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Geothermal Power: Policy, Generation, and Prospects a Decade of Progress (2015–2025) and the Road Ahead: Global, African Continental, and Nigerian Perspectives

DANJUMA T. THEOPHILUS[1], PAUL A. EMMANUEL[2], MICHAEL O. ADELEYE[3], OMOLARA V. OYELADE[4], JOSEPH O. ALAO[5]
[1,2,3,4]*Department of Physics, Bingham University, Karu, Nasarawa State, Nigeria*
[5]*Department of Physics, Air Force Institute of Technology (AFIT), Kaduna, Nigeria*

Abstract- Geothermal energy is one of the most underutilised yet strategically potent renewable resources in the global energy portfolio, uniquely providing dispatchable baseload electricity with capacity factors exceeding 75–90% — attributes unmatched by solar or wind technologies. This study employs a structured evidence synthesis and multi-scalar policy analysis methodology, integrating quantitative installed-capacity data from IRENA, IEA, and the Global Energy Monitor (2015–2024) with qualitative critical analysis of geothermal policy frameworks across global, African continental, and Nigerian jurisdictional scales. Nigerian geological evidence is drawn from peer-reviewed aeromagnetic, gravity, and heat flow studies of the Benue Trough, Jos Plateau, Niger Delta, Chad Basin, and Anambra Basin. Global installed geothermal capacity grew from 11.84 GW in 2015 to 15.1 GW by end-2024, a 27.6% decadal increase. Africa's installed base remains overwhelmingly concentrated in Kenya (≥985 MW conventional; >1,800 MW total by mid-2025 following Olkaria VI commissioning), with all other sub-Saharan African nations recording negligible commercial capacity. Nigeria currently has zero installed geothermal capacity despite geophysical evidence of elevated heat flow (>155 mW/m² in the Middle Benue Trough), shallow Curie point depths (6.0–8.0 km), and geothermal gradients exceeding 74°C/km — sufficient for binary-cycle ORC generation. Nigeria possesses credible but critically underexplored geothermal potential. The immediate policy priority is a nationally funded pre-competitive geothermal resource survey, complemented by dedicated legislation and a specialised public development agency modelled on Kenya's Geothermal Development Company. The convergence of the IEA's landmark EGS projections (800 GW globally by 2050), Nigeria's energy access deficit, and the enabling provisions of the Electricity Act 2023 creates a strategic window of opportunity demanding urgent policy action.

Keywords: Geothermal Energy, Energy Transition Plan, Enhanced Geothermal Systems (EGS), Binary Cycle ORC, Sustainable Energy, Renewable Baseload

I. INTRODUCTION

Energy security, climate change mitigation, and the imperative of universal electricity access represent three of the most consequential geopolitical and developmental challenges of the twenty-first century. In pursuit of a sustainable energy future, the global community has deployed solar photovoltaic (PV) and wind technologies at unprecedented scale. Yet geothermal power which is the oldest industrial renewable energy technology has remained systematically underinvested relative to its technical potential, despite possessing attributes unmatched by variable renewables: round-the-clock baseload generation, inherent grid stability, a minimal surface footprint, and an operational lifespan exceeding 25 years (Bertani, 2016; IEA, 2024).

Global geothermal electricity generation capacity stood at approximately 11.84 GW in 2015. By end-2024, this had risen to 15.1 GW a decadal expansion of approximately 27.6%, driven by strategic investments in Kenya, Indonesia, Türkiye, New Zealand, and the Philippines (REN21, 2025). Figure 1 illustrates this growth trajectory, showing both cumulative installed capacity and annual additions across the decade.

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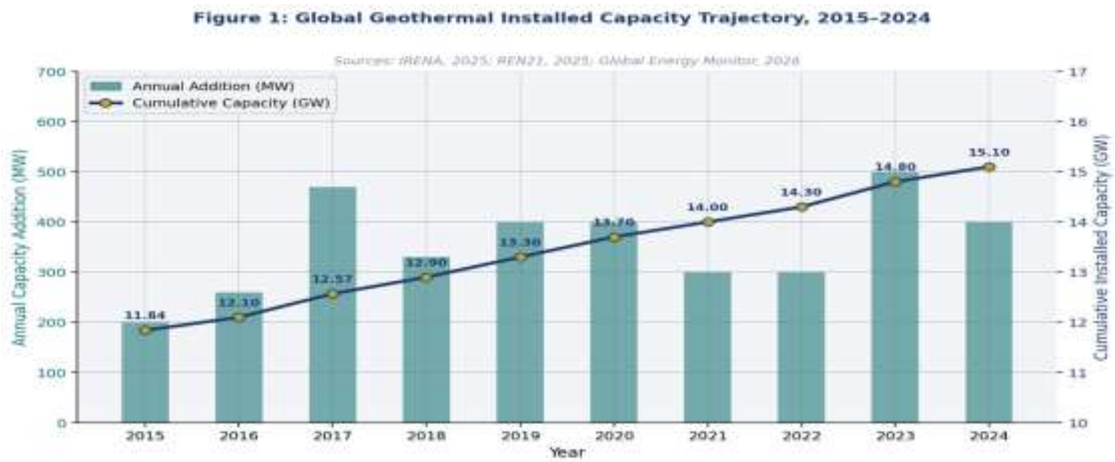

Figure 1: Global Geothermal Installed Capacity Trajectory, 2015–2024 (Cumulative GW on right axis; Annual additions MW on left axis. Sources: IRENA, 2025; REN21, 2025; Global Energy Monitor, 2026)

The emergence of Enhanced Geothermal Systems (EGS) technology is poised to expand the technically exploitable resource base approximately 2,000-fold relative to conventional hydrothermal methods (IEA, 2024). The IEA's landmark report, The Future of Geothermal Energy (2024), projects up to 800 GW of deployable geothermal capacity by 2050.

