nigeria's economy, is plagued by inefficiency and contradictions. Although the country exports millions of barrels of crude oil annually, it imports the majority of its refined products because its refineries operate far below capacity [7]. This dependence on imports makes the country vulnerable to price volatility and foreign exchange pressures. It also perpetuates the recurring cycle of fuel scarcity and subsidy crises that frequently disrupt national life. Each episode of fuel scarcity inflates transport costs, drives up food prices, and fuels inflation [8]. The irony of a resource-rich nation struggling to fuel its own vehicles underscores the structural failures of Nigeria's energy governance.

The consequences of the energy crisis extend to the social and developmental spheres. Over 85 million Nigerians (about 43% of the population) still lack access to grid electricity, representing the largest energy access deficit globally [9]. The situation is worse in rural areas, where power infrastructure is

minimal or non-existent. Lack of energy access constrains agricultural processing, healthcare delivery, and educational advancement. Healthcare facilities without electricity struggle to operate essential equipment or preserve vaccines, while schools lack modern learning tools such as computers and projectors. The absence of reliable power deepens the urban-rural divide and perpetuates cycles of poverty, inequality, and underdevelopment.

Environmental degradation provides another dimension of the crisis. The use of petrol and diesel generators has increased air and noise pollution in urban areas, contributing to respiratory illnesses and climate change [4]. The Niger Delta, Nigeria's oil-producing region, has borne the brunt of decades of environmental exploitation through oil spills, gas flaring, and land degradation. These ecological disasters have destroyed livelihoods, poisoned water bodies, and displaced communities [3]. Environmental degradation in turn fuels social unrest and militancy, linking the energy crisis to the nation's broader issues of insecurity and instability.

Attempts to reform Nigeria's energy sector have been ongoing for decades, yet success remains limited. The Power Sector Reform Act of 2005 and the subsequent privatization of the Power Holding Company of Nigeria in 2013 were major steps toward liberalizing the sector [5]. However, privatization has not yielded the desired stability. Generation and distribution companies (GenCos and DisCos) continue to face liquidity issues, obsolete infrastructure, and poor metering systems. The Transmission Company of Nigeria (TCN) remains a weak link in the electricity value chain. These structural inefficiencies are compounded by persistent corruption, policy reversals, and a lack of political will to implement long-term solutions [1].

Despite these challenges, Nigeria retains significant potential to overcome its energy obstacles. The country's renewable energy resources (particularly solar, hydro, and wind) remain underutilized. Given its high solar radiation levels, renewable energy could play a transformative role in electrifying rural communities and diversifying the energy mix [6]. Policy frameworks such as the Renewable Energy Master Plan (REMP) and the Decade of Gas Initiative represent steps in the right direction, though implementation remains weak [5]. Leveraging public-private partnerships and adopting decentralized energy systems such as mini-grids could help close the access gap and reduce dependence on fossil fuels.

Ultimately, Nigeria's energy crisis is not merely a technical malfunction but a reflection of governance quality, leadership vision, and institutional effectiveness. Reliable energy supply is a prerequisite for industrialization, innovation, and inclusive growth. A nation that cannot light its homes or power its industries cannot fully realize its developmental aspirations. The path to energy stability requires more than financial investment; hence, it demands transparent governance, long-term policy consistency, and the political courage to reform entrenched inefficiencies.

In the end, Nigeria's ability to address its energy crisis will

determine the pace of its national transformation. Energy is not only about lighting bulbs or running machines; it is about dignity, opportunity, and progress. By harnessing its abundant resources responsibly and prioritising sustainable solutions, Nigeria can turn its energy paradox into a story of empowerment and renewal. A brighter, more resilient energy future is not only possible, but essential for the nation's survival and its place in the global economy.

## 2. Causes of the Energy Crisis in Nigeria

Nigeria's energy crisis is a result of multiple structural, governance-related and neglectable concerns. These are:

### 2.1. Inadequate Generation Capacity

Nigeria's installed electricity generation capacity remains grossly insufficient relative to its population and industrial demand. Although nominal capacity exceeds 12,000 megawatts, actual output fluctuates between 3,000 and 5,000 megawatts due to operational inefficiencies, outdated equipment, and limited investment [6]. The result is a persistent gap between supply and demand, leading to nationwide blackouts and suppressed industrial productivity.

