

# Development Of An Energy Scenario For Improving Energy Infrastructure In A Developing Nation(Nigeria As Case Study)

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## INTRODUCTION & AIM

- **The Energy Gap:** Approximately 43% of Nigeria's population (nearly 96 million people) lacks access to electricity.
- **Infrastructure Decay:** The sector is crippled by low generation capacity (4,000–5,000 MW actual vs. 13,000 MW installed), unstable grids, and 25% transmission losses.
- **Economic Cost:** Power instability leads to massive economic losses and a heavy reliance on expensive, polluting diesel generators (self-generation exceeds 40%).
- **Primary Objective:** To develop a strategic energy infrastructure model that prioritizes Renewable Energy (RE) integration and decentralized power systems to enhance reliability and sustainability.

## FINDINGS

- **Industrial Demand Surge:** Major projects like the Dangote Refinery (1,200 MW) and Lekki Free Trade Zone (3,800 MW) will require massive, dedicated power injections by 2030.
- **The Gas Paradox:** Nigeria flares 8.3 billion cubic feet of gas daily, losing \$3.5 billion annually while contributing 400 million tons of CO<sub>2</sub> emissions.
- **Institutional Bottlenecks:** Progress is stalled by \$16 billion debt to gas suppliers and overlapping regulatory roles between NERC, REA, and the Ministry of Power.
- **Technological Solution:** Coupling dual-axis solar tracking with dust detection can increase energy output by over 40%, making small-scale RE highly viable for energy-poor communities.

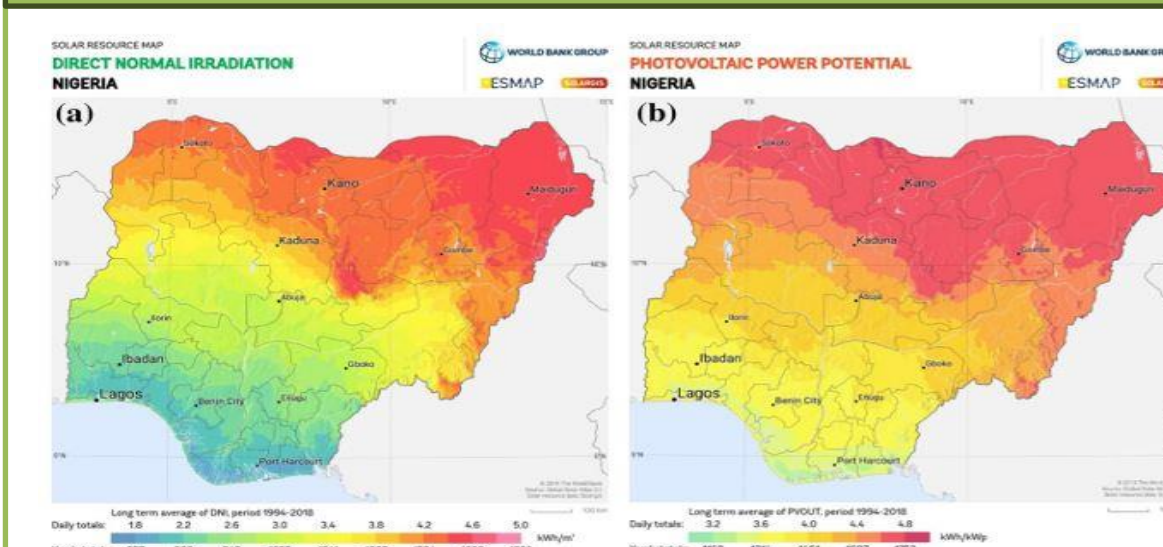
## METHODOLOGY

- **Scenario Modeling:** Development of multiple energy scenarios accounting for technological advancement, policy frameworks, and investment patterns.
- **Data-Driven Forecasting:** Analysis of urbanization trends (65% urban by 2050) and population growth (400M by 2040) to project future load requirements.
- **Resource Mapping:** Techno-economic feasibility studies of Nigeria's vast
- **Untapped Resources:** 206 Tcf gas reserves, solar irradiation, and wind/hydro potential.
- **Integrated Planning:** Aligning energy supply and demand with infrastructure growth through smart grid technologies and automated management systems.

