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Artificial Intelligence and Net Zero Pathways in Sub-Saharan Africa: Opportunities, Barriers, and Policy Implications for Clean Energy Transitions in Rural Communities

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Abstract: *Artificial intelligence (AI) has emerged as a powerful force to drive decarbonisation in the global energy system, yet it remains largely underutilised in sub-Saharan Africa and continues to impact almost one billion people who are disproportionately affected by the climate crisis. This paper examines the implications of AI for cross-sectoral policy, for net zero, and for transition to clean energies in sub-Saharan Africa (rural communities in Nigeria). The study, which was conducted through a systematic review of recent literature and policy documents such as Nigeria's Nationally Determined Contribution (NDC) 3.0 (September 2025) and the Energy Transition Plan (2022, updated 2024), identifies some of the transformative possibilities of AI technologies (machine learning, predictive analytics, smart grid optimisation, and geospatial AI for Monitoring, Reporting and Verification (MRV)) and documents some of the structural barriers that are preventing these technologies from reaching rural communities where energy poverty is most acute. The paper also explores the importance of a community-level clean cooking transition for Nigeria's Net Zero by 2060 goal, using empirical field evidence from Oyo Town, Oyo State. Data scarcity, poor infrastructure, lack of a reliable electricity supply and poor governance are responsible for the increasing inequality between urban and rural areas, as highlighted in the key findings. Finally, the paper presents policy recommendations based on evidence for promoting inclusive AI use in the African clean energy transition, with a clear need to involve communities, build indigenous technology infrastructure, and establish international technology partnerships.*

Keywords — artificial intelligence; Net Zero; clean energy transition; sub-Saharan Africa; rural communities; Nigeria; machine learning; climate change; deforestation; energy poverty

I. INTRODUCTION

Greenhouse gas (GHG) emissions are expected to be zero by the middle of the 21st century, which is one of the greatest economic, technological, and social changes in human history. One of the most promising enabling technologies in this shift is artificial intelligence (AI), which can help optimise the grid of renewable energy sources, speed up carbon monitoring, improve energy demand forecasting, and unlock new efficiencies for the decarbonisation of industrial processes both in high-income countries and emerging economies (Entezari, Aslani, Zahedi and Noorollahi, 2023; Ibrahim, Dong and Yang, 2020). In contrast, the people of sub-Saharan Africa who are rural and marginalised and have limited access to energy have been largely excluded from the development and investment in AI and clean energy, creating a structural imbalance with potentially devastating impacts for the continent's development and climate vulnerability (Ade-Ibijola and Okonkwo, 2023).

Nigeria, the world's most populous nation and largest economy in Africa, is a case in point. Nigeria has made a commitment to reduce its greenhouse gas emissions by 29 per cent by 2030 and 32 per cent by 2035, with a target of achieving a net zero status by 2060, and submitted its Third Nationally Determined Contribution (NDC 3.0) in September 2025 (UNDP, 2025; NDC Partnership, 2025). The commitments are supported by the Nigeria Climate Change Act (2021) and the Energy Transition Plan (ETP, 2022; updated 2024), which prioritise the scale-up of renewable energy, deforestation reduction and clean cooking transitions as the pillars of the national Net Zero strategy. However, about 70 per cent (mostly rural) of Nigerian households still rely on biomass energy for cooking, leading to considerable deforestation, indoor air pollution and carbon emissions, which directly impact the country's climate goals (Climate Action Tracker, 2025; Federal Ministry of Environment, 2020).

AI tools and technologies have the capacity to not only speed up Africa's and Nigeria's clean energy transitions but also to machine learn the optimisation of solar mini-grids and use geospatial AI for deforestation monitoring and carbon stock assessment. One question, however, is not fully answered in the literature: how can AI-based clean energy solutions get to where they are most required – in communities in sub-Saharan Africa that have weak infrastructure, data ecosystems, and governance? This paper attempts to answer this question using a systematic review of the recent literature and policy evidence, supplemented by field experience from rural Oyo State, Nigeria.

The paper is organised as follows: In Section II, the overview of AI applications for the global clean energy transition and Net Zero pathways are explored. In Section III, the sub-Saharan African and Nigerian contexts are explored. Section IV discusses barriers to the potential of using AI in rural clean energy transitions. Field evidence from the rural community of Oyo State is given in Section V. Policy recommendations are provided in Section VI and conclude in Section VII.