### 2.2. Poor Transmission Infrastructure and Inefficient Distribution Networks

The weak state of Nigeria's transmission network is a major structural bottleneck in the power sector. The Transmission Company of Nigeria (TCN) operates an ageing infrastructure that lacks the capacity to evacuate generated power efficiently. Frequent system collapses and grid instability illustrate the fragility of the system [5]. Even when electricity is successfully generated and transmitted, the distribution companies (DisCos) also face serious technical and commercial losses. Most networks are outdated, with inadequate metering, poor revenue collection, and frequent breakdowns [2]. Consequently, only a fraction of the energy generated is billed and paid for, creating revenue shortfalls across the value chain. Bottlenecks within this midstream segment often nullify generation improvements and prevent power from reaching consumers.

### 2.3. Gas Supply Constraints

Gas-fired plants, which account for approximately 80% of Nigeria's grid-based electricity, often suffer from inconsistent gas supply due to pipeline vandalism, inadequate infrastructure, and competing export priorities [4]. Many thermal stations operate below capacity because of unstable gas feedstock, resulting in forced outages and expensive maintenance cycles.

### 2.4. Weak Sector Governance and Policy Inconsistency

The Nigerian energy sector has been plagued by regulatory overlap, corruption, and policy reversals. Frequent changes in leadership, unclear mandates between government agencies, and inconsistent reform implementation have hindered investor confidence [1]. Poor governance not only delays projects but also encourages inefficiency and rent-seeking behaviour among key stakeholders.

### 2.5. Non-Cost-Reflective Electricity Tariffs

Electricity tariffs in Nigeria remain below cost-recovery levels, discouraging private investment and limiting the financial stability of distribution companies. Artificially low tariffs, influenced by political pressure, prevent operators from covering operating costs or reinvesting in infrastructure [9]. This imbalance perpetuates revenue shortfalls and discourages expansion of service coverage.

### 2.6. Liquidity Crisis in the Power Sector

Chronic payment arrears and poor cash flow have resulted in a liquidity crunch across the power market. Distribution companies fail to remit adequate revenues to generation companies, while gas suppliers remain unpaid, creating a vicious cycle of financial distress [7]. The absence of effective regulatory enforcement deepens this financial instability.

### 2.7. Aging and Poorly Maintained Infrastructure

Much of Nigeria's energy infrastructure - spanning power stations, transmission lines, and substations - dates back to the 1970s and 1980s [5]. Decades of inadequate maintenance, vandalism, and delayed upgrades have left assets inefficient and prone to breakdown. The result is frequent system failures and energy losses at every stage of the supply chain.

### 2.8. Limited Energy Diversification

Nigeria's heavy reliance on fossil fuels, especially natural gas and oil, undermines energy security. Renewable sources such as solar, wind, and hydro remain underdeveloped despite vast potential [6]. The absence of a coherent diversification strategy has made the grid vulnerable to fuel supply disruptions and environmental pressures.

### 2.9. Rapid Population Growth and Urbanisation

Nigeria's rapidly expanding population—expected to exceed 250 million by 2030—has intensified energy demand

across residential, industrial, and commercial sectors [9]. Urban sprawl and informal settlements have outpaced electricity infrastructure development, widening the supply-demand gap and increasing the number of unserved consumers.

### **2.10. Energy Theft and Vandalism, and Insecurity and Regional Instability**

Widespread electricity theft, illegal connections, and vandalism of infrastructure significantly undermine revenue and system reliability. Distribution utilities lose substantial income through unmetered consumption and tampered connections [2]. Also, the worsening insecurity across several regions, particularly in the Niger Delta and northern states, has hampered energy infrastructure development and maintenance. Attacks on oil facilities, insurgent activities, and community unrest disrupt gas pipelines and transmission assets [3]. Such instability increases operational costs and deters both domestic and foreign investment in the power sector. Additionally, the vandalism of pipelines and power installations disrupts fuel supply and grid operations.