Africa's East African Rift System (EARS), spanning approximately 6,000 km from Eritrea to Mozambique, harbours an estimated conventional geothermal potential exceeding 20 GW and an EGS potential of approximately 115 TW. Yet only Kenya has achieved significant commercial generation, with over 1,800 MW by mid-2025. Nigeria which is Africa's most populous nation with over 220 million citizens and an estimated 140 million lacking reliable electricity access (IEA, 2022) has zero installed geothermal capacity despite credible geological indicators. This paper addresses this gap, delivering a multi-scalar policy analysis, geological synthesis, and phased investment roadmap.

II. METHODOLOGY

2.1 Research Design and Epistemological Framework

This study adopts an evidence-synthesis and comparative policy analysis research design, combining quantitative secondary data analysis with qualitative critical assessment of policy frameworks across three jurisdictional scales: global, African continental, and Nigerian. The epistemological approach is grounded in interpretive policy analysis (Fischer, 2003), examining not only formal policy content but also structural gaps and political economy factors.

2.2 Data Sources and Selection Criteria

Quantitative installed-capacity data were sourced from IRENA Renewable Energy Statistics 2025; REN21 Renewables 2025 Global Status Report; IEA Future of Geothermal Energy 2024; IGA 2025 capacity surveys; and the Global Energy Monitor Geothermal Power Tracker (2026). For Nigeria's geothermal geology, evidence was drawn exclusively from peer-reviewed indexed journal articles: Ejiga et al. (2022) on the Middle Benue Trough; Abangwu et al. (2023) on the Upper Benue Trough; and Johnston et al. (2020) on the Niger Delta.

2.3 Analytical Framework

Global and African geothermal trajectories are analysed through a political economy lens examining resource endowment, institutional design, financing architecture, and policy commitment as co-determinants of development outcomes. Nigeria's situation is assessed using a barriers analysis framework (Carnegie Endowment, 2025). The investment roadmap is constructed using a phased development model derived from the Kenya GDC institutional template, validated against IEA (2024) best-practice recommendations.

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2.4 Limitations

Three acknowledged limitations: (1) Nigeria-specific geological conclusions are based on proxy geophysical indicators, not direct well measurements; (2) African capacity figures carry inherent data uncertainty given variable national reporting standards; (3) EGS projections are long-term indicative scenarios, not near-term forecasts. These limitations reinforce the paper's core recommendation for a national resource survey.

III. GEOTHERMAL ENERGY: SCIENTIFIC AND TECHNICAL FUNDAMENTALS

3.1 Origins and Resource Types

Geothermal energy derives from two primary heat sources: primordial heat retained from planetary accretion approximately 4.5 billion years ago, and radiogenic heat generated by radioactive decay of uranium (U-238), thorium (Th-232), and potassium (K-40) isotopes. The geothermal gradient averages 25–30°C per kilometre globally, rising to 70–150°C/km in tectonically active regions (Bertani, 2016; Dickson & Fanelli, 2013). Three primary resource types exist for power generation: (1) Hydrothermal Systems (naturally occurring steam/hot water at ≤3 km depth); (2) Enhanced Geothermal Systems (EGS), created via hydraulic fracturing in hot dry rock; and (3) Geo-pressured and magma energy systems, currently pre-commercial.

3.2 Power Generation Technologies

Three plant configurations dominate commercial generation. Figure 3 provides a comparative scientific illustration of their capacity factor ranges and operating temperature requirements, placing Nigeria's binary-cycle ORC opportunity in direct visual context.