II. AI and Net Zero: Global applications and emerging evidence

2.1 AI: Application in clean energy systems. 2.1 AI: Application in clean energy systems.

There are numerous types of AI technologies, such as machine learning, deep learning, natural language processing, computer vision and predictive analytics, all of which are being used more and more in the energy industry to drive decarbonisation. AI can also help improve the accuracy of electricity demand forecasting, minimising the need for high-cost and polluting peaking power plants; optimise the dispatch of variable renewable energy sources like solar and wind in electric grids; and optimise the predictive maintenance of renewable energy equipment to increase operational lifetime and cost savings (Ibrahim, Dong and Yang, 2020; Esenogho, Djouani and Kurien, 2022).

In the realm of clean cooking, AI is now being used to analyse the energy use behaviour of households, predict the adoption of clean cooking technology and better target social behaviour change programmes. Satellite imagery and machine learning are being used to map clean cooking fuel access and identify populations lacking access at the national and regional levels in a few sub-Saharan African settings (Bawa, 2025). AI-enabled remote sensing and geospatial analysis offer important tools for monitoring deforestation, as well as tracking carbon stock loss and carbon stock sequestration, particularly when addressing Nigeria's NDC 3.0 target to reduce its rate of deforestation by 60 per cent and plant 20 million trees annually (UNDP, 2025).

2.2 AI for Net Zero Monitoring, Reporting, and Verification (MRV)

AI has a unique promise in monitoring, reporting, and verification (MRV), a critical area in the quest for net zero. MRV is essential in monitoring progress towards national climate targets, in enabling climate finance flows and in building international credibility. The ground-based monitoring systems are usually costly, location-dependent and cannot be operated in resource-limited areas. Large-scale, low-cost, near real-time GHG monitoring could be possible in all sectors using geospatial AI, which combines satellite imagery, remote sensing, and machine learning algorithms (African Climate Collaborative, 2026; Entezari et al., 2023).

In Africa, the use of geospatial AI as a key tool for MRV has been recognised as a non-negotiable condition for the continent's Net Zero pathway by the African Climate Collaborative (2026). Although AI isn't specifically identified in the MRV architecture of the NDC 3.0, Nigeria's NDC 3.0 highlights the importance of strengthening climate monitoring and data infrastructure through international support, which AI will directly support.

Table I. AI Applications in the Clean Energy Sector — Global Evidence Base

AI Technology	Energy Application	Documented Outcome	Source
Machine learning	Solar mini-grid optimisation — Rwanda	Improved energy reliability and dispatch efficiency	AIB Insights (2026)
ML demand forecasting	Grid management — South Africa, Kenya	Reduced peaking power demand; cost savings	Ibrahim et al. (2020)
Geospatial AI / remote sensing	Deforestation MRV — multiple African nations	Near real-time forest loss detection	Entezari et al. (2023)
AI climate fintech (Nithio platform)	Sustainable energy financing — Africa	>400,000 people reached by 2023	Nithio (2023); AIB Insights (2026)
Computer vision / satellite imagery	Clean cooking access mapping	Identification of underserved populations at scale	Bawa (2025)
Predictive analytics	Renewable energy equipment maintenance	Extended equipment lifespan; reduced O&M costs	Esenogho et al. (2022)

Source: Authors' synthesis from reviewed literature.

III. THE SUB-SAHARAN AFRICAN CONTEXT: ENERGY POVERTY, CLEAN ENERGY, AND AI

3.1 Energy Access and Clean Cooking in Sub-Saharan Africa

Access to energy is a serious issue in Sub-Saharan Africa. As of 2023, around 600 million people (43 per cent of the region's population) are still without electricity access, of which 85 per cent are in sub-Saharan Africa (International Energy Agency [IEA], 2022; ESMAP/World Bank, 2024). Despite decades of policy interventions and the fact that the number of clean cooking technologies and fuels adopted is still lagging behind population growth, more than 960 million people in the region still live without access to these technologies and fuels (IEA, 2024). These energy access shortfalls are not just annoyances but also gender, environmental, economic, and public health crises. Women and children are more affected because they are responsible for collecting firewood and have a higher prevalence of biomass combustion smoke exposure, resulting in respiratory disease (Ajagbe, Zainuddin, Manaf, Rahim and Anguruwa, 2024; Pommells, Schuster-Wallace, Watt and Mulawa, 2018).