## **3. Climate Change and Environmental Impacts**

Nigeria's energy crisis has also intensified environmental degradation and contributed to climate change. The widespread use of fossil fuels for self-generation results in significant greenhouse gas and particulate pollution. Urban centers like Lagos and Port Harcourt suffer from high levels of air pollution due to the heavy emissions from generators and vehicles, raising public health concerns [4]. Similarly, the dependence on biomass and charcoal in rural areas accelerates deforestation, undermining biodiversity and carbon sequestration efforts.

The Niger Delta presents another critical environmental dimension. Continuous oil spills, pipeline vandalism, and gas flaring have devastated ecosystems, polluted water sources, and destroyed livelihoods, particularly among fishing and farming communities [3]. The cumulative environmental cost threatens food security and amplifies regional instability.

Moreover, inadequate power infrastructure limits Nigeria's ability to transition to cleaner energy systems, undermining its contribution to the global fight against climate change. With climate-related events such as droughts and flooding increasingly disrupting energy and agricultural systems, the crisis compounds climate vulnerability [4]. Without a shift toward low-carbon energy solutions, Nigeria risks perpetuating a cycle of environmental degradation and socio-economic underdevelopment.

## **3.1. Solutions**

### **3.2. Climate-Resilient Energy Development**

Nigeria's energy strategy must incorporate climate resilience by adapting infrastructure to withstand flooding, temperature extremes, and other climate shocks. Transitioning toward low-carbon energy systems and integrating environmental safeguards will ensure long-term sustainability [4]. Aligning energy policy with climate goals also attracts international funding.

### **3.3. Reduce Dependence on Generators**

The widespread use of generators highlights systemic energy failure. Policies should promote cleaner, centralised, and off-grid power solutions to reduce generator dependence and emissions. Incentives for renewable energy adoption, coupled with stricter emissions standards, can shift the nation toward sustainable energy consumption [6].

## **4. The Path Forward**

Mitigating these impacts requires an integrated approach that links energy reform with environmental sustainability. Expanding renewable energy, adopting efficient technologies, and enforcing environmental safeguards can reduce greenhouse gas emissions while enhancing energy reliability. Investments in clean energy infrastructure and inclusive energy access will not only drive economic growth but also align Nigeria with global climate resilience objectives [6].

## **5. Strategies for Addressing the Energy Crisis in Nigeria**

While the energy crisis still remains one of the alarming concerns faced every day in Nigeria, there are still strategies that must be adopted to put a stop to this challenge. Here are some of these strategies discussed below:

### **5.1. Expansion and Diversifying Power Generation**

Nigeria must expand its generation capacity while diversifying its energy mix toward cleaner and renewable sources such as solar, wind, biomass, and small hydropower. Decentralised solar mini-grids and hybrid systems can rapidly extend electricity access to underserved rural regions [6]. Diversification reduces dependence on fossil fuels, enhances energy security, and aligns Nigeria with global climate commitments [4].

## 5.2. Strengthen the National Transmission Network

Upgrading the transmission grid is critical to ensuring stability and efficient power delivery. The Transmission Company of Nigeria (TCN) requires substantial investment in modern substations, digital monitoring, and high-capacity lines to evacuate generated power effectively [5]. Strengthening transmission will reduce frequent system collapses and regional imbalances.

## 5.3. Improve Electricity Distribution Networks

Distribution remains the weakest link in Nigeria's power value chain. Upgrading transformers, expanding feeder lines, and improving metering systems are essential to reduce losses and improve service reliability [2]. Strengthening DisCos with transparent regulation and performance-based incentives can enhance customer satisfaction and financial sustainability.

## 5.4. Ensure Reliable Gas Supply to Power Plants

Since natural gas powers most grid-connected plants, a stable gas supply is crucial. This can be achieved through improved pipeline protection, domestic supply prioritisation, and reduced gas flaring [7]. Encouraging investments in gas gathering, compression, and distribution infrastructure would help minimise disruptions in power generation.

## 5.5. Implement Cost-Reflective and Fair Tariffs

To ensure industry sustainability, electricity tariffs should be cost-reflective while protecting vulnerable consumers through targeted subsidies. Appropriate pricing encourages investment, reduces market deficits, and promotes transparency in billing (World Bank, 2021). Fair tariffs can also motivate DisCos to expand service and improve efficiency.

