



Biannual Power Sector Report

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ABOUT US

An Abode Of New Possibilities With Data Analytics & Solutions To Enhance Business Growth

WaterHouse is a data analytics company that offers innovative and cutting-edge analytics services to businesses, with a primary focus on the African market.



Our Mission

At WaterHouse we are established to help businesses – large and small – recognize and utilize the power of data science and analytics.

With the interest of our clients and customers at heart, we customize solutions to address the unique business needs and challenges they face using latest trends, and technologies to meet needs of our clients.

Our Vision

At WaterHouse, our vision is to transform businesses and organizations with the untapped power of data science and analytics, to offer solutions which help them stay ahead of the competition.

We harness the latest technologies, and the best practices to provide our clients with strategic and calculative information to achieve this.

■ WHAT WE DO?

Valuable insights that enable businesses to make informed decisions and manage risk effectively with a team of skilled data scientists and energy analysts working tirelessly to provide cutting-edge solutions to the energy industry.



■ Our Services

01

Data Acquisition

We can assist you in acquiring relevant and reliable data for your business needs in the energy and environment, oil and gas, Renewables, or Net Zero sectors.

02

Data Analysis

Once we have acquired the necessary data, our team of experienced data analysts will conduct a thorough analysis of the data to extract valuable insights.

03

Insight Delivery

After the analysis, we will present the insights to the clients in a clear and concise report that highlights the key findings, recommendations, and visualizations.



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Executive Summary

Nigeria's energy landscape is characterized by a heavy reliance on biofuels and waste, accounting for 85% of energy consumption. Astonishingly, nearly 90% of this energy is directed towards residential use, primarily for cooking. Despite being a major oil producer within OPEC, Nigeria grapples with energy poverty, with 60% of its population lacking access to electricity, especially in rural areas. Environmental concerns have arisen due to a 25.84% increase in greenhouse gas emissions, primarily from fossil fuels. Nigeria has responded with ambitious net-zero targets for 2030 and 2060, accompanied by comprehensive climate legislation and policy developments.

The energy landscape predominantly relies on natural gas for electricity generation, with hydropower playing a significant role. However, greenhouse gas emissions remain high, necessitating a shift towards renewables. Nigeria aims to achieve a 30:30:30 goal by 2030, targeting 30 MW of energy with 30% from renewables.

Renewable energy holds promise, with Nigeria committing to wind and solar power at COP26 in 2021 to achieve net-zero emissions by 2060. Despite the dominance of hydropower, residential energy needs highlight the importance of adapting renewable technologies to meet household demands.

Public investments in Nigeria's energy sector exhibit fluctuations, with a recent focus on renewables. The pivotal moment arrived in 2020 when Nigeria pledged carbon neutrality by 2060, introducing the Energy Transition Plan (ETP) requiring a substantial financial commitment of \$1.9 trillion. This ambitious plan opens doors to \$23 billion USD worth of investment opportunities.



Executive Summary

Electricity tariff adjustments have raised concerns, with factors like foreign exchange rates and inflation playing a role. In 2023, the administration of President Bola Ahmed Tinubu aims to implement significant changes, including an anticipated 40% tariff increase.

In conclusion, Nigeria stands at a critical juncture in its energy journey, striving to balance resources, address environmental concerns, achieve net-zero targets, and attract investments for a sustainable energy future.

Introduction



Navigating Nigeria's Renewable Energy Landscape: An Analytical Journey - 2023

As the global community increasingly recognizes the urgency of addressing climate change and transitioning to sustainable energy sources, the role of renewable energy in Nigeria has taken center stage. This report, prepared for the mid-year assessment provides a concise yet insightful analysis of the current state of renewable energy in Nigeria.

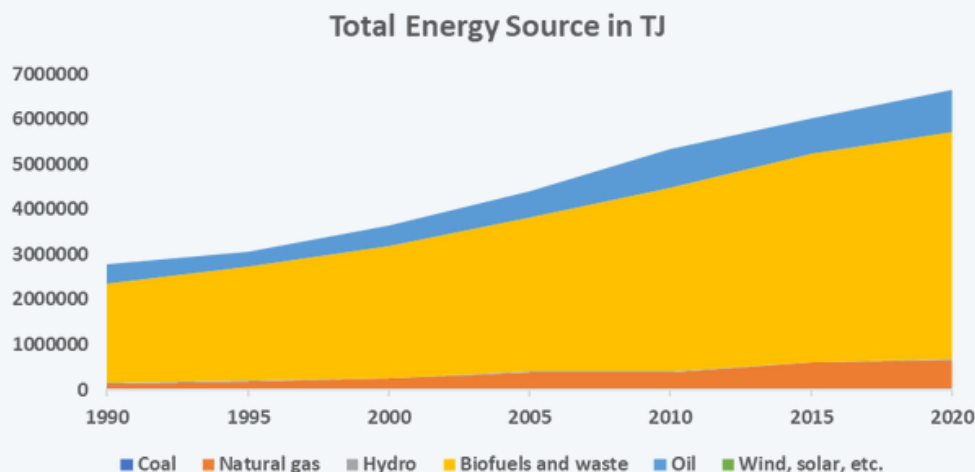
Within these pages, you will find a thorough assessment of the renewable energy sector, encompassing governance, environmental and socioeconomic considerations, targets, and an analysis of the current energy scenario. Drawing on robust data, we delve into recent sectoral developments, progress to date, financial dynamics, successful projects, and prospects for 2023.

Join me in this analytical journey as we decipher the renewable energy terrain, bridging data with actionable insights, and contributing to a more sustainable energy future for Nigeria.

Background



Nigeria, often hailed as Africa's energy powerhouse, boasts a significant presence in the continent's energy landscape. As the foremost oil-producing nation, Nigeria, in conjunction with Libya, commands approximately two-thirds of Africa's crude oil reserves. Furthermore, it ranks second only to Algeria in terms of natural gas reserves. A diverse array of energy resources underpins Nigeria's energy sector, including coal, petroleum reserves, natural gas, peat, hydroelectricity, solar, and wind energy.



The energy consumption profile in Nigeria reveals a noteworthy reliance on biofuels and waste, which contribute to roughly 85% of the nation's total energy consumption, translating to approximately 99.3 million tonnes of oil equivalent (Mtoe) annually. Remarkably, nearly 90% of this energy is channeled into residential applications, primarily for cooking purposes.

With an historical average daily oil production ranging from approximately 1.8 to 2.4 million barrels, Nigeria ranked as the seventh-largest crude oil producer within the Organization of the Petroleum Exporting Countries (OPEC) between 2009 and 2013. In 2022, its oil production averaged 1.2 million barrels per day (bopd), alongside 300 barrels per day (bpd) of condensate, solidifying its status as the largest oil producer on the African continent.

It's worth noting that while oil contributes 16% to Nigeria's Gross Domestic Product (GDP), it commands a substantial share, accounting for approximately 75% of government revenues and a staggering 90% of export earnings. Nonetheless, Nigeria grapples with challenges in its oil sector, including oil theft and supply disruptions resulting from pipeline sabotage.

The gas sector, pivotal for diversifying Nigeria's energy portfolio, faces challenges arising from inadequate infrastructure to monetize currently flared gas. Furthermore, despite its significant oil production capacity, Nigeria continues to import approximately 85% of its refined petroleum products, largely due to the limited utilization of domestic oil refineries, which operate at a mere 30% capacity.

Critically, the power sector in Nigeria has been identified by analysts as a key bottleneck in economic development. The World Bank's 2015 Doing Business report ranked Nigeria 187 out of 189 countries concerning the ease of accessing electricity. Access to electricity has seen incremental growth, rising from 50% in the period from 1990 to 2010 to a modest 55.6% in recent years from 2011 onwards.

The impetus behind this lackluster performance in electricity supply is multifaceted. A decline in investment in the nationalized power sector in the early 1990s resulted in diminished maintenance budgets and stagnation in capacity expansion. Faced with a dire electricity supply situation, the government initiated the privatization of the electricity sector in 2013 with the aim of enhancing the reliability of electricity supply.

Key Governing Bodies



Nigeria's renewable energy sector is overseen by several key governing bodies and organizations, each playing a critical role in shaping policies, regulations, and initiatives in this dynamic field. These organizations collaborate to promote sustainable energy practices, facilitate investments, and drive the transition towards renewable energy sources.



Nigerian Electricity Regulatory Commission (NERC)

Regulates the electricity industry and establishes policies for renewable energy integration.



Federal Ministry of Power, Works, and Housing

Formulates and implements renewable energy policies and project coordination.



Rural Electrification Agency (REA)

Focuses on rural electrification using renewable energy solutions.



Nigerian Investment Promotion Commission (NIPC)

Attracts and facilitates investments in renewable energy projects.



International Renewable Energy Agency (IRENA)

Provides technical support and policy guidance for renewable energy development.

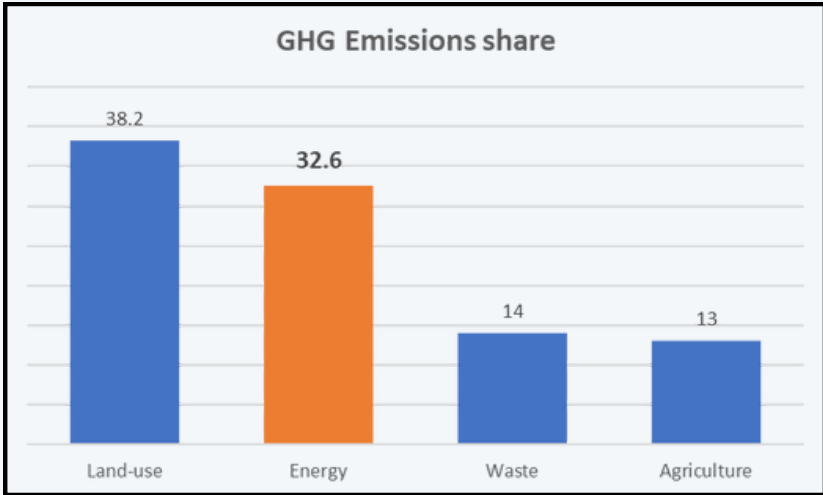


Renewable Energy Association of Nigeria (REAN)

Advocates for renewable energy adoption, conducts research, and influences policy development.

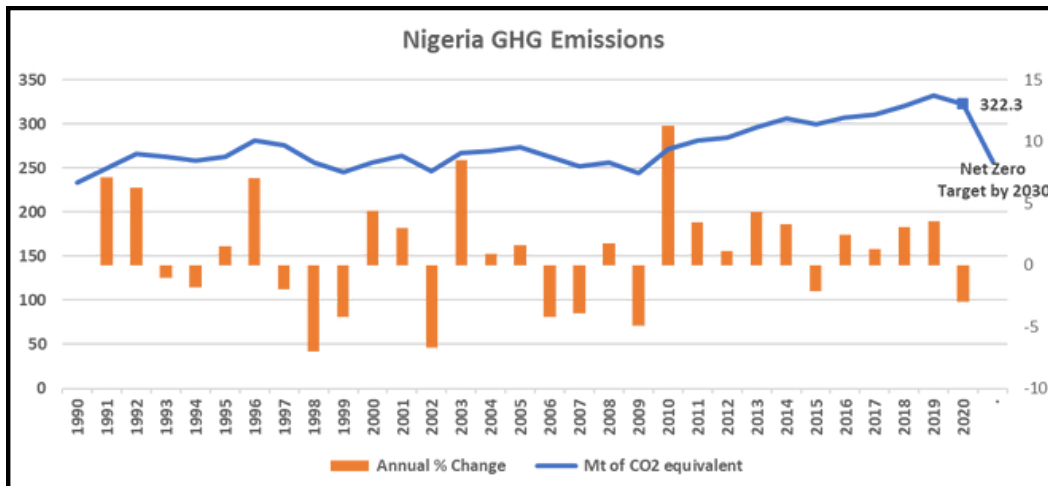
Environmental and Socio-economic Considerations

The imperative concept of greenhouse gas (GHG) removal entails the active removal of carbon dioxide and its equivalents from the atmosphere. This process involves a spectrum of techniques, ranging from nature-based solutions, such as afforestation and enhancing carbon sequestration in soils, to engineered approaches. GHG removal strategies play a pivotal role in achieving the global ambition of attaining net-zero emissions by 2050.



source: iea

Reviewing the data spanning over two decades, it is evident that Nigeria has witnessed a substantial 25.84% increase in GHG emissions, primarily stemming from carbon dioxide emissions. In 2015, Nigeria held the unenviable distinction of ranking as the world's 17th largest emitter of GHGs and the second-largest in Africa. This status is, in large part, attributed to the country's heavy reliance on fossil fuels to drive its economic activities.



source: iea

Furthermore, the limited access to electricity infrastructure has perpetuated the reliance on biomass, such as wood, for energy needs, contributing to emissions. In response to these pressing environmental challenges, Nigeria has embarked on a transformative journey. The nation has committed to ambitious targets, including achieving net-zero emissions by 2030 and 2060. Additionally, Nigeria is set to enact comprehensive climate legislation to solidify its climate action commitment.