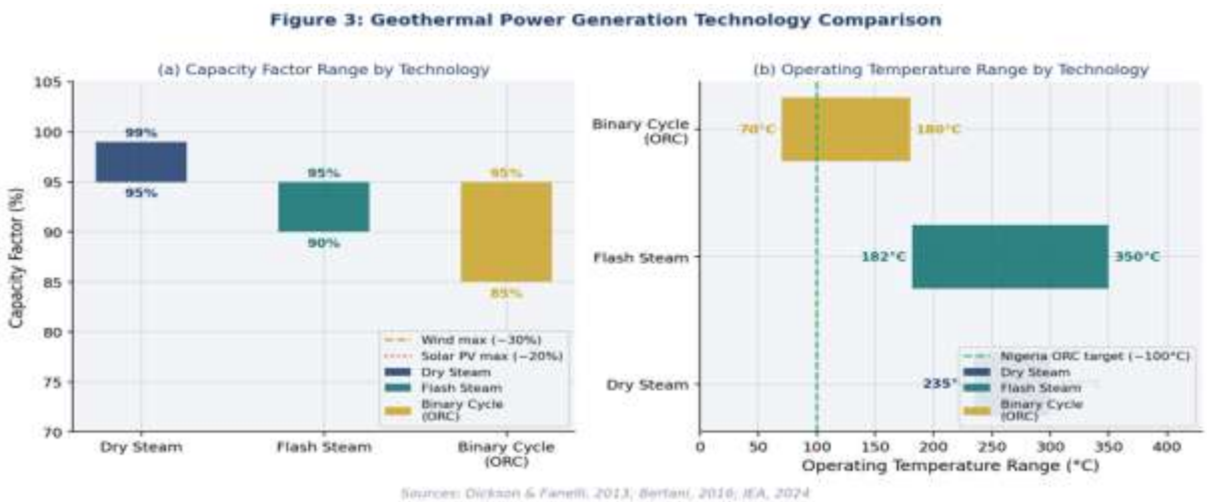

Figure 3: Geothermal Power Generation Technology Comparison — (a) Capacity Factor Range by Technology vs. Solar PV and Wind Benchmarks; (b) Operating Temperature Range, with Nigeria's ORC Target Threshold Marked (Sources: Dickson & Fanelli, 2013; Bertani, 2016; IEA, 2024)

Binary-cycle Organic Rankine Cycle (ORC) technology merits particular emphasis for Nigeria. Operating on resources of 70–180°C, ORC plants are suited to the geothermal gradients documented in Nigerian basins, which fall below the temperature thresholds required for flash or dry steam generation. The closed-loop nature of ORC systems eliminates direct geothermal fluid emissions, making them environmentally well-suited to first-deployment contexts.

3.3 Geothermal Indicators and Surface Manifestations

Surface manifestations indicative of subsurface geothermal activity include hot springs, fumaroles, mud pools, geysers, elevated soil temperatures, and hydrothermal mineralisation. Nigeria's documented

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manifestations are Ikogosi Warm Spring (Ekiti, ~37°C), Wikki Warm Spring (Bauchi, ~31°C), Lamurde Hot Spring (Adamawa, ~45–50°C), and the Akiri and Keana springs of the Benue Trough all consistent with underlying geothermal systems meriting systematic investigation (Businessday Nigeria, 2025).

Geothermal achieves capacity factors of 75–90% versus <30% for wind and <15–20% for solar PV, making it uniquely suited as dispatchable baseload. The IEA (2024) estimates an LCOE of approximately $88/MWh as of 2025, competitive with fossil fuels while remaining marginally above least-cost wind and solar.

IV. GLOBAL GEOTHERMAL POWER: POLICY, GENERATION AND TRENDS, 2015–2025

4.1 Installed Capacity Growth: A Decade in Review

IRENA data confirm growth from 11.84 GW in 2015 to an estimated 15.43 GW by end-2024 (Figure 1). Annual additions remained within the 200–500 MW range, reflecting capital-intensive and long-lead-time project development. The five leading countries are the United States (3,800 MW), Indonesia (2,276 MW), the Philippines (1,900 MW), Türkiye (1,780 MW), and New Zealand (1,280 MW) which collectively account for approximately 73% of global installed capacity. Figure 2 provides a comparative visualisation of global capacity distribution.

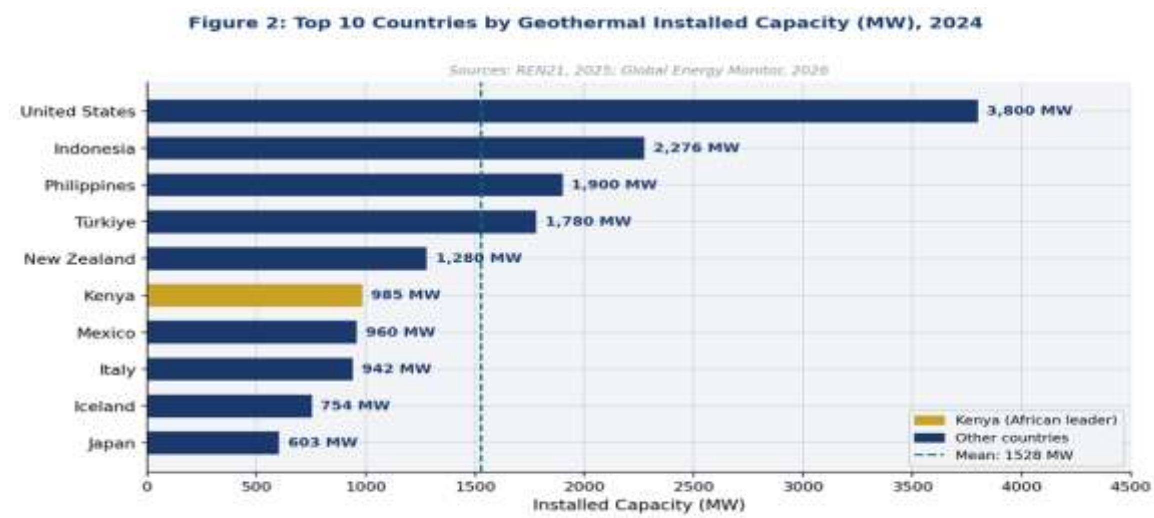

Figure 2: Top 10 Countries by Geothermal Installed Capacity (MW), 2024 — Kenya highlighted as Africa's sole significant producer (Sources: REN21, 2025; Global Energy Monitor, 2026)

4.2 Key Global Policy Developments

The 2015 Paris Agreement and concurrent launch of the Global Geothermal Alliance at COP21 established a five-fold capacity growth target by 2030. The US Inflation Reduction Act (IRA) 2022 extended production tax credits to geothermal and funded EGS research, enabling Fervo Energy's commercial-scale EGS demonstration in Nevada by 2025 (Carnegie Endowment, 2025). New Zealand's 2024 Tauhara plant (225 MW binary ORC with full CO_2 reinjection) validated large-scale binary technology commercially. The IEA's The Future of Geothermal Energy (2024) constitutes the decade's pivotal analytical contribution: 800 GW EGS capacity globally by 2050, with Africa's EGS potential at approximately 115 TW (IEA, 2024).