## 5.6. Resolve the Power-Sector Liquidity Crisis

Addressing the liquidity shortfall requires financial restructuring, improved payment discipline, and effective market settlement mechanisms. A functioning electricity market, supported by government credit guarantees and enforcement of remittances, is vital to restore investor trust [1]. A strong financial base ensures the stability of the entire power ecosystem.

## 5.7. Strengthen Energy Governance and Regulation

Transparent and consistent regulation is the cornerstone of sectoral reform. The government must enhance coordination among agencies such as the Nigerian Electricity Regulatory

Commission (NERC) and the Rural Electrification Agency (REA). Clear mandates, data transparency, and reduced political interference are essential for long-term investor confidence [5].

## 5.8. Promote Decentralized and Off-Grid Solutions

Decentralized renewable systems such as solar mini-grids and standalone home systems can bridge Nigeria's significant access gap. Off-grid solutions offer affordable, scalable electricity for rural businesses and households [6]. Integration into rural development plans can accelerate energy inclusion and stimulate local economies.

## 5.9. Enhance Energy Efficiency and Demand Management

Promoting energy-efficient appliances, smart metering, and demand-side management reduces waste and optimises supply. Public awareness campaigns, energy labelling, and industrial efficiency programs can lower national demand pressures [4]. This approach is both economical and environmentally sustainable.

## 5.10. Improve Security of Energy Infrastructure

Frequent vandalism and theft of energy infrastructure remain critical threats. Strengthening community engagement, deploying modern surveillance technology, and enhancing law enforcement cooperation can improve asset protection [3]. Secure infrastructure guarantees a continuous supply and reduces operational costs.

## 6. Conclusion and Policy Recommendations

Nigeria's prolonged energy crisis continues to undermine national development, hinder industrial productivity, and exacerbate social inequality. Despite being richly endowed with natural and renewable energy resources, the country remains trapped in a cycle of inadequate power generation, weak infrastructure, and inefficient governance. This structural failure not only constrains economic growth but also fuels environmental degradation and deepens energy poverty among its most vulnerable populations [9]. Addressing these challenges requires a comprehensive and coordinated strategy that promotes efficiency, transparency, and sustainability within the energy sector.

## 7. Policy Recommendations

### 7.1. Accelerate Investment in Renewable Energy

Nigeria should scale up renewable energy deployment, particularly in solar, wind, and small hydro technologies, to diversify the energy mix and increase access in rural communities. Expanding renewable mini-grids and off-grid systems can deliver cost-effective and climate-friendly electricity to millions [6].

### 7.2. Strengthen Governance and Regulatory Frameworks

Transparent and consistent governance is essential for sector stability. The federal and state governments must empower institutions like the Nigerian Electricity Regulatory Commission (NERC) to enforce compliance, improve market transparency, and minimize political interference [1]. Strengthened accountability mechanisms will also attract long-term private investment.

### 7.3. Upgrade Transmission and Distribution Networks

Modernizing the national grid and improving last-mile distribution will help minimize power losses and ensure a reliable supply. Targeted investments in digital monitoring, metering, and network automation can reduce system collapse and technical inefficiencies [5].

### 7.4. Implement Cost-Reflective and Equitable Tariffs

Introducing tariffs that reflect the true cost of power generation while protecting low-income households through targeted subsidies is vital for the financial health of the sector [9]. This balance ensures investor confidence and long-term sector sustainability.

### 7.5. Address Liquidity and Financial Challenges

The current liquidity crisis within the power sector should be mitigated through better market design, enforcement of payment discipline, and fiscal transparency. Introducing flexible credit arrangements and reforming payment settlements among market participants can stabilise financial flows [7].

### 7.6. Promote Energy Efficiency and Climate Resilience

Enforcing energy efficiency standards for appliances and

buildings will help reduce national electricity demand. Simultaneously, integrating climate resilience into energy planning - through low-carbon technologies and environmental safeguards—will ensure long-term sustainability and align Nigeria with global climate goals [4].