To accelerate emissions reductions, Nigeria has taken proactive measures

- the recent adoption of Methane Guidelines in January 2023. These guidelines impose mandatory measures on oil and gas companies, including leak detection initiatives, aimed at mitigating methane emissions from the oil and gas sector.
- the government is diligently working on the development of a carbon tax and carbon trading system, as mandated by the 2021 Climate Change Act. Plans for a forthcoming carbon tax policy have been announced, reinforcing Nigeria's commitment to addressing the high levels of GHG emissions."

Current Energy Situation in Nigeria

NIGERIA CURRENT ENERGY LANDSCAPE

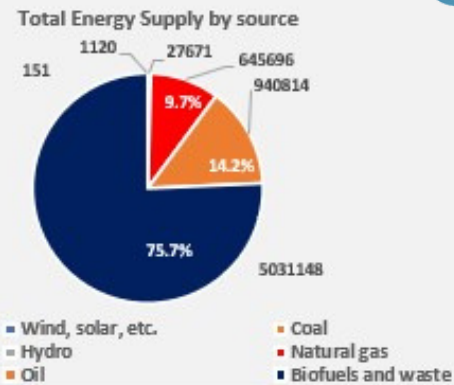


Energy in 2020

6646600 TJ Total Supply

5710383 TJ Total Consumption

-3221 PJ Net Imports



Electricity in 2021

Total Generated: **36398 TWh**

Total Transmitted: **35654 TWh**

Total Demand: **31 TWh**

59.5%
of Nigerians have access to electricity
4% increase from 2020



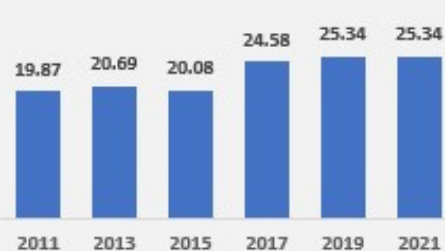
89.2%
of electricity access in urban areas

26.3%
in rural areas

Nigeria GHG Emissions



% Renewable share in Electricity



Nigeria's present energy profile remains predominantly reliant on traditional sources, notably biofuels, oil, and gas, as indicated in the provided energy and electricity dashboard. This historical trend not only underscores their pivotal role in the nation's economic framework but also highlights an accompanying concern regarding the escalation of CO₂ emissions.

In response to these challenges, Nigeria has initiated measures to transition towards enhanced energy efficiency and reduced carbon emissions. The country has committed to achieving a net-zero target for CO₂ emissions by 2060, coupled with a pivotal goal of integrating 30% renewable energy into its energy mix by 2030. While progress has been made in the integration of renewable energy sources, it is evident that significant strides are still required to fulfill these ambitious commitments.

Despite Nigeria's status as an oil-rich nation, it grapples with formidable challenges in power generation. The current electricity capacity stands at approximately 16,384 MW. In 2021, the demand for electricity surged to 31.2 TWh, with an actual generation of 36.4 TWh. Remarkably, Nigeria exports a portion of its electricity, including 2.3 TWh to neighboring Benin and Niger in 2019, with Togo also receiving Nigerian electricity exports. Nonetheless, the stark reality remains that access to electricity remains limited, with only 60% of the population enjoying this vital resource.

In summation, the prevailing energy landscape in Nigeria is a complex interplay of historical reliance on conventional energy sources, ambitious commitments to renewable energy integration, and persisting challenges in electricity generation and distribution. This intricate web of factors encapsulates the current state of Nigeria's energy sector

News in the Sector

National



Stakeholders push for downstream petroleum project funding

The African Refiners and Distributors Association (ARDA) and top international financial experts have mulled options to unlock sustainable funding for the regional downstream petroleum industry, as tightening global financial conditions pose challenges for oil and gas.

Federal Government Introduces New Regulations to Address Environmental and Safety Concerns

The Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) revealed the addition of four regulations aimed at improving value and fostering a favorable environment in the midstream and downstream petroleum sector. Aligned with the Petroleum Industry Act of 2021, these regulations are set to bolster sector activities for the betterment of Nigerians. Adherence by market operators is stressed.

Fuel Subsidy's Detrimental Impact on Downstream Sector in Nigeria

Prof. Adeola Adenikinju of the University of Ibadan highlights that Nigeria's fuel subsidy has caused more harm than good, leading to collapsed refineries, logistical challenges, and fiscal losses as reported. Adenikinju argues that removing petrol subsidies wouldn't have as severe macroeconomic effects as perceived and emphasizes their skewed benefits towards the affluent, driving unsustainable fuel consumption. He urges immediate measures, including cash transfers, school feeding programs, affordable public transport, and expanded mass transit systems, to mitigate negative consequences and spur sustainable growth.

Focus on Net-zero



The fundamental objective of the Paris Agreement is to address climate change by striving to limit the global average temperature increase to "well below 2°C above preindustrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels."

In the wake of the Paris Agreement and the release of the IPCC Special Report on Global Warming of 1.5°C, an increasing number of nations worldwide have made resolute commitments to achieving net-zero emissions targets. As of March 2022, 33 countries, along with the European Union, have formally established such targets, either through legislative measures or policy documentation.(CAT)

Nigeria's Pursuit of Net Zero Emissions

Nigeria, too, has embarked on a path toward a net-zero emissions future, marked by significant policy developments and actions:

- **Climate Change Act (November 2021):** In November 2021, Nigeria ratified the Climate Change Act, a seminal legislative milestone. This legislation sets the stage for the nation's ambitious objective to attain low greenhouse gas emissions while fostering green and sustainable growth. It provides a framework within which Nigeria commits to the target of achieving net-zero emissions, aligning with a timeframe spanning between 2050 and 2070 (Okereke & Onuigbo, 2021).
- **COP26 Commitment (2021):** At the 26th UN Climate Change Conference of the Parties (COP26), Nigeria reaffirmed its commitment to the pursuit of net-zero emissions. In alignment with the Climate Change Act, Nigeria pledged to achieve this pivotal milestone by 2060, marking a significant step toward climate resilience and sustainability (Lo, 2021).

-
- **Vision 30:30:30:** President Buhari outlined an ambitious vision as part of Nigeria's National Renewable Energy and Energy Efficiency Policy. This vision, known as "30:30:30," aims to generate 30 GW of electricity by the year 2030, with renewable energy sources constituting 30% of the nation's energy mix. This strategic initiative underscores Nigeria's dedication to transitioning to cleaner and more sustainable energy sources, which is vital for achieving net-zero emissions (Buhari, [Year of Statement]).

Nigeria Emission's Reduction Commitment

2030 Unconditional NDC Target

20%

below BAU
by 2030

304-331

MtCO₂e in 2030
(excl. LULUCF)

17-27%

above 2010 levels

2030 Conditional NDC Target

47%

below BAU
by 2030

201-264

MtCO₂e in 2030
(excl. LULUCF)

17-27%

1% above to 23%
below 2010

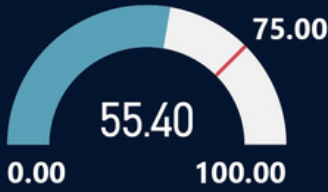


PROGRESS TO DATE

- **Energy Analysis in Nigeria**
- **Renewable Energy**
 - Solar
 - Bioenergy
 - Hydropower