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4.3 Economic Profile and Cost Trajectory

Table 1 summarises key economic and operational metrics for the geothermal sector as of 2024–2025.

Metric	Value (2024–2025)	Notes and Comparisons
LCOE (Geothermal)	~$88/MWh	Approximately half the cost of equivalent coal or gas
Capital Cost (Hydrothermal)	$3,000–$6,000/kW	Higher upfront than wind ($1,700–$2,100/kW); offset by capacity factor
Capacity Factor	>75–90%	Versus <30% wind; <15% solar PV
Global Generation (2024)	~99 TWh	~1% of global renewable electricity
Direct Heat Use (2024)	~245 TWh (882 PJ)	20% year-on-year increase
Countries (electricity)	28	65 countries use geothermal heat directly
Global Market Size (2023)	USD $66.24 billion	Projected $179 billion by 2030; CAGR 6.61%

Table 1. Key economic and operational metrics for geothermal power, 2024–2025 (Sources: REN21, 2025; Fortune Business Insights, 2024; University of Michigan CSS, 2025).

V. AFRICA'S GEOTHERMAL LANDSCAPE: THE EAST AFRICAN RIFT CORRIDOR

5.1 The Geological Foundation: East African Rift System

The EARS extends approximately 6,000–6,400 km from the Afar Triangle in northeastern Ethiopia to Mozambique, marking the active separation of the Nubian and Somali tectonic plates. It comprises two branches: the Eastern Branch (Eritrea, Ethiopia, Kenya, N. Tanzania) high-enthalpy, volcanic, basis for Kenya's commercial programme; and the Western Branch (Uganda, DRC, Rwanda, Zambia, Malawi) with lower temperature, medium-enthalpy, more analogous to Nigeria's tectonic context and suitable for binary-cycle ORC technology (Pasqua et al., 2023; IEA, 2024).

5.2 Kenya: Africa's Geothermal Exemplar

Starting from Africa's first geothermal plant (Olkaria I, 45 MW, 1981), Kenya methodically expanded to over 1,800 MW by mid-2025 following the April 2025 commissioning of the 500 MW Olkaria VI complex ($320M AfDB financing), representing over 40% of Kenya's electricity generation mix (Global Electricity, 2025; Huduma Global, 2026). The Geothermal Development Company (GDC), established 2008 as a government-owned special purpose vehicle, absorbs upstream exploration risk and delivers proven steam fields to KenGen and IPPs which is a risk-unbundling model critical to unlocking private capital. Four transferable lessons: dedicated public entity for exploration risk; multilateral DFI catalysis; phased multi-field development; community royalty-sharing (Kenya Energy Act 2019). None of these currently exists in Nigeria.

5.3 Other African Nations and Continental Scenarios

Figure 5 presents both the current stark concentration of African geothermal capacity in Kenya and the four scenario projections to 2050 derived from IGA, Rystad Energy, and IEA analyses.

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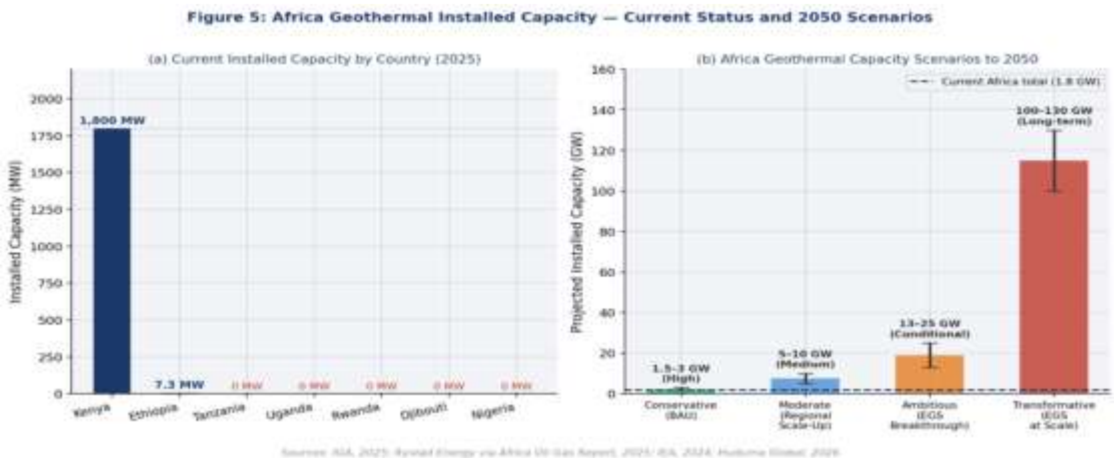

Figure 5: Africa Geothermal Installed Capacity — (a) Current Status by Country (2025); (b) Four Capacity Scenarios to 2050 with Probability Ratings (Sources: IGA, 2025; Rystad Energy via Africa Oil Gas Report, 2025; IEA, 2024; Huduma Global, 2026)

Ethiopia leads beyond Kenya with 7.3 MW operational at Aluto-Langano and PPAs signed for 150 MW each at Corbetti and Tulu Moye, though these remain pending financial close as of 2025, illustrating the gap between contractual and financial progress. Nigeria is absent from all current scenario projections; this paper argues it could contribute 0.5–2 GW to a revised moderate scenario by 2045 with institutional investment beginning in 2025.