### 7.7. Develop Local Content and Technical Capacity

Investing in education, research, and training institutions can expand domestic expertise and strengthen Nigeria's position in the global shift in clean and renewable energy, grid engineering, and energy management. Building local capacity will reduce dependency on foreign contractors and empower indigenous industries [2]. A resilient power sector not only improves livelihoods and economic competitiveness but also lays the foundation for climate-smart, inclusive national development [6, 9].

### 7.8. Enhance Security of Energy Infrastructure

Securing pipelines, transmission lines, and power installations through community partnerships, surveillance technology, and law enforcement collaboration will safeguard investments and ensure continuous operations [3].

### 7.9. Support State-Level Power Markets

Decentralizing electricity regulation to empower states, as encouraged by the 2023 constitutional amendment, promotes innovation and competition. State-level power markets can attract localized investment and improve supply reliability [7]. This bottom-up approach ensures tailored solutions to region-specific energy challenges.

## 8. Improve Data, Planning, and Long-Term Strategy

A unified national energy database is crucial for effective planning and evaluation. Data-driven policy decisions will help anticipate demand growth, manage risks, and coordinate national and state-level energy programs [5]. Finally, the path to resolving Nigeria's energy crisis lies in a deliberate shift from short-term interventions to strategic, inclusive, and sustainable energy planning. A modern energy system anchored on renewable sources, efficient infrastructure, and transparent institutions will stimulate inclusive growth and environmental resilience. By prioritising clean energy investment, sound regulation, and equitable access, Nigeria can transform its enduring energy challenge into a catalyst for economic transformation and national renewal.

## Abbreviations

|        |                                            |
|--------|--------------------------------------------|
| NEPA   | National Electric Power Authority          |
| ECN    | Energy Commission of Nigeria               |
| TCN    | Transmission Company of Nigeria            |
| IEA    | International Energy Agency                |
| ECN    | Energy Commission of Nigeria               |
| REMP   | Renewable Energy Master Plan               |
| REA    | Rural Electrification Agency               |
| NERC   | Nigerian Electricity Regulatory Commission |
| DisCos | Distribution Companies                     |
| GenCo  | Generation Companies                       |

## Author Contributions

**Oliver Linus Sunday:** Data curation, Formal Analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing, Conceptualisation

## Conflicts of Interest

No conflict of interest.

## References

- [1] Adenikinju, A. (2019). *Energy policy, fuel subsidies and the Nigerian economy*. Nigerian Economic Summit Group Journal, 4(2), 14- 29.
- [2] Akinyemi, O., & Akeredolu, F. (2020). *Energy inefficiency and industrial development in Nigeria*. African Development Review, 32(1), 90- 102.
- [3] Amnesty International. (2018). *Nigeria: The true cost of oil pollution in the Niger Delta*. <https://www.amnesty.org/en/latest/news/2018/03/nigeria-niger-delta-oil>
- [4] Dahunsi, S. O. (2021). Energy generation and environmental pollution in Nigeria: Pathways to sustainability. *Energy Reports*, 7, 234-247.
- [5] Energy Commission of Nigeria. (2020). *National energy policy review*. Abuja: Federal Government of Nigeria.
- [6] International Energy Agency. (2022). *Nigeria Energy Outlook 2022*. Paris: IEA.
- [7] Nwokeoma, B. (2021). Nigeria's petroleum paradox: Between abundance and inefficiency. *Journal of Energy Policy Studies*, 8(3), 44-56.
- [8] Onyeji, E. (2023, May 14). *Nigeria's fuel subsidy and its economic reality*. *Premium Times*. <https://www.premiumtimesng.com/business>
- [9] World Bank. (2021). Electricity access in Sub-Saharan Africa: Nigeria country profile. Washington, DC: World Bank.

## Biography



**Oliver Linus Sunday** is an independent researcher, a member of the Nigerian Society of Engineers (NSE) and the Nigerian Institute of Electrical and Electronics Engineers (NIEEE), and a writer with a strong interest in energy policy, sustainable development, and environmental governance in Nigeria and Africa. His research explores how institutional reform, clean energy investment, and equitable policy design can drive inclusive economic growth. As a passionate advocate for sustainable energy solutions, Oliver Linus Sunday seeks to contribute to evidence-based policymaking and national reform through original research and commentary.