Energy Analytics: Energy Analysis in Nigeria

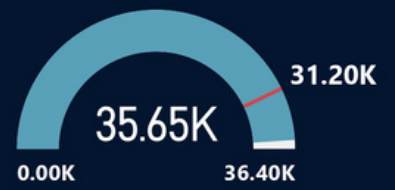
2020 Electricity Access rate



Renewable share of Electricity with 2030 Target

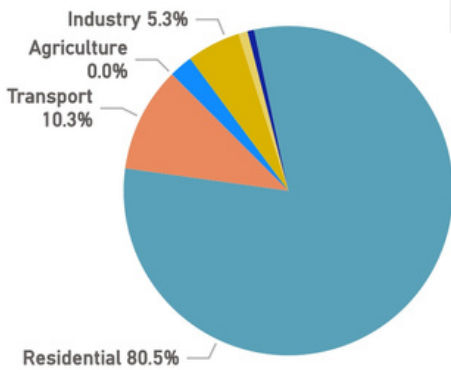


Electricity Generated vs transmitted

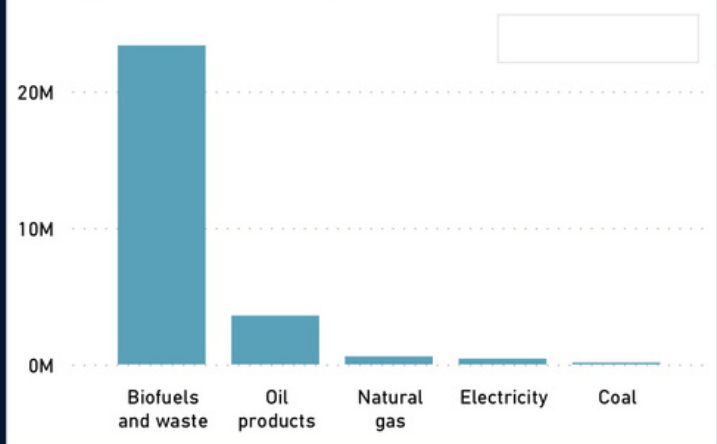


Energy Consumption (TJ) by Sector

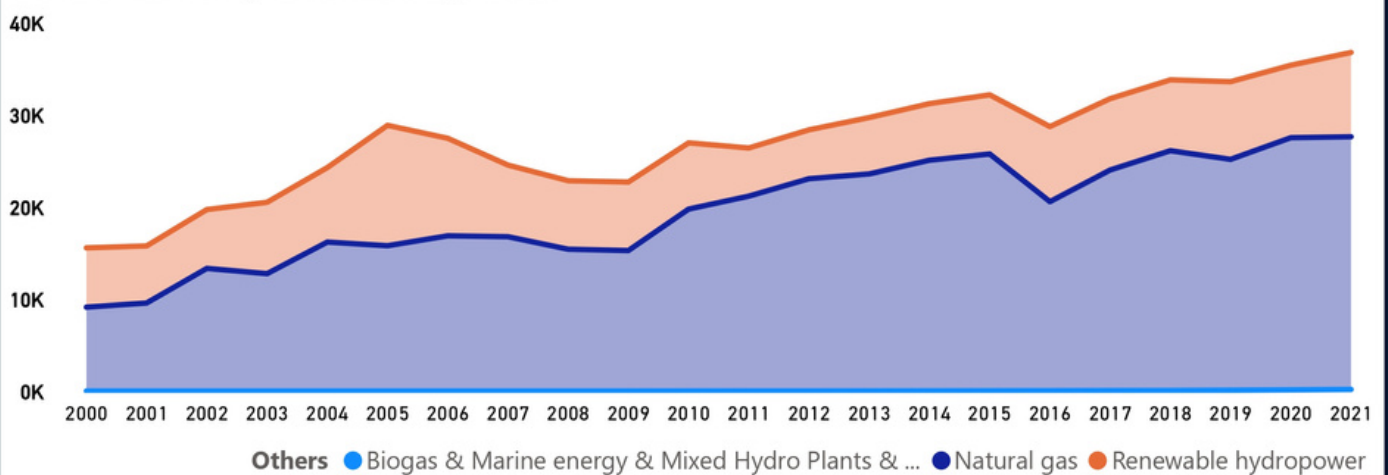
Year



Energy Consumption by Source

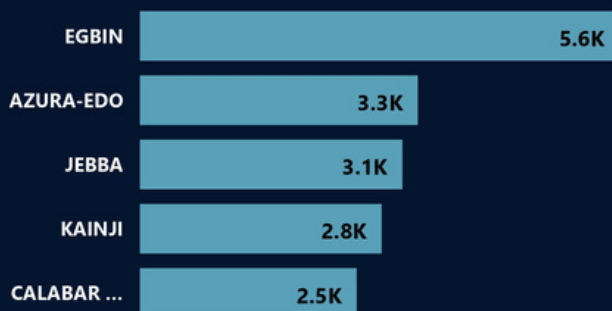


Trend of Electricity Generation by Source

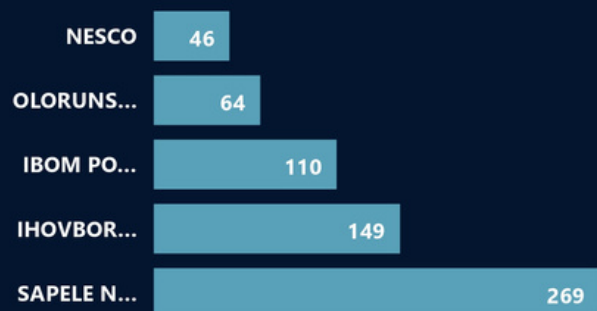


2021

Top 5 GENCOs generating Energy (GWh)



Bottom 5 GENCOs generated Energy (GWh)



Energy Analysis in Nigeria



In the dynamic landscape of Nigeria's energy sector, this comprehensive dashboard serves as a testament to the nation's remarkable strides towards achieving its ambitious energy goals. With a dual emphasis on both the broader energy landscape and the specific advancements within the renewable sector, this analysis provides a detailed narrative of Nigeria's journey towards a sustainable and resilient energy future.

Against a backdrop of increasing global consciousness about climate change, Nigeria has set ambitious targets to redefine its energy mix, reducing reliance on traditional fossil fuels and embracing renewable alternatives. This dashboard intricately weaves together a narrative of progress, charting the nation's trajectory in meeting its set milestones. By examining key performance indicators and data-driven metrics, stakeholders gain valuable insights into the tangible achievements and transformative shifts within the general energy spectrum.

Discussions

- Biofuels and waste dominate Nigeria's energy consumption, primarily within the residential sector. This highlights the significant role of households in energy usage, encompassing cooking, appliances, and transportation. Addressing energy challenges should prioritize the residential and transport sectors.
- Natural gas is the predominant source for electricity generation in Nigeria, followed by renewable hydropower. Solar, wind, and biogas contribute minimally. Despite government policies, greenhouse gas emissions remain high, suggesting a need to shift focus from gas power plants to renewables.
- Nigeria has set ambitious targets, aiming for a 30:30:30 goal by 2030—30 MW of energy with 30% from renewables. In 2021, renewables accounted for 25.34%, indicating progress at a rate of 3.15% per year to meet the 2030 target. Meeting these targets requires sustained effort.
- Nigeria falls behind in electricity access, with a target of 75% by 2020, achieving 55.4%. The 2030 goal is 90%, demanding an annual increase of 3.5% compared to 3% that would have been needed if the 2020 target was achieved. This area deserves heightened attention.
- Nigeria faces power generation challenges despite its oil wealth. Current capacity stands at 16,384 MW. In 2021, electricity demand surpassed supply, leading to a shortfall. Contributing to this issue is Nigeria's export of electricity to neighboring countries, such as Benin, Niger, and Togo.
- Nigeria's electricity generation sector consists of 29 Generation Companies, primarily divided into two categories: 83% are gas-fired power plants, while the remaining 17% utilize hydropower. In terms of energy output measured in gigawatt-hours (GWh), hydropower plants contribute 27%, with the remaining 73% generated by gas-fired facilities. This distribution underscores the predominant role of gas-fired generation in meeting the country's electricity demands.

Generated in 2021

9.32GWh

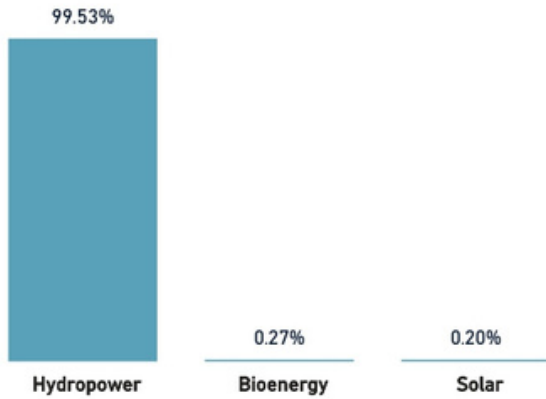
Capacity in 2021

2.2MW

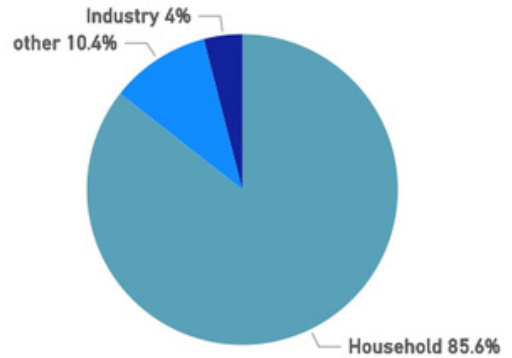
Renewable Share



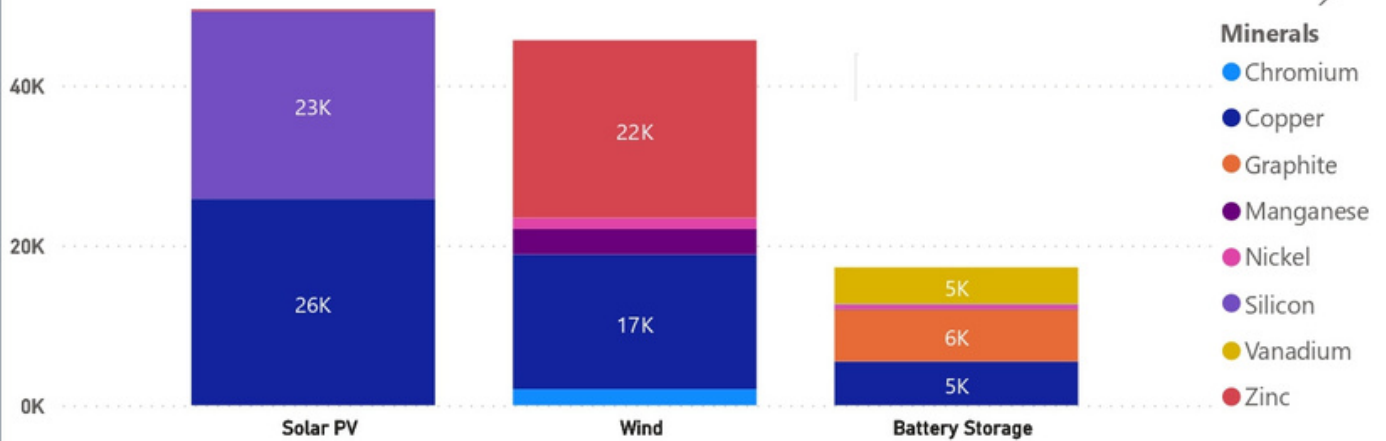
% Renewable Energy Generated by Technology



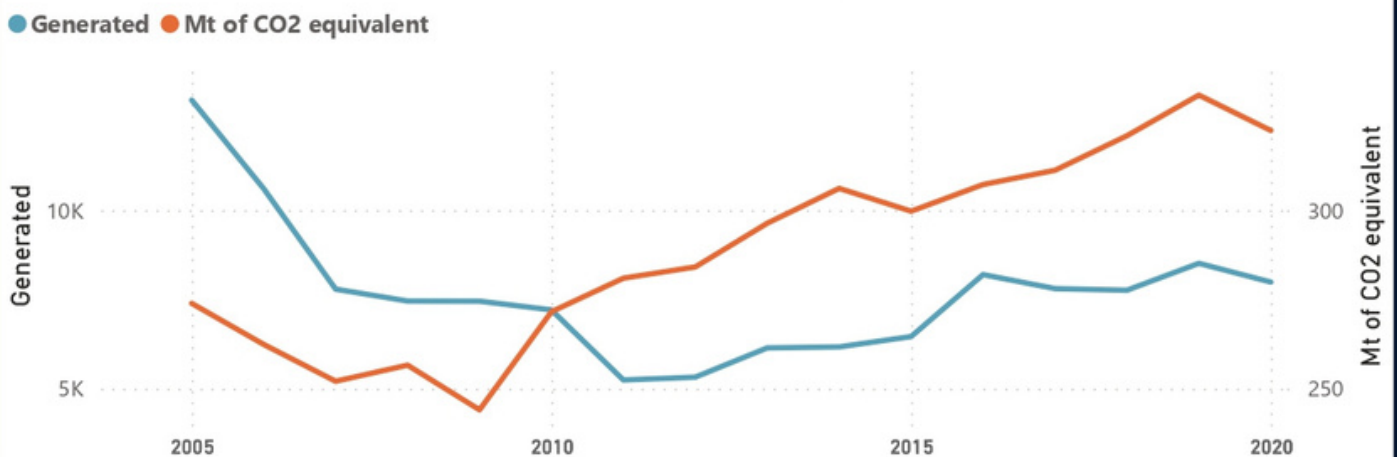
Renewable share by Sector



Renewables Minerals Demand (kt) in 2022



Renewable Generated and Mt of CO2 equivalent by Year



RENEWABLE ENERGY ANALYSIS IN NIGERIA

In the renewable energy sector, the following dashboards meticulously explore Nigeria's progress in the renewable sector, shedding light on the success stories and innovations that have driven the nation towards a more diversified and eco-friendly energy portfolio.

From the expanding footprint of solar installations to the harnessing of wind energy, the strategic utilization of hydropower resources, and the innovative integration of biomass, this analysis navigates through the nuanced layers of each renewable source. Unraveling the threads of achievement in solar, wind, hydropower, and biomass, it becomes evident that Nigeria is not only setting goals but actively realizing them across a spectrum of sustainable energy solutions. This concerted effort is paving the way for a comprehensive and globally resonant sustainable energy landscape, positioning Nigeria as a leader in the renewable energy transition.



Discussions

- Nigeria, at the 2021 UN Climate Conference (COP26), made a significant commitment to achieve net-zero emissions by 2060. To fulfill this pledge, the nation is shifting its energy focus from traditional fossil fuels to renewable alternatives, such as wind and solar power. This transition is pivotal in addressing climate change and ensuring a sustainable future.
- In 2021, Nigeria generated 9.32 GWh of electricity, with a capacity of 2.2 MW, accounting for 25.34% of its total electricity generation. Hydropower dominates the renewable energy sector at 99.53%, followed by bioenergy (0.27%) and solar (0.20%). Notably, the household sector comprises the largest share at 85.6%, emphasizing the importance of tailoring renewable technologies to meet residential needs.
- Nations worldwide, including Nigeria, have intensified efforts in response to the International Energy Agency's (IEA) analysis on critical minerals in clean energy transitions. Clean energy technologies, such as solar PV plants, wind farms, and electric vehicles, rely on these minerals. Demand for battery storage minerals is projected to surge by 10 to 30 times by 2040, according to the Minister of Mines and Steel Development, Olamilenka Adegbite.
- While Nigeria's commitment to clean energy is commendable, the nation faces challenges due to its limited domestic mining of critical minerals. This results in a heavy reliance on imports, particularly from China. However, there is potential for local assembly if supported by robust infrastructure and policies.
- Despite the increase in renewable energy generation, Nigeria continues to grapple with rising CO₂ emissions. This paradox underscores the need for a comprehensive shift from conventional energy sources, like natural gas and oil, to renewables. Achieving net-zero emissions demands progressive policies, investments in infrastructure, and a steadfast commitment to cleaner energy sources.