VI. NIGERIA'S GEOTHERMAL ENDOWMENT: GEOLOGY, ASSESSMENT, AND STATUS

6.1 Geological Context and Tectonic Setting

Nigeria sits on the stable West African Craton lacking active plate boundaries or contemporary volcanic systems. This has historically generated the misconception that Nigeria possesses no meaningful geothermal resources, conflating high-enthalpy volcanic geothermal with the broader category of low-to-medium enthalpy resources accessible via binary ORC. Nigeria's geothermal potential arises from three mechanisms: (a) radiogenic heat in Jos Plateau and Abakaliki Anticlinorium granitic basement rocks; (b) amplified geothermal gradients from low thermal conductivity sediments in the Benue Trough, Niger Delta, Chad Basin, and Anambra Basin; and (c) residual lithospheric thinning associated with the Benue Trough whcich a Cretaceous failed rift arm (aulacogen) from Gondwana breakup (Ekwok et al., 2020; Ejiga et al., 2022).

6.2 Multi-Metric Basin Assessment

Figure 4 provides a scientific multi-metric comparison of Nigeria's six principal geothermal basins, normalising peer-reviewed heat flow, geothermal gradient, Curie point depth, data coverage, and ORC suitability scores onto a common 0–10 scale to enable direct comparison.

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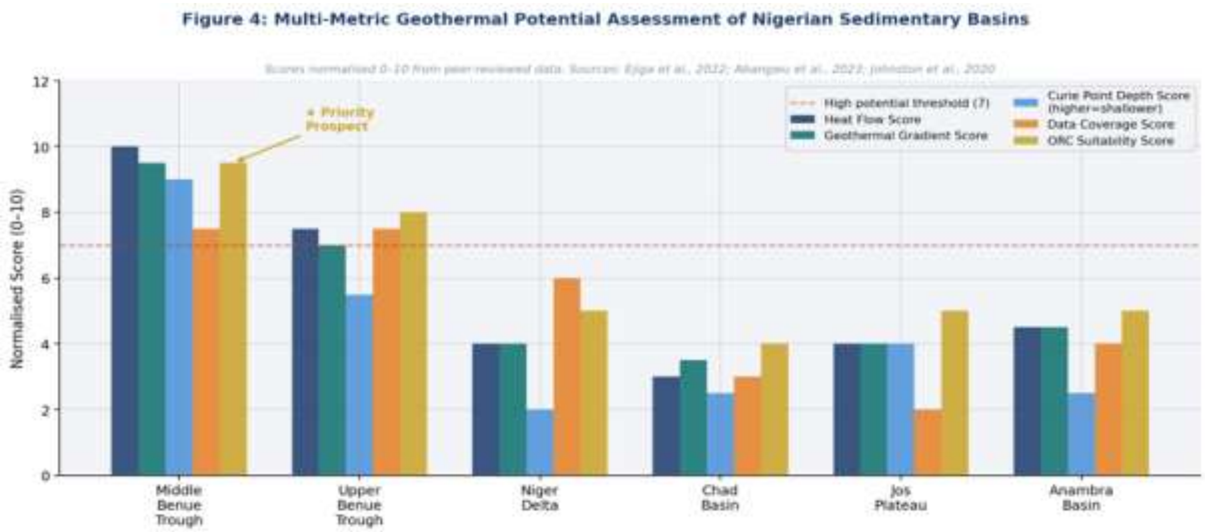

Figure 4: Multi-Metric Geothermal Potential Assessment of Nigerian Sedimentary Basins — Scores normalised 0–10 from peer-reviewed geophysical data; Middle Benue Trough identified as priority prospect (Sources: Ejiga et al., 2022; Abangwu et al., 2023; Johnston et al., 2020)

The Middle Benue Trough is characterised by heat flows exceeding 155 mW/m² (vs. global continental average ~65 mW/m²) and Curie point depths as shallow as 6.0–8.0 km which represents the most

prospective Nigerian basin. Ejiga et al. (2022) identified geothermal gradients exceeding 74°C/km, sufficient to reach ORC-compatible temperatures (>100°C) at depths of approximately 1,500–2,000 m within the range of conventional oilfield drilling. The Niger Delta presents a complementary opportunity: extensive bottom-hole temperature (BHT) data from hydrocarbon wells constitutes a de facto pre-competitive geothermal dataset, and Johnston et al. (2020) confirmed gradients sufficient for ORC generation at moderate depths.

6.3 Nigeria's Energy Supply-Demand Gap and Geothermal Contribution

Figure 6 statistically illustrates Nigeria's structural electricity deficit on a logarithmic scale and places phased geothermal contributions in context, from a Phase 2 pilot (20 MW by 2033) through to the 1,000+ MW Phase 4 target by 2050 and the ETP's 277 GW system target by 2060.