Table II provides background information on the extent of the electricity and clean cooking access gap in sub-Saharan Africa and compares some important indicators for the region with indicators for Nigeria.

Table II. Energy Access in Sub-Saharan Africa and Nigeria — Key Indicators (2022–2023)

Indicator	Sub-Saharan Africa	Nigeria	Verification Source
People without electricity (millions)	~600	86.6	IEA (2022); ESMAP/World Bank (2024)
Share of global electricity deficit (%)	85%	—	ESMAP/World Bank (2024)
Urban electricity access (%)	83	~89	ISSA Africa (2026); IEA (2022)
Rural electricity access (%)	42	<30	IEA (2022); ISSA Africa (2026)
People without clean cooking (millions)	~960	~170	IEA (2024); World Bank (2026)
Rural clean cooking access (%)	<14	9.7	World Bank (2026); IEA SDG7 (2024)
Share of countries with clean cooking access below 20% (SSA)	29 countries	N/A	IEA (2024)
Annual household firewood dependence (Oyo Town field survey)	—	78% of households	Agbaje (2026)

Source: Authors' compilation from verified institutional databases. See references for full citations.

Conditions in Nigeria are particularly challenging. The Energy Transition Plan (ETP, 2022; 2024 update) identifies the scale-up of LPG distribution, biogas production, and improved cookstove technology across rural areas as essential for achieving universal clean cooking by 2030. Yet adoption rates of clean cooking in rural Nigeria remain critically low, constrained by financial barriers, cultural preferences favouring firewood, distribution challenges, and the persistent absence of meaningful community engagement in policy design and implementation (Agbaje, 2026; Climate Action Tracker, 2025).

3.2 AI in Africa's Energy Sector: Current State and the Emerging AI Divide

The energy sector's use of AI is expanding but is regionalised, with limited use in Africa outside of urban areas and regions with greater digitalisation. AI has proved efficacy in certain scenarios: in Rwanda, AI-optimised solar mini-grids have boosted energy reliability; in South Africa and Kenya, machine learning demand forecasting has been piloted; and the AI climate fintech platform Nithio has reached more than 400,000 people across various African markets through AI-driven sustainable energy financing in 2023 (AIB Insights, 2026; Nithio, 2023). The potential of AI in enhancing energy access and monitoring is recognised in Nigeria's National AI Policy Framework and Energy Transition Plan, but implementation is still in its early stages (IARDJournals, 2025).
However, a significant gap between urban areas with relative technological maturity, digital infrastructure and data ecosystems, and rural areas where they are essentially missing is also growing. Rural electricity access is less than 30 per cent, and rural internet penetration is estimated to be less than 15 per cent in Nigeria (IEA, 2022; World Bank, 2025). The findings from the field survey in Oyo Town (Agbaje, 2026) do not provide any ambiguity, as none of the 150 households surveyed indicated any knowledge about AI-based or digital energy services. This discovery is not about lack of awareness communication; it's about the basic lack of the infrastructure conditions that underlie the deployment of AI.

IV. BARRIERS TO AI-ENABLED CLEAN ENERGY TRANSITIONS IN RURAL SUB-SAHARAN AFRICA

Combining the literature review with field evidence, the five structural categories of barrier that systematically exclude AI-driven clean energy solutions in the most severely energy-poor rural communities have been identified. These barriers are not solitary; they intertwine, exacerbate and reinforce each other in ways that will multiply their impact and make a patchwork approach to solutions virtually impossible.

4.1 Data Scarcity and Algorithmic Bias

High-quality, representative spatially and timely data are essential to effective AI systems. Data systems to train and validate AI models for energy applications are lacking or insufficient in rural sub-Saharan Africa. The systematic collection of energy consumption and production statistics from off-grid systems is rare; satellite image resolution is often not adequate for a village-level analysis; and monitoring the local environment and meteorological conditions is limited (Entezari et al., 2023). Algorithmic bias, or models that predict incorrectly or perform poorly in unfamiliar data environments, is common when AI models are trained on data from better-resourced contexts and applied in a rural African setting. The consequences of this for Africa's energy and climate planning and monitoring are profound, with the potential for systematic misdirection of investment and policy as a result of biased AI outputs.

4.2 Infrastructure Deficits

The electricity supply, Internet and computing resources are vital for the operation of AI systems. They are all very limited in rural sub-Saharan