Focus on Solar



Energy Analytics: Solar

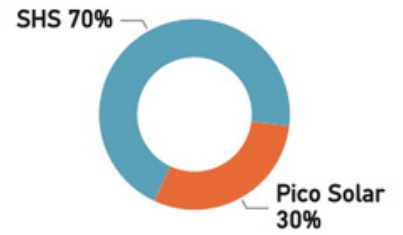
Capacity Share in 2021

3.3%

2022 Capacity(MW) with target by 2025



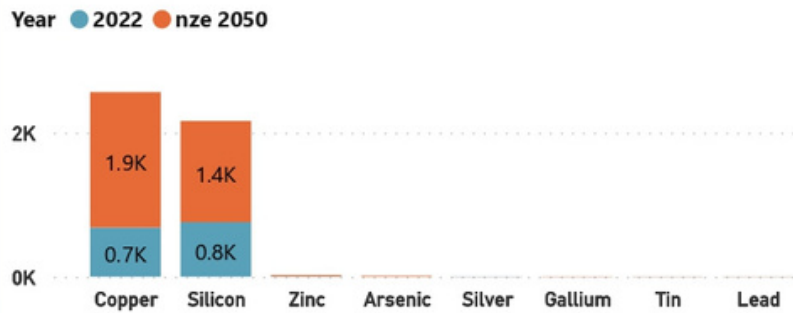
Share of Solar



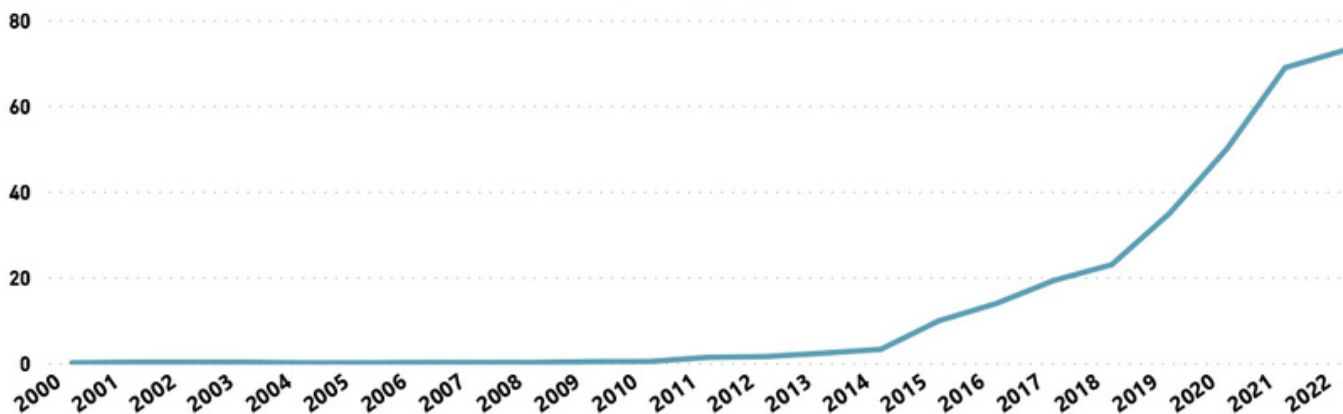
Generated(TWh) in 2021

101.69

Mineral Demand (kt) with respect to Net-Zero



Trend in Capacity



Discussions

- Solar energy plays a vital role in Nigeria's renewable electricity capacity, accounting for 3.3% in 2021. Notably, 70% of this capacity is dedicated to Solar Home Systems (SHS), with the remaining portion allocated to Pico solar solutions.
- Solar energy is used for lighting, small appliances, water pumping, irrigation, refrigeration, telecommunications, and electrification. Remarkably, the cost of solar has significantly reduced over the years, plummeting from \$5 per watt in 2000 to a mere \$0.37 in 2017—a remarkable 93% reduction. Despite this progress, the prevailing perception remains that the average cost of installing a 1KW solar system, coupled with the battery bank for storage, remains somewhat prohibitive for many Nigerians.
- The Rural Electrification Agency (REA), guided by its visionary mission has made significant progress. The REA connecting over one million households with SHS in 2022. Notably, the southwestern region accounted for a substantial portion, with 674,656 connections ranging from 6Wp to 1800Wp.
- The Renewable Energy Master Plan (REMP) for 2025 outlines ambitious targets for Solar PV installed capacity, aiming for 500MW by 2025. Current data, as reported by the International Energy Agency (IEA) in 2022, reveals a total installed capacity of 72.82 MW in Nigeria. To attain the REMP goal, an annual increase of 142.4% will be required. Notably, historical data indicates a remarkable surge in solar capacity from 2010 to 2015, with a 3100% increase, followed by a 412% increase from 2015 to 2020. Maintaining this pace could position Nigeria to meet the REMP target and contribute to achieving the 2030 renewable energy share objective.
- While Nigeria's solar energy sector shows promise, it grapples with challenges, including limited local solar panel manufacturing capacity. Addressing this issue necessitates the formulation of robust policies, consistent government support, stringent quality control measures, and enhanced awareness and information dissemination.

Electrification using Solar



Energy Analytics: Solar Electrification

State

11.99M

Average Electricity Demand (KWh)

32.85M

Average 2030 Electrification Cost (USD)

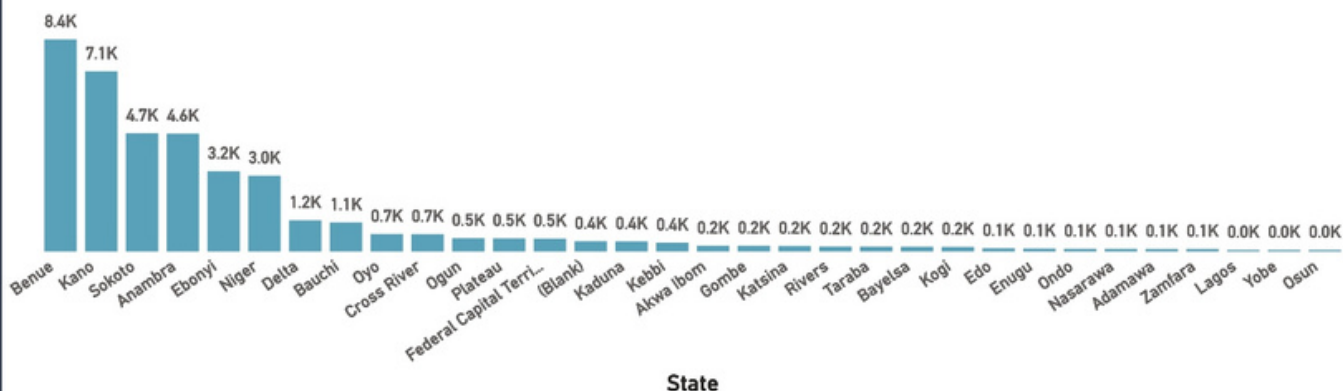
19M

Total No of Households

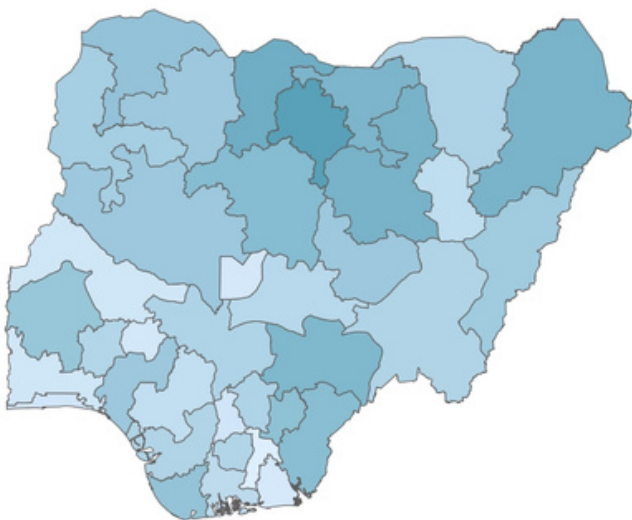
16.12

Average % access to clean cooking 2030

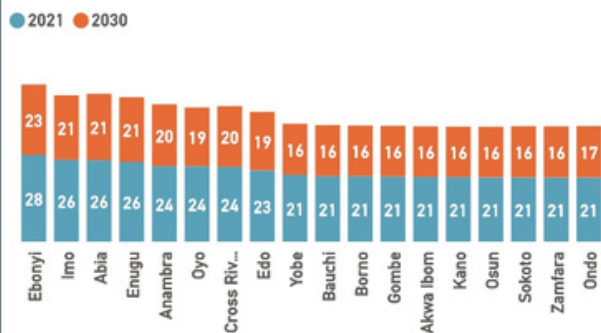
Total Power of Minigrids by State



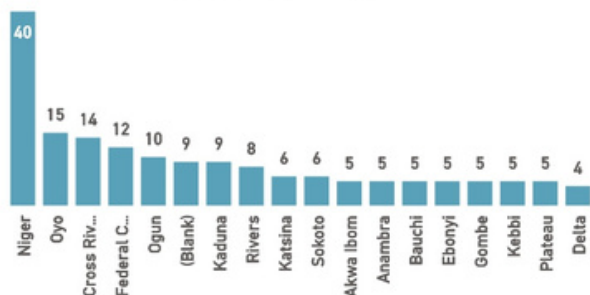
Total Electricity Demand (KWh) by State



Average % of access to clean cooking by state



Total Minigrids by State



Discussions

- As of 2030, 16.12% of households in Nigeria have access to clean cooking.
- The average electrification cost for this endeavor stands at approximately \$32.85 million.
- Areas with the highest electricity demand and potential for electrification are the Northern states and the South-East.
- Despite having more solar mini-grids, the Northern states require increased focus due to their extensive landmass and higher solar energy potential.
- States such as Enugu, Imo, Abia, and Enugu have a higher percentage of access to clean cooking, while Lagos, Rivers, Ogun, Bayelsa, and the Federal Capital Territory (FCT) lag behind.
- Attention to the latter states is crucial, as they significantly contribute to the country's greenhouse gas emissions.