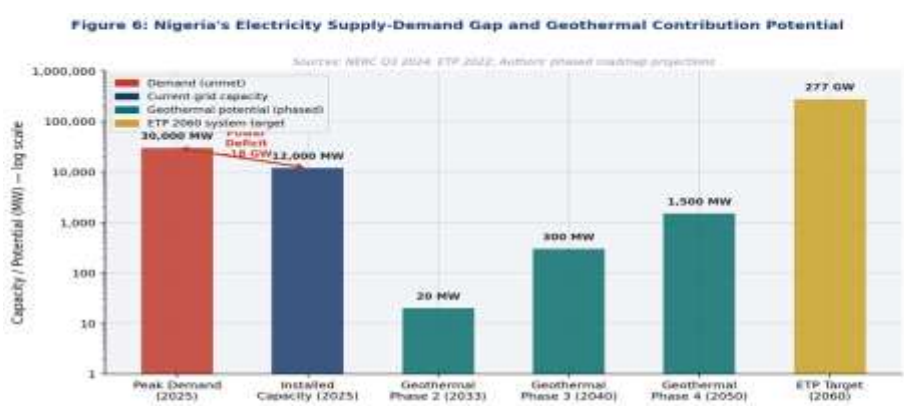

Figure 6: Nigeria's Electricity Supply-Demand Gap and Geothermal Contribution Potential (Logarithmic Scale) — Showing current ~18 GW structural deficit and phased geothermal ramp-up trajectory (Sources: NERC Q3 2024; ETP 2022; Authors' phased roadmap projections)

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As of June 2025, Nigeria has no installed commercial geothermal capacity. The electricity grid relies on thermal gas generation (~80%) and ageing hydropower (~20%), with grid-connected installed capacity of approximately 10,400–12,000 MW against peak demand exceeding 30,000 MW (NERC Q3 Report, 2024). Geothermal baseload technology is directly suited to closing this structural deficit.

VII. POLICY ARCHITECTURE FOR GEOTHERMAL ENERGY IN NIGERIA

7.1 Policy Timeline and the Nominal Inclusion Trap

Nigeria has generated nine major energy policy instruments since 2003. A consistent pattern emerges: geothermal is listed in every major renewable energy framework but never assigned specific capacity targets, licensing pathways, investment mandates, or institutional responsibilities. This constitutes what this paper terms the nominal inclusion trap where

listing a technology creates the appearance of policy coverage while providing no substantive development mechanism. Figure 7 presents a scored quantitative analysis of each instrument's geothermal specificity.

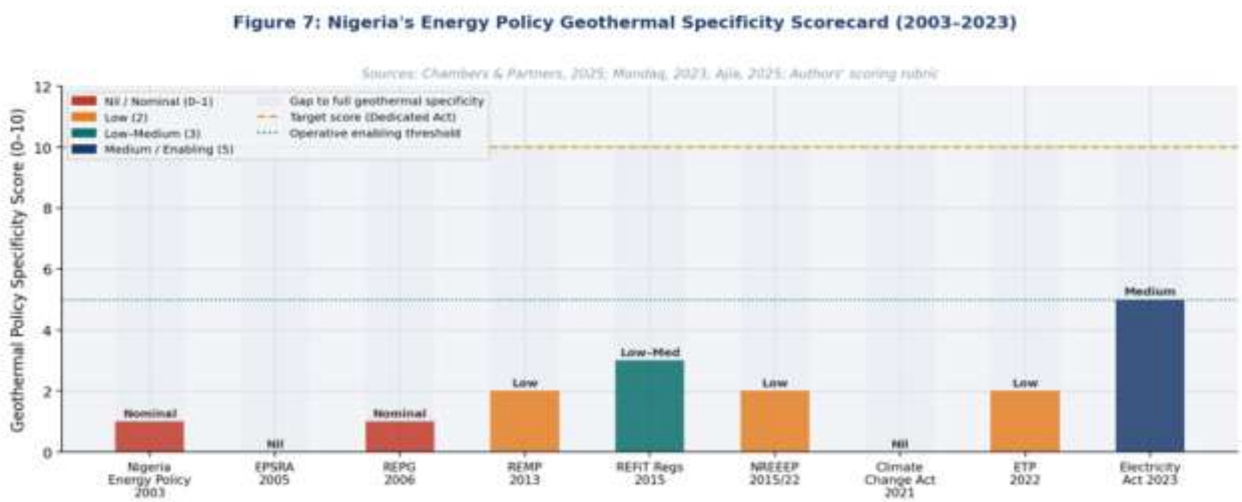

Figure 7: Nigeria's Energy Policy Geothermal Specificity Scorecard (2003–2023) — Scores rated 0–10 against dedicated Geothermal Act benchmark; operative enabling threshold marked at 5 (Sources: Chambers & Partners, 2025; Mondaq, 2023; Ajia, 2025; Authors' scoring rubric)

The scorecard reveals that no Nigerian policy instrument has reached the operative enabling threshold of 5/10 for geothermal specificity. The Electricity Act 2023 achieves the highest rating (5/10) is reflecting its multi-licence IPP framework, mandatory FiT directive, decentralisation provisions, and mandated grid access, but remains below the score a dedicated Geothermal Energy Act would deliver.