## STRATEGIC IMPLEMENTATION & EXPERIMENTAL RESULTS

- **The Gas Paradox:** Nigeria flares 8.3 billion cubic feet of gas daily, resulting in \$3.5 billion in annual lost revenue and 400 million tons of CO<sub>2</sub> emissions.
- **Infrastructure Age:** Over 60% of Nigeria's transmission lines are more than 30 years old, contributing to technical losses of up to 25% of generated electricity.
- **The Generation Gap:** While installed capacity is 13,000 MW, actual generation fluctuates between only 4,000 MW and 5,000 MW due to gas supply gaps and maintenance issues.
- **Industrial Load Growth:** Major industrial milestones, such as the Dangote Refinery, will require 1,200 MW which is roughly equivalent to the power needs of 2.4 million homes.
- **Urbanization Pressure:** By 2040, Lagos alone will require an additional 10,000 MW of power to support its projected 25 million residents.
- **Self-Generation Dominance:** Due to grid unreliability, over 40% of Nigeria's power is currently self-generated using expensive diesel and petrol generators.

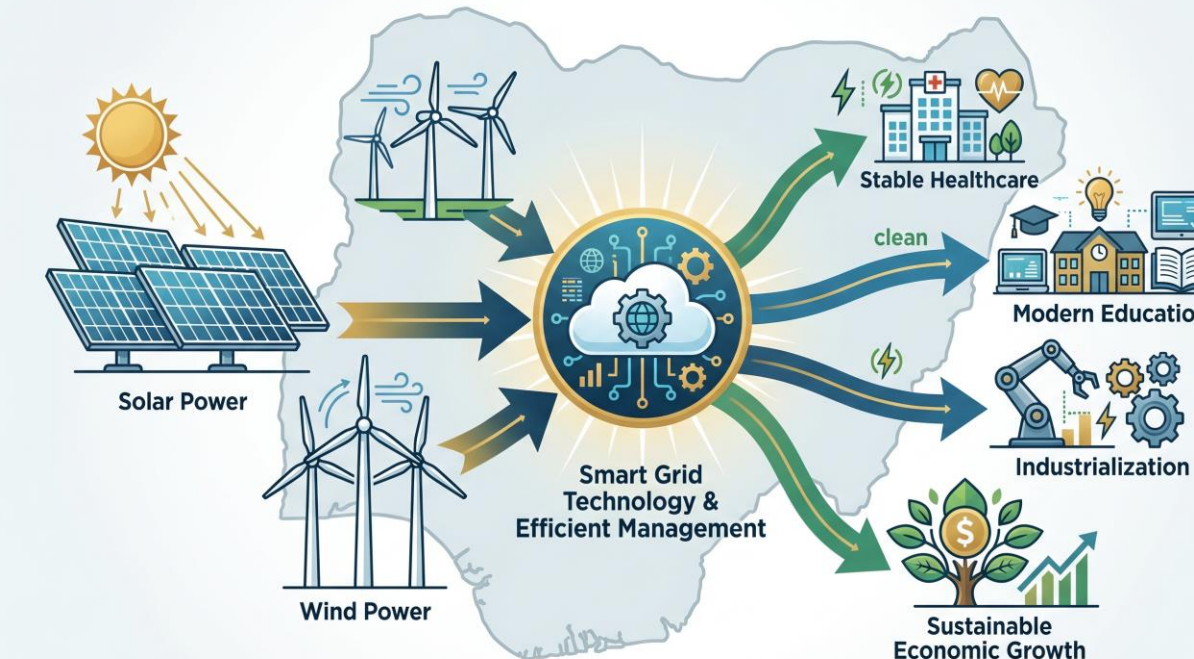
## RESULT/INFOGRAPHICS



### Navigating Nigeria's Energy Demands: Urbanization, Industry, and Infrastructure Strain



### FUTURE ENERGY GRID FOR NIGERIA: A SUSTAINABLE PATHWAY



## CONCLUSION AND RECOMMENDATIONS

- **Transition to Decentralized Platforms:** Nigeria must shift toward mini-grids, off-grid solar, and distributed generation to reach rural and underserved urban zones.
- **Policy Reform:** Strengthen enforcement against gas flaring and resolve sector debts to attract private investment via Public-Private Partnerships (PPPs).
- **Infrastructure Upgrades:** Replace over 8,000 km of aging transmission lines (30+ years old) to reduce the 25% technical loss rate.
- **Capacity Building:** Invest in technical training for host communities to ensure the long-term sustainability of renewable energy projects.

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