Solar Minigrids in Nigeria

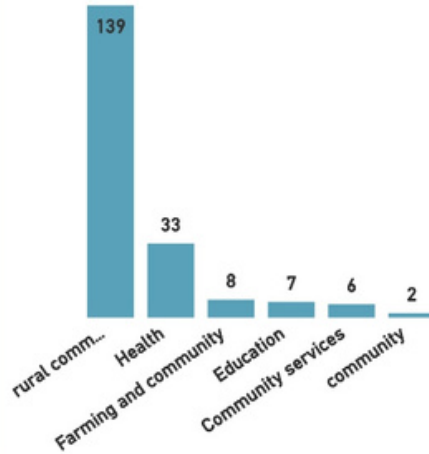


Energy Analytics: Solar Minigrids

States ▼
All ▼

199
Minigrids

39,541
Total power (kw)



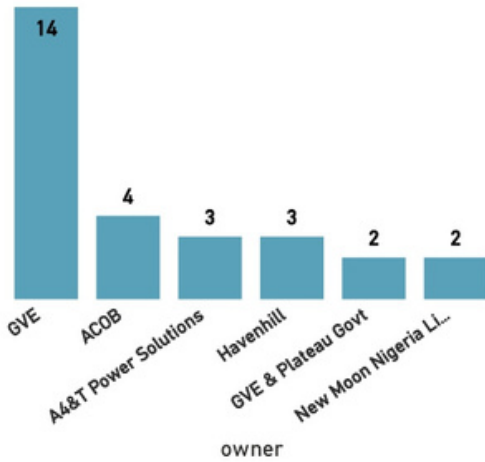
Power system type



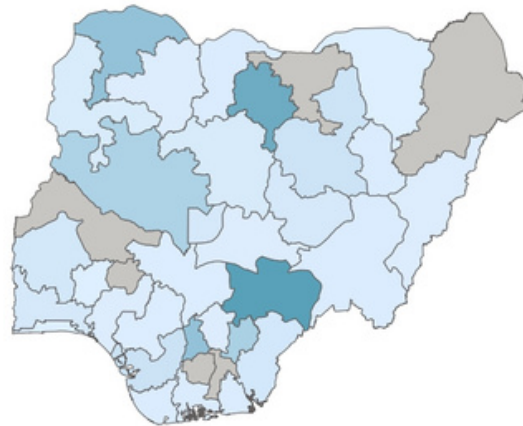
Operational Status



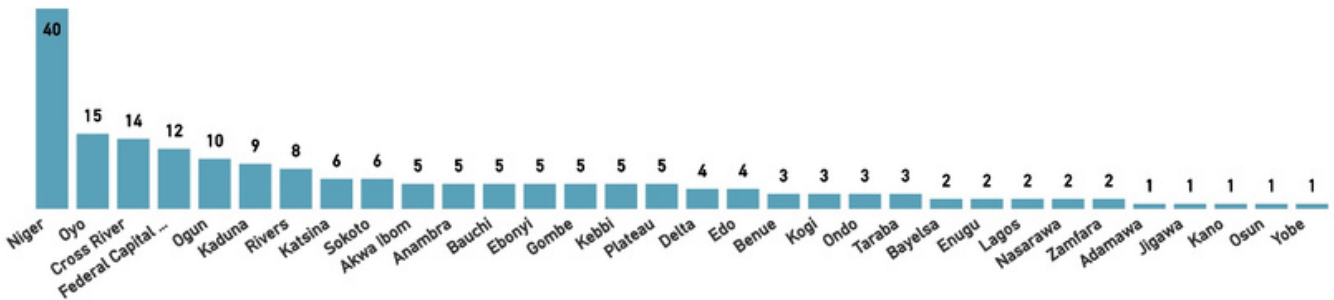
Top Owners



Total Power of Minigrids by state



No of Minigrids by State



Discussions

- Nigeria has witnessed a surge in solar mini-grid installations, totaling 199+ across approximately 33 states, with a combined power capacity of 39.54MW.
- The majority of these mini-grids cater to rural communities, mainly due to the challenges faced by grid-connected rural areas.
- Health facilities have become a primary focus for solar mini-grid deployment, reflecting the government's commitment to improving healthcare access.
- Benue and Kano stand out with the highest solar mini-grid capacity, attributed to their well-established university-based mini-grids.
- When excluding educational institutions, Niger, Oyo, Cross Rivers, Ogun, Plateau have higher mini-grid capacities due to the increased number of installations in these states.
- Borno, Jigawa, Kwara, Kebbi, Imo, and Abia have unmet electrification demand but lack any solar mini-grid installations.

Key Players:

- GVE and ACOB are the dominant stakeholders in the solar mini-grid market in Nigeria.
- Other mini-grid notable players include A4&T Power Solutions and Havenhill.

Focus on Bioenergy



Energy Analytics: Bioenergy

Capacity Share in 2021

1%

Capacity(MW) in 2015



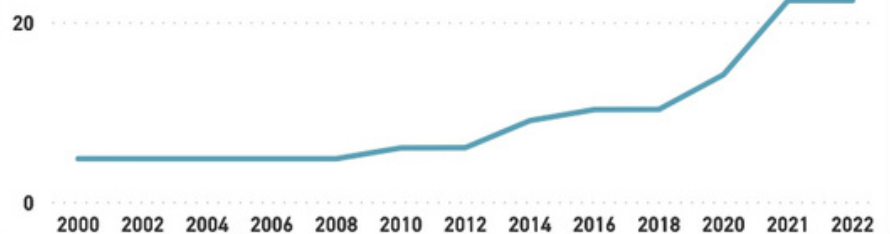
Capacity(MW) in 2025



Generated(TWh) in 2021

62.11

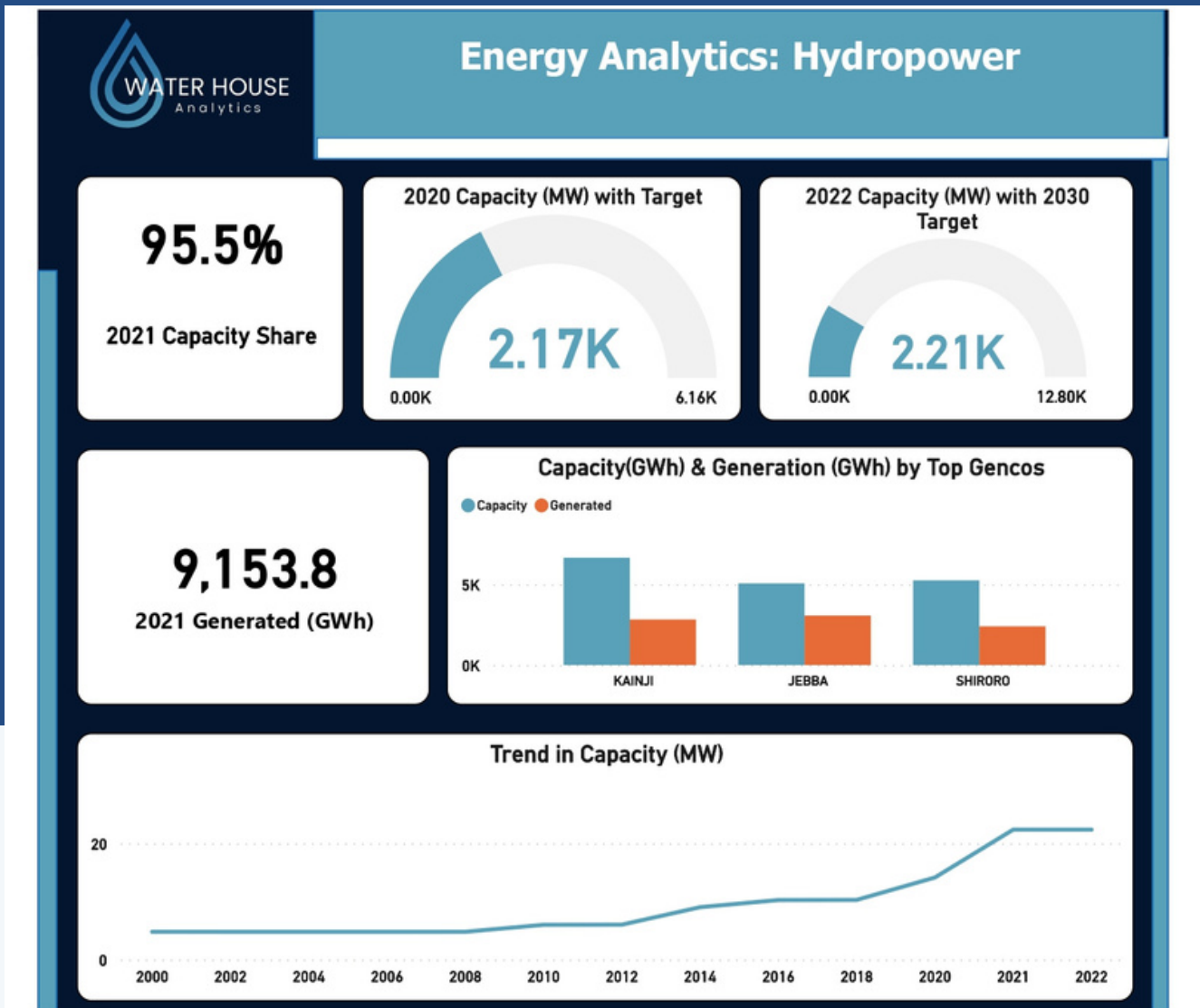
Trend in Capacity (MW)



Data Source: iea

- Bioenergy takes a share of 1% in the renewable capacity and The Renewable Energy Master Plan (REMP) for 2025 and outlines ambitious targets for Biomass-based power plants aiming for 50 MW in 2015 and 400 MW by 2025.
- From analysis on current data, In 2015, Nigeria achieved only 9.03 MW of installed capacity, falling significantly short of the 50 MW target. By 2022, the country had installed approximately 22.39 MW, roughly half the 2015 goal, indicating a decline in this sector.
- To meet the 2025 target, Nigeria needs an annual capacity increase of 1690% from 2022. Despite abundant biomass resources, unsustainable use persists, particularly in rural communities.

Focus on Hydropower



Data Source: iea

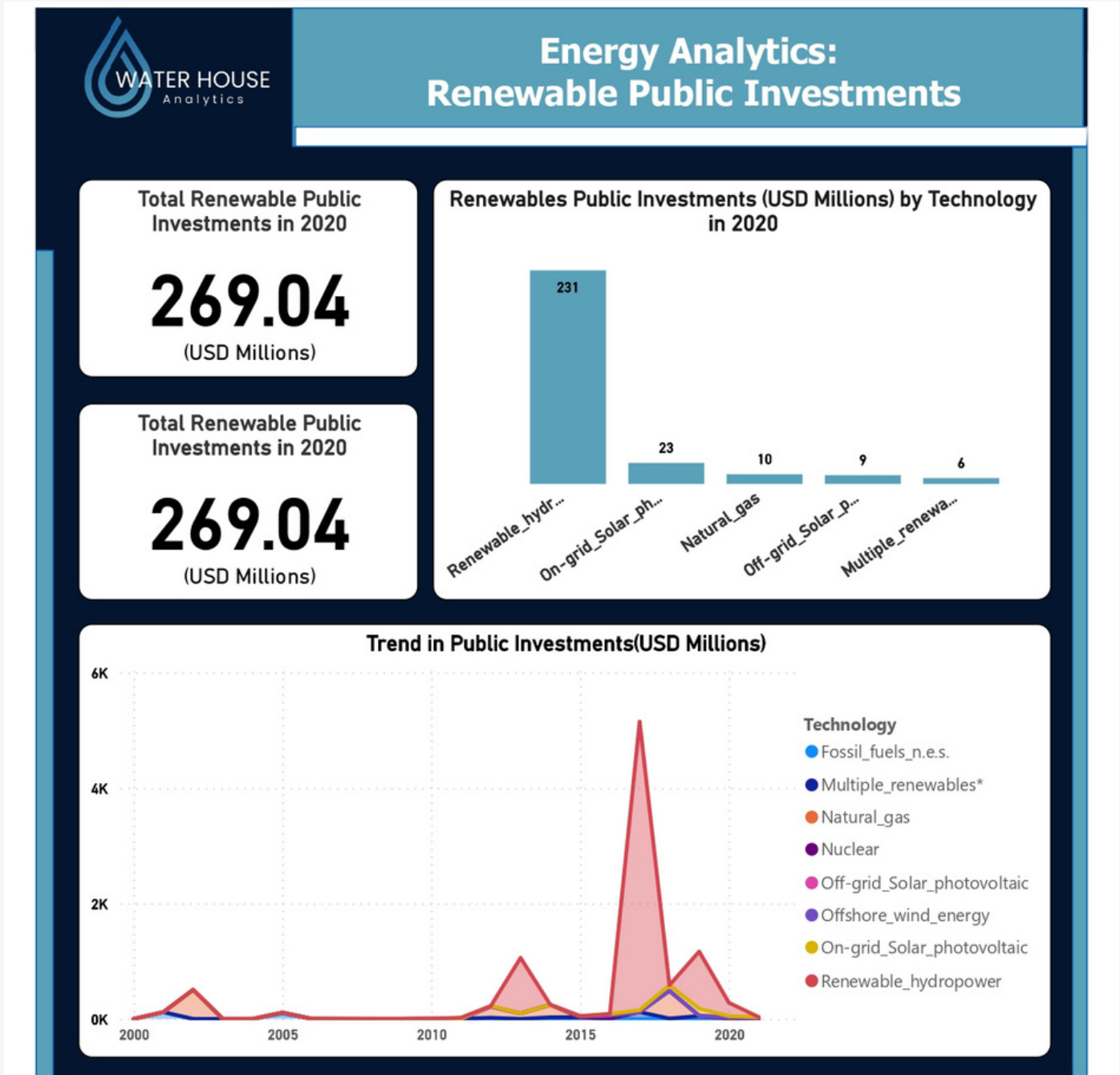
- Bioenergy takes a share of 95.5% in the renewable capacity and The Renewable Energy Master Plan (REMP) for 2025 and outlines ambitious targets for hydro aiming for 6,156 MW for in 2020 and 12,801 MW by 2030.
- From analysis on current data, In 2020, Nigeria achieved only 2170 MW of installed capacity, falling significantly short of the 6156 MW target. By 2022, the country had installed approximately 2211 MW, indicating a decline in this sector meeting its targets.
- To meet the 2030 target, Nigeria needs an annual capacity increase of 1324% from 2022. Nigeria is really blessed with water resources with high potential in Niger and Benue rivers as well as Lake Chad basin, with an estimated renewable water resources of 1,800 m³ per capita per year, yet she still fails to meet demand. Thus, more investments and management is needed in this sector