7.2 The Electricity Act 2023: A Transformative Milestone

The EA 2023 is the most enabling renewable energy legislation in Nigeria's history. Key provisions include: (1) decentralisation enabling subnational geothermal pilot projects; (2) multi-licence IPP framework removing the EPSRA single-buyer constraint; (3) mandatory NERC FiT directive for technology-specific rates; (4) mandated grid access for renewable generators. However, the Act's silence on geothermal-specific provisions (reservoir access rights, fluid management protocols, exploration licensing, risk insurance) means a dedicated geothermal regulatory instrument remains necessary.

7.3 The ETP 2022 and its Geothermal Gap

Nigeria's ETP targets net-zero by 2060 with $1.9 trillion total investment, modelling solar, gas, wind, and hydropower as priority deployment vectors. Geothermal receives only conceptual

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acknowledgement without capacity target, investment allocation, or timeline creating a self-reinforcing feedback trap: no resource data → no ETP inclusion → no investment → no exploration → no data. Breaking this cycle requires deliberate public investment in pre-competitive data acquisition.

7.4 Five Structural Policy Gaps vs. Kenya Benchmark

Comparative benchmarking reveals five discrete gaps: (1) no dedicated Geothermal Energy Act; (2) no specialised public development agency; (3) no geothermal capacity targets in ETP or NREEEP; (4) no pre-competitive resource survey programme; (5) no geothermal-specific FiT provisions. Each is addressable through targeted legislative, institutional, and financial action.

VIII. CHALLENGES, BARRIERS, AND THE RISK LANDSCAPE

8.1 Global Barriers

Table 2 presents a structured assessment of global geothermal development barriers and their mitigation precedents.

Challenge Category	Specific Issue	Severity	Mitigation Precedent
High Upfront Capital	Exploration drilling costs $5–10M per well	Critical	GDC Kenya model; World Bank risk guarantees
Exploration Risk	30–40% probability of non-commercial wells	High	Surface mapping; seismic surveys reduce risk
Long Lead Times	8–12 years from exploration to generation	High	Phased development; EGS compresses timelines
Regulatory Complexity	Licensing overlaps; land access conflicts	Medium–High	One-stop-shop windows (Philippines model)
Grid Integration	Remote resource locations vs. demand centres	Medium	HVDC transmission; industrial park PPAs
Community Acceptance	Land rights; benefit-sharing disputes	Medium	Kenya Energy Act 2019 royalty-sharing mandate
EGS Technical Risk	Induced seismicity; reservoir uncertainty	Medium	Monitoring protocols; pilot-first approach

Table 2. Global geothermal challenge and barrier matrix (Sources: REN21, 2025; Carnegie Endowment, 2025; African Climate Insights, 2025).

8.2 Nigeria-Specific Barriers

Nigeria faces seven compounding barriers absent from EARS geothermal-producing countries: (1) Knowledge and Data Gap which is foundational barrier, no exploration wells drilled; (2) Policy and Regulatory Vacuum, no operative geothermal enabling framework; (3) Macroeconomic Constraints with ~25% inflation, naira depreciation elevate effective project finance cost; (4) Institutional Capacity, no GDC equivalent, no geothermal expertise in NERC or Federal Ministry of Power; (5) Competing Energy Priorities shows gas institutional inertia risks crowding out long-horizon geothermal investment; (6) Absence of Domestic Track Record, first-mover risk at maximum, reinforcing the case for public sector risk absorption; (7) Tectonic Setting Misconception: incorrect policymaker assumption that non-volcanic = no geothermal resources, risking perpetual neglect.

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IX. PROSPECTS, INVESTMENT OPPORTUNITIES, AND RECOMMENDATIONS

9.1 Investment Potential

Conservative modelling indicates 50–200 MW deployable within a decade of initiating systematic exploration. A long-term contribution of 1,000–2,000 MW within Nigeria's 277 GW ETP system (2060) would represent 3–7% of total capacity but a disproportionately high baseload reliability contribution. At 85% capacity factor, a 1,000 MW geothermal fleet offsets approximately 7.5 million tonnes of CO_2 annually relative to equivalent gas generation, materially relevant to Nigeria's NDC commitments.

9.2 Phased Strategic Investment Roadmap

Figure 8 presents the phased investment roadmap as a Gantt-style timeline, illustrating the sequential progression from data acquisition through institutional establishment, pilot deployment, and commercial scale-up to regional leadership.