Renewable Energy Sector

- **Investments and Funding**
- **Manufacturing costs and Critical Minerals**
- **Electricity Tariffs**
- **Renewable Energy projects**

Investments and Funding

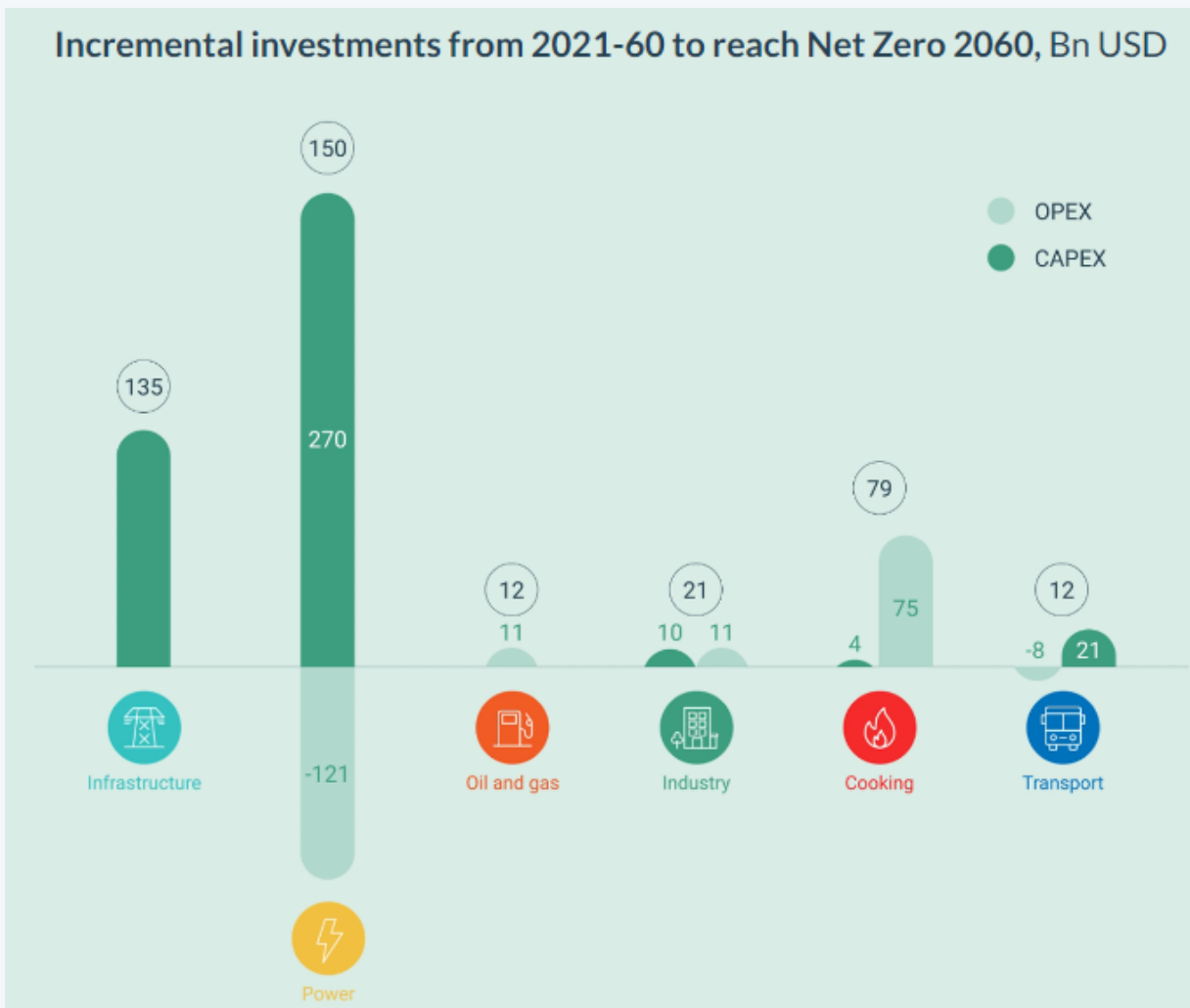


Public investments in Nigeria's energy sector have exhibited significant fluctuations over the years. The data reveals a tendency to allocate these investments primarily to renewables, consistently exceeding 96% in recent years. However, 2017 witnessed an anomaly with a substantial \$5.1 billion USD investment, followed by a staggering 781% decrease to \$584 million USD in the subsequent year. In 2019, investments amounted to \$1.17 billion USD, predominantly channeled into Renewable Hydropower.

Investments and Funding

The year 2020 marked a pivotal moment as Nigeria pledged carbon neutrality by 2060 at COP26 and introduced the Energy Transition Plan (ETP), officially approved in 2022. Encompassing key sectors such as Power, Transport, Oil and Gas, Cooking, and Industry, the ETP necessitates a significant financial commitment of \$1.9 trillion. This includes \$410 billion USD beyond projected expenditure, resulting in an annual additional cost of \$10 billion USD, with a considerable portion allocated to the Power sector.

Despite these financial demands, Nigeria remains open to substantial investment opportunities, with an identified \$23 billion USD potential. These opportunities are directly linked to ongoing national programs and projects aligned with the energy transition, indicating significant room for growth and development in the sector.



Capture: Nigeria Energy transition Plan

Investments and Funding

The data on public investments in Nigeria's energy sector indicates a degree of inconsistency and volatility in resource allocation over the years. While there have been substantial investments, particularly in renewables, the fluctuations raise questions about the stability of funding for long-term energy projects.

The identification of a \$23 billion USD investment opportunity demonstrates that Nigeria has considerable untapped potential for attracting funding related to its energy transition efforts. To successfully meet its energy transition objectives and achieve carbon neutrality, Nigeria must prioritize stable, sustained, and strategic investments in its energy sector while actively engaging with domestic and international stakeholders to facilitate these investments.

Manufacturing costs and Critical Minerals

Since the release of the International Energy Agency (IEA) analysis on the Role of critical minerals in clean energy transitions in March 2022, nations and organizations around the world have intensified their efforts in this direction, and Nigeria is no exception.

Critical Minerals

Clean energy technologies, such as solar photovoltaic (PV) plants, wind farms, and electric vehicles (EVs), rely on a diverse array of minerals. This chart illustrates the increased demand for critical minerals in renewable energy compared to traditional hydrocarbon sources

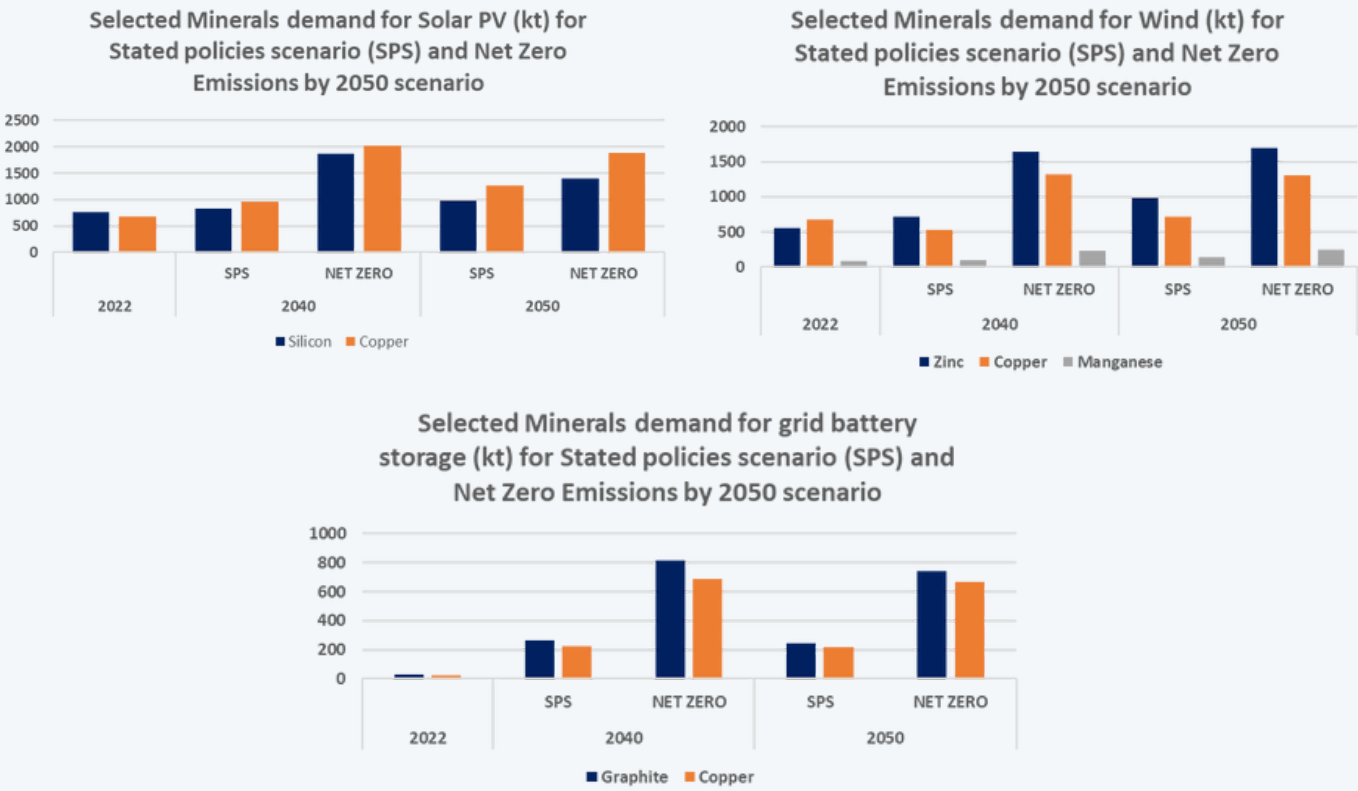
	Offshore wind (kg/MW)	Onshore wind (kg/MW)	Solar PV (kg/MW)	Nuclear (kg/MW)	Coal (kg/MW)	Natural gas (kg/MW)	Electric car (kg/vehicle)
Copper	8000	2900	2822.1	1473	1150	1100	53.2
Nickel	240	403.5	1.3	1297.4	721.04	15.75	39.9
Manganese	790	780	0	147.69	4.63		24.5
Cobalt	0		0	0	201.46	1.8	13.3
Chromium	525	470	0	2190	307.5	48.34	0
Molybdenum	109	99	0	70.8	66.25	0	0
Zinc	5500	5500	29.99	0	0	0	0.1
Rare earths	239	14		0.5	0	0	0.5
Silicon	0		3948.3	0	0	0	0
Graphite	0	0	0	0	0	0	66.3
Others	6	0	31.95	94.28	33.9	0	0.31

Data Source: iea

Lithium, nickel, cobalt, manganese, and graphite are essential for battery performance. Rare earth elements are vital for wind turbines and EV motors, while copper and aluminum are cornerstone materials for electricity networks.

Nigeria, richly endowed with critical minerals, including lithium, tantalite, tin, nickel, and rare earth elements, stands to benefit from the global demand surge for these materials.

Meeting the goals of the Paris Agreement, particularly the aim of limiting global temperature rise to "well below 2°C" as outlined in the Sustainable Development Scenario (SDS) with the stated policies scenario (SPS), would necessitate doubling mineral requirements for clean energy technologies by 2040. In the pursuit of an even faster transition to achieve global net-zero emissions by 2050, the demand for minerals in 2040 is projected to increase sixfold compared to today. The chart below shows the 2022 global demand for solar and wind and battery storages in relation to their stated policies scenarios and the net zero emission by 2040 & 2050.

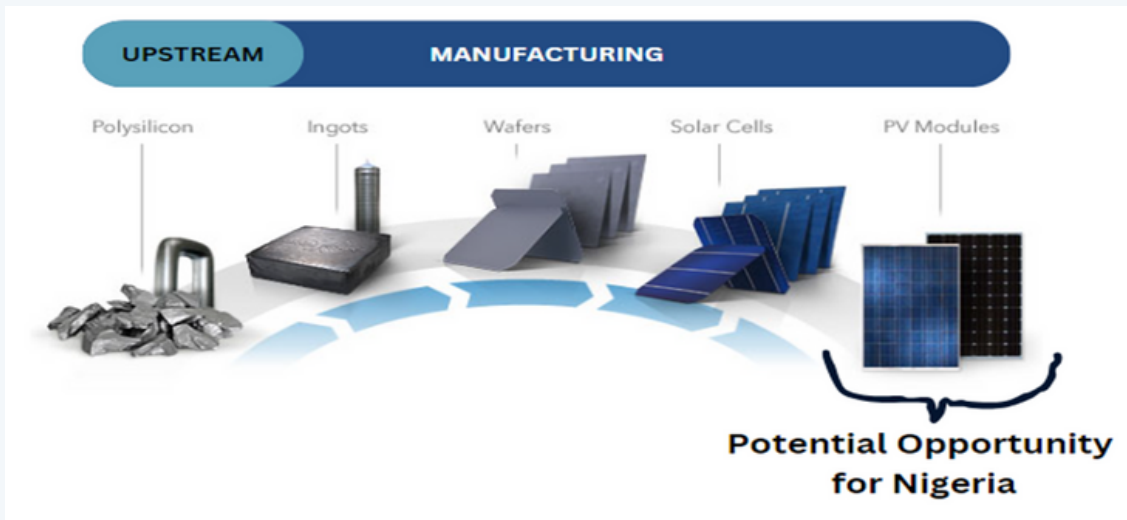
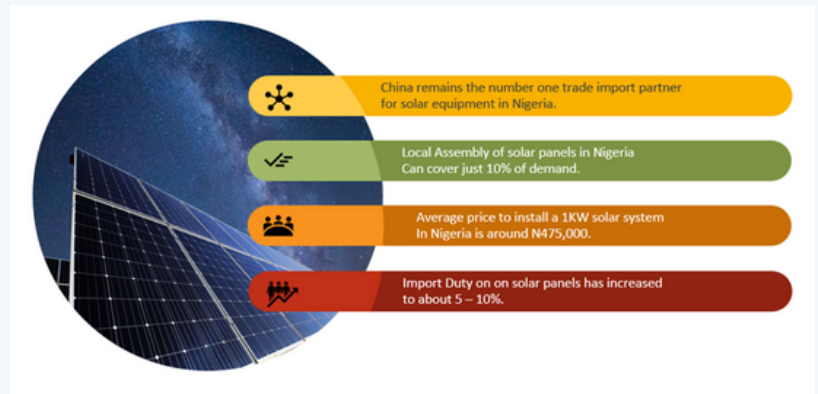


Data Source: IEA

Manufacturing Costs

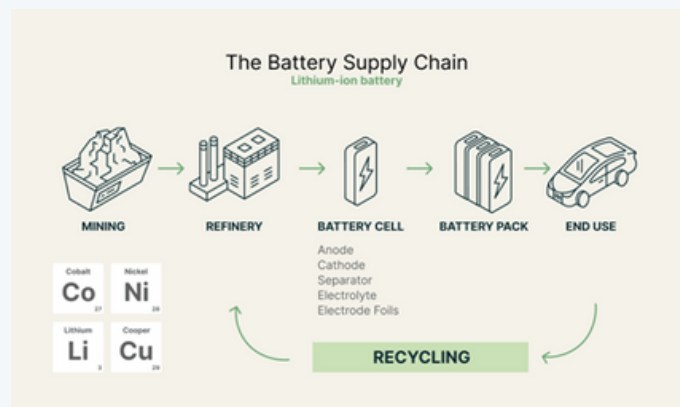
Manufacturing costs play a pivotal role in shaping the affordability of renewable energy technologies. In Nigeria, manufacturing of solar equipment remains limited due to a lack of necessary materials and minerals. Only 10% of demand is met through local assembly.

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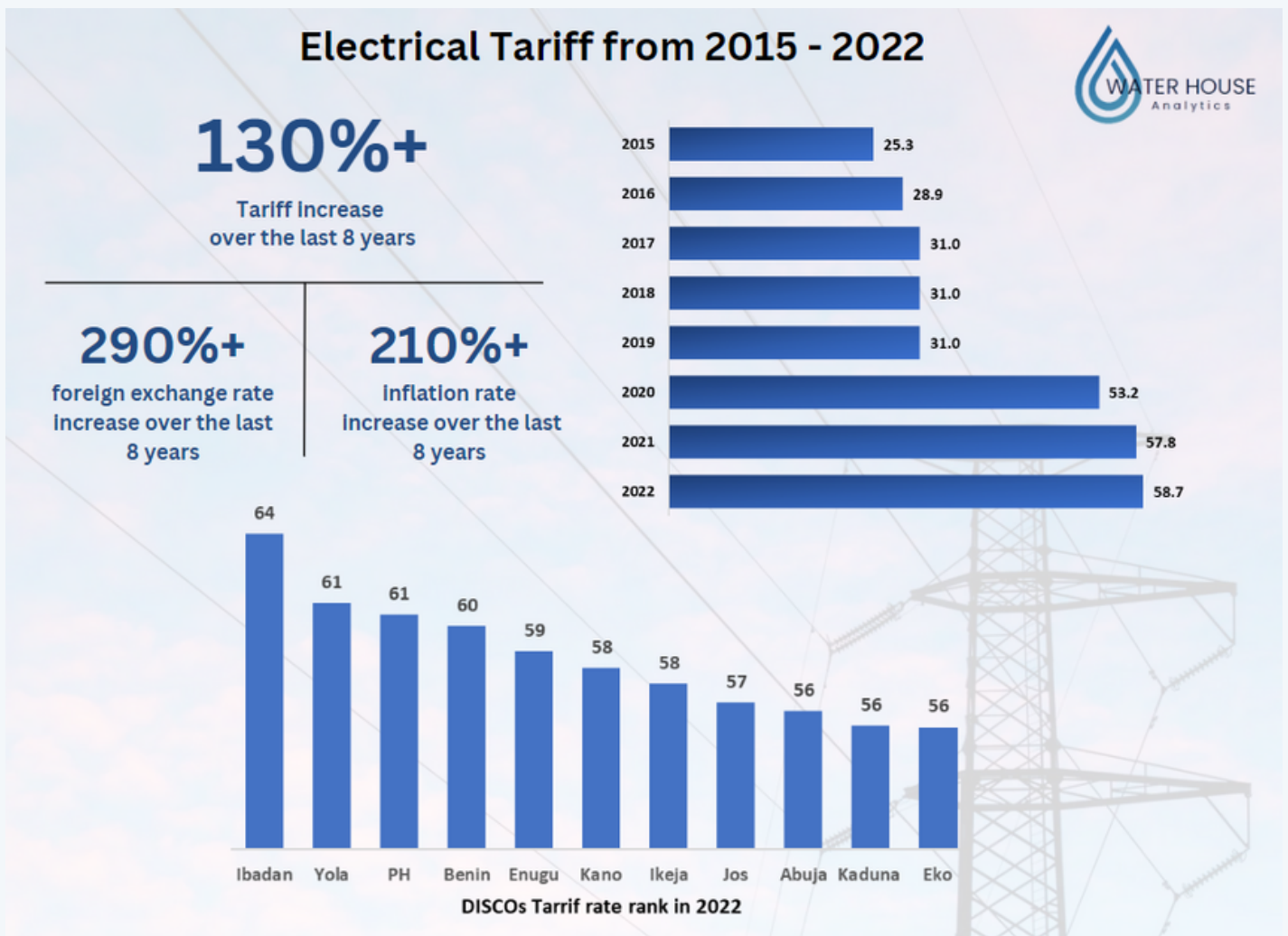


Manufacturing costs for solar PV systems in Nigeria remain high due to the importation of components. Most of the manufacturing takes place outside the country. Nigeria has potential for improvement in solar module assembly, which could help reduce manufacturing costs domestically."

Battery manufacturing, particularly lithium-ion batteries, is another area with growth potential. While Nigeria possesses the raw materials, most batteries are imported from China. Investing in a domestic lithium-battery value chain could unlock the potential for battery manufacturing in Nigeria, reducing import dependence and fostering local industries



Electricity Tariffs in Nigeria



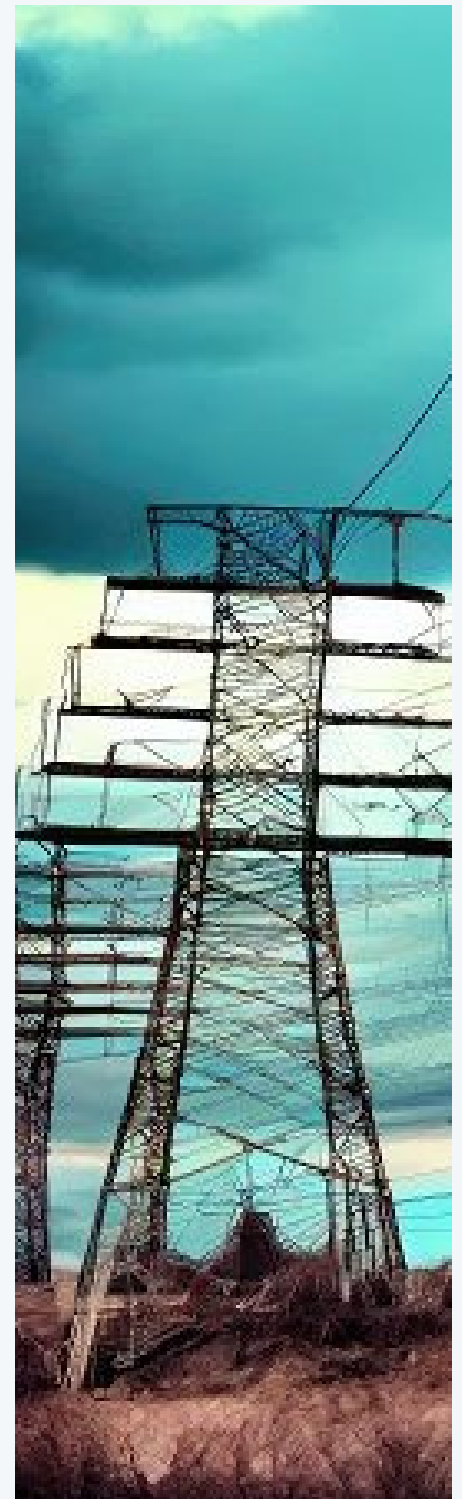
The Nigerian Electricity Regulatory Commission (NERC) plays a critical role in overseeing electricity tariffs in the nation. NERC conducts periodic assessments and modifications of tariff rates, taking into account a wide range of factors such as inflation levels, exchange rates, gas prices, the US inflation rate, available power generation capacity, adjustments in Capital Expenditure (CAPEX), and the operational expenses associated with the power sector. A significant milestone was reached with the introduction of the Multi-Year Tariff Order (MYTO), designed to ensure that electricity tariffs in Nigeria accurately reflect the costs of generating and distributing electricity. This system incrementally raises tariff rates over time, aligning them with the actual expenses incurred in the electricity production and distribution process.