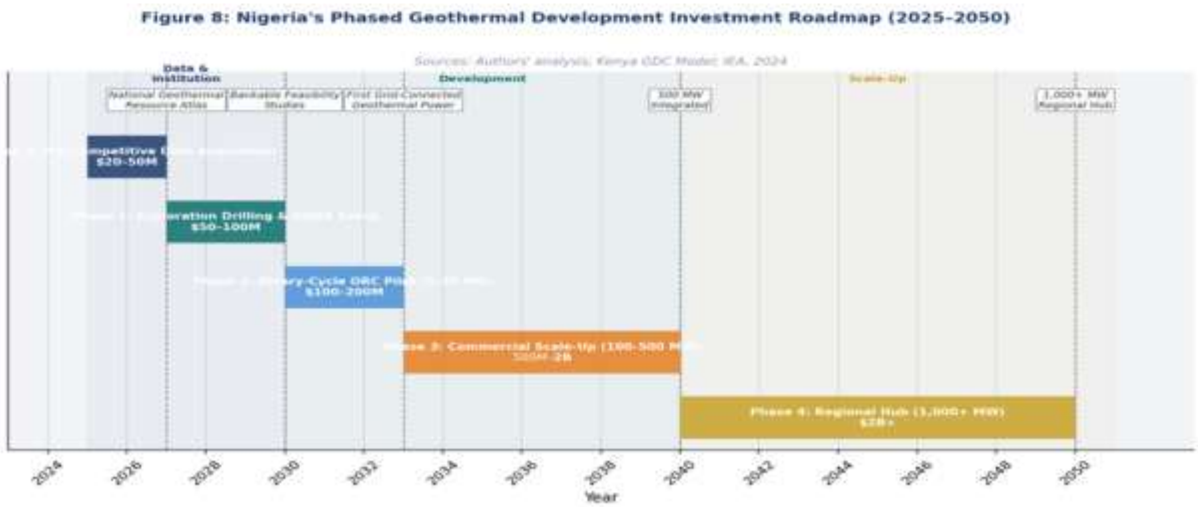

Figure 8: Nigeria's Phased Geothermal Development Investment Roadmap (2025–2050) — Five phases from pre-competitive data acquisition to regional hub, with key milestones and indicative investment ranges (Sources: Authors' analysis; Kenya GDC Model; IEA, 2024)

9.3 Policy Recommendations for the Federal Government

Four priority actions: (1) Enact a dedicated Geothermal Energy Act modelled on Kenya's Geothermal Resources Act which is defining resource ownership, licensing regime, community royalty-sharing, and exploration-phase risk insurance; (2) Establish the Nigerian Geothermal Development Agency (NGDA) as a government-owned SPV capitalised from federal budget, DFI grants, and climate funds; (3) Revise the ETP 2022/2024 to include an explicit geothermal capacity target of not less than 500 MW by 2040 with a dedicated financing window; (4) Direct NERC to develop geothermal-specific FiT rates under the Electricity Act 2023 mandate, enabling bankable PPAs for Phase 2 pilot projects.

9.4 Recommendations for Investors and Development Finance Institutions

The primary bottleneck is pre-competitive data. DFIs (World Bank, AfDB, JICA, GIZ, USAID Power Africa) and climate funds (GCF, SREP) should co-fund Phase 0 geophysical surveys as public-good investments with the model successfully deployed in Tanzania, Uganda, and Ethiopia. First geothermal PPAs should be structured with federal sovereign guarantees and/or MIGA political risk insurance. Binary-cycle ORC should be specified as target technology. Nigeria's oil and gas sector where up to

80% of geothermal investment involves transferable skills and equipment (IEA, 2024); this represents a natural strategic partnership opportunity.

9.5 Recommendations for Research Institutions
Geothermal research centres should be established at the University across each geopolitical zones in Nigeria with engagement with the UN University Geothermal Training Programme (Iceland). A systematic reanalysis of existing geological datasets with oil company BHT records, aeromagnetic archives, GSN survey data should be commissioned immediately as a low-cost step toward a national geothermal resource atlas, achievable within 12–18 months.

X. CONCLUSION

This paper has presented a comprehensive, multi-scalar analysis of geothermal energy policy, generation trends, and development prospects. Six overarching conclusions emerge.

First, geothermal energy is entering a new technological era. The IEA's EGS projections transform the technology from a niche hydrothermal resource into a potentially mainstream baseload option applicable across far broader geological settings than previously feasible, demanding accelerated national and international policy response.

Second, Africa's geothermal trajectory is real but dangerously concentrated. Kenya's ~1,800 MW by mid-2025 proves what is possible within the GDC institutional model; the failure of all other EARS nations to replicate even a fraction of this demonstrates that geological endowment alone is insufficient because institutional capacity, policy commitment, and patient capital are equally determinative.

Third, Nigeria's geothermal prospects are credible but critically underdeveloped. Peer-reviewed evidence confirms heat flow exceeding 155 mW/m² and gradients above 74°C/km in the Middle Benue Trough are consistent with viable binary-cycle ORC systems. Surface manifestations from Ekiti to Adamawa provide corroborating evidence. Non-volcanic tectonic setting is not a valid basis for policy inaction.

Fourth, Nigeria's policy architecture requires dedicated geothermal articulation. The Electricity Act 2023 is the most enabling renewable energy legislation in Nigerian history, but its generic provisions cannot substitute for a dedicated geothermal law, a specialised development agency, or specific resource survey investments. The ETP's silence on geothermal targets is a strategic omission with direct investment consequences.

Fifth, pre-competitive data acquisition is the highest-priority single intervention. A national geothermal resource survey ($20–50M, Phase 0) would break the policy-data-investment feedback trap. Its cost is trivial relative to the $1.9 trillion total ETP investment requirement.

Sixth, the strategic window is currently optimal. The convergence of IEA's EGS projections, Nigeria's energy access deficit, the Electricity Act 2023, a large oil-and-gas workforce with transferable skills, and available multilateral DFI support creates a historically unusual alignment of enabling conditions. Delay is an affirmative choice to remain fossil-fuel dependent and progressively energy-impoverished. Nigeria's geothermal journey must begin now.

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