Historically, the average tariff per kilowatt-hour has evolved over the years. Up until 2020, there had been a smooth rise in electricity tariffs with people not really taking note of since it was still in a good range, but at 2022, the sudden increase to about 60 Naira per kwh brought a sudden concern of the end users with NERC explaining that the range of factors used in setting the price has increased, while the MYTO for 2022 raised it to N64 across different customer categories.

The foreign exchange rate used in tariff calculations has seen significant changes, with N198.97/\$ in 2015, N383.80/\$ in 2020, and N441.78/\$ in 2022. Inflation rates have followed a similar trajectory, with 8.3% in 2015, 12% in 2020, and 16.97% in 2022. Currently, the exchange rate is N778/\$ and Nigeria's annual inflation rate climbed to 25.8% in August 2023, from 24.08% in July marking the highest rate since September 2005, reflecting the impact of the removal of fuel subsidies, the devaluation of the official exchange rate and security issues in food-producing regions.

The administration of President Bola Ahmed Tinubu is poised to implement significant changes to electricity tariffs in Nigeria, with an anticipated increase of up to 40% in 2023.



In a pivotal move, President Tinubu signed the Electricity Bill into law in July 2022. This legislative action effectively repealed the Electricity and Power Sector Reform Act of 2005, ushering in the Electricity Act of 2023. The new act consolidates all regulatory measures governing the electricity supply industry, establishing a comprehensive institutional framework for guiding Nigeria's electricity sector post-privatization. The primary objective is to foster private sector investment while dismantling monopolies in electricity generation, transmission, and distribution at the national level. This shift empowers states, companies, and individuals to participate actively in the generation, transmission, and distribution of electricity.

With the removal of fuel subsidies and the ongoing increase in foreign exchange rates and inflation rates, concerns are already mounting among ordinary Nigerians regarding the impact on household incomes, expenditures, and the cost of doing business. Additionally, manufacturing companies are expressing their apprehension about the worsening economic conditions that may inevitably arise from this policy shift. This concern persists even as individuals and businesses continue to grapple with the challenge of paying for electricity that remains largely unavailable in many areas.

Renewable Energy Projects

Three case study projects are looked into showing the viability of these sector in the energy industry.

1

Kumbosto Solar Power Plant



Kano State



January 2023



\$15 million

10 MWp

21,000 Pv solar panels

6MVA Transformers

52 Inverters

12Km Structure

Ownership

FG - 85%

Kano - 15%

Kumbotso - 5%

Largest grid-connected solar plant in Nigeria

2

Nigerian Breweries Solar plant



Oyo State



May 2021



N300 million

663.6 KWp

1680 Solar Panels on roof

800MW Power Annually

10,000 tonnes reduced
carbon footprint

Ownership

Commissioned +Topec (PON Power)

CrossBoundary was Engaged

Nigeria breweries to extend energy initiatives starting with Aba, Enugu, Lagos brewery

Case Study 3:

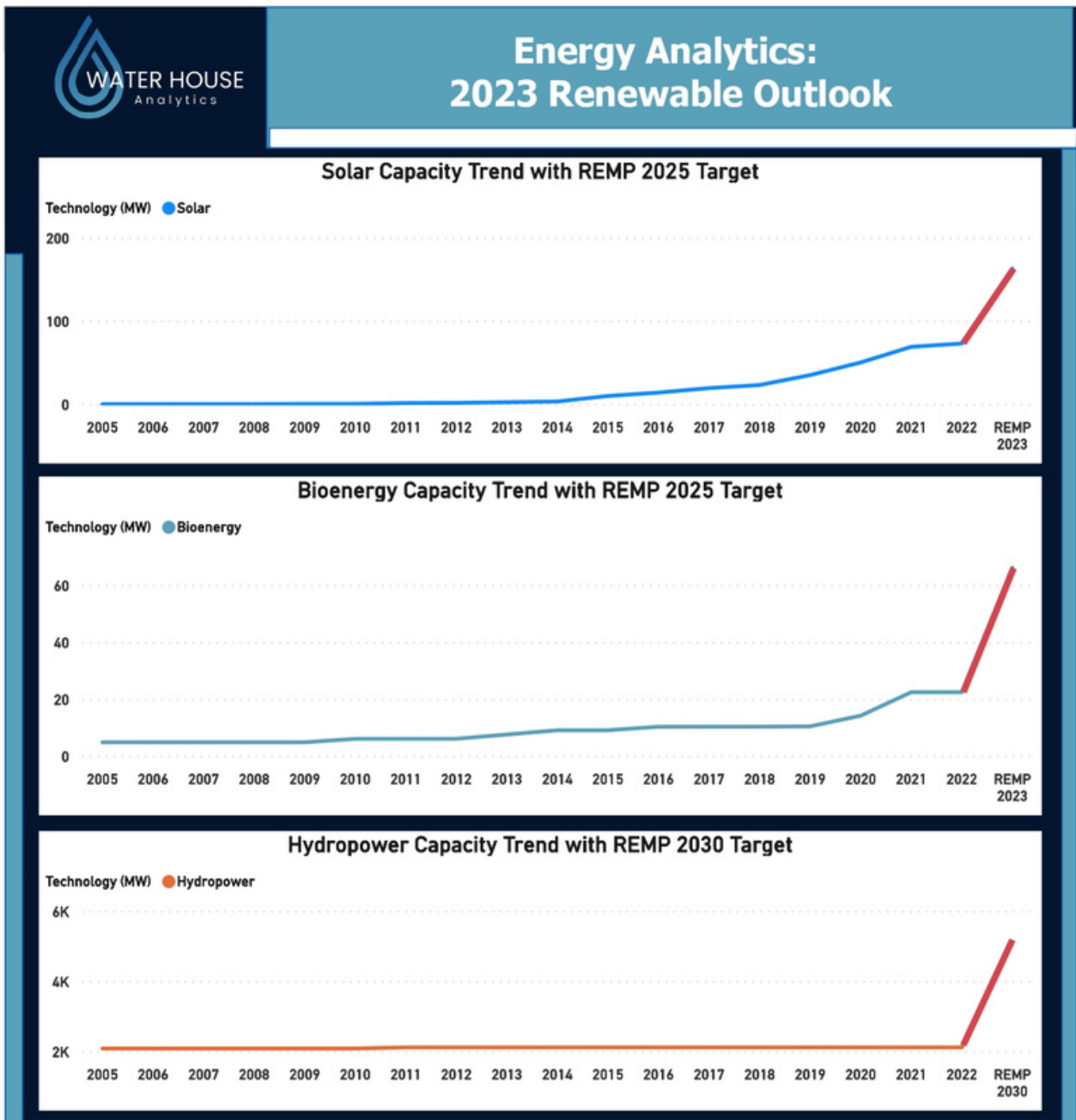
REA deploys 6 Solar Hybrid Plants through the Energizing Education Programme (EEP) I:

Between the years 2019 and 2022, five (5) universities were energized with clean, safe and reliable energy with funding from the Federal Government's Green Bond.

- 1.1MW Abubakar Tafawa Balewa University Bauchi State (ATBU)
- 1.1MW University Petroleum Resources Effurun Delta State (FUPRE)
- 8.3MW University of Agriculture, Makurdi, Benue State (FUAM)
- 4.4MW Usmanu Danfodiyo University Sokoto State (UDUS)
- 4.4MW Nnamdi Azikiwe University Anambra State (NAU)
- 7.1MW Bayero University Kano State (BUK)

OUTLOOK FOR 2023 IN THE RENEWABLE ENERGY SECTOR

The year 2023 signifies a pivotal moment in Nigeria's journey towards energy transition and the realization of ambitious targets set for 2025 and 2030. Nigeria has laid out comprehensive policies and strategies to achieve these objectives, with a particular emphasis on the solar energy sector, given its historical significance.



In the Solar energy sector, to align with The Renewable Energy Master Plan (REMP) for 2025, a total capacity of approximately 162MW is projected for 2023. This projection hinges on maintaining an annual increase of 122.73%. Encouragingly, the Rural Electrification Agency (REA), in collaboration with private investors through the approval of the 2nd Call of the Rural Electrification Fund (REF Call 2), is playing a crucial role. This collaboration positions Nigeria favorably to meet its 2023 solar energy capacity targets.

Conversely, the Bioenergy sector faces a more challenging trajectory. To align with The Renewable Energy Master Plan (REMP) for 2025, a total capacity of approximately 66.1MW is targeted for the end of 2023, contingent on sustaining an annual increase of 191.79%. However, as of the first half of the year, there have been no reported commissioning activities within this sector. Consequently, the sector's capacity may remain static unless significant developments occur in the latter part of the year.

Similarly, the Hydropower sector faces capacity stagnation. To meet The Renewable Energy Master Plan (REMP) for 2030, a total capacity of around 5125MW is envisioned for the end of 2023, predicated on maintaining an annual increase of 131.87%. Regrettably, the sector has seen no reported project commissioning in the first half of the year, suggesting a potential status quo in capacity. This situation is consistent with the sector's historical trends, which have remained unchanged for the past 8 years.

In conclusion, the year 2023 should witness a notable increase in the share of renewables in Nigeria's electricity generation, primarily driven by the Solar energy sector. Nigeria's current Energy Transition Plan (ETP) holds the potential to achieve its targets by 2060, provided substantial investments and sustained efforts are dedicated to renewable energy. However, given Nigeria's historical context, achieving these targets remains uncertain. To improve the prospects of success, Nigeria must demonstrate year-on-year progress, continuously update regulations and policies, and prioritize diversification of its energy sources with reduced dependence on conventional options.



Conclusion

Nigeria's energy landscape stands at a crossroads, with pressing energy poverty issues and environmental challenges. Despite its historical oil prominence, millions still lack access to electricity, while emissions surge from fossil fuel reliance.

The nation has embarked on a transformative journey towards renewable energy adoption, supported by key policies like the Climate Change Act and international commitments like the Paris Agreement. Successful projects, such as the Kumbotso solar plant and Nigerian Breweries' solar installation, exemplify Nigeria's potential in clean energy.

In 2023, Nigeria's focus on solar energy could yield notable results, driven by collaborations between government, private investors, and international partners. Meeting renewable capacity targets, especially in solar and bioenergy, remains vital, necessitating sustained investments and robust regulations.

To ensure a cleaner energy mix, Nigeria must diversify and reduce reliance on conventional fuels. Ongoing policy updates are crucial to creating an environment conducive to renewable energy growth.

In summary, Nigeria's renewable energy journey is at a pivotal juncture in 2023. With determination, strategic planning, and international support, Nigeria can emerge as a regional leader in renewables, securing energy access and contributing to global climate efforts. This year marks a crucial step toward a sustainable energy future, shaping Nigeria's landscape for years to come.



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- Nigeria Energy Transition Plan (2023). Nigeria's pathway to achieve carbon neutrality by 2060. <https://energytransition.gov.ng/>

Glossary

- **AGO:** Also known as "Diesel Fuel" or "Diesel". AGO is a type of fuel used in diesel engines, commonly found in trucks, buses, generators, and industrial machinery, it has a higher energy density compared to gasoline.
- **Downstream:** It refers to the segment of the industry involved in the processing, distribution, and marketing of petroleum products. This phase encompasses activities following the extraction and production of crude oil and natural gas.
- **DPK:** Stands for "Dual Purpose kerosene." DPk is a type of kerosene used for both domestic cooking and as a lighting fuel. It is typically of a higher quality and has undergone additional refining processes compared to other kerosene grades, making it suitable for cleaner combustion in stoves and lamps.
- **Midstream:** It refers to the intermediate phase of the oil and gas industry that involves the transportation, storage, and wholesale marketing of crude oil, natural gas, and refined petroleum products. This sector bridges the gap between the upstream extraction and production activities and the downstream refining and distribution processes.
- **PMS:** Also commonly known as "Petrol" or "Gasoline". It is a fuel used in internal combustion engines, primarily in vehicles with spark-ignition engines (gasoline engines).
- **Volume Discharged:** It refers to the quantity of petroleum products or substances released from storage or transportation facilities, such as tanks, pipelines, or vessels, typically into distribution networks or end-user channels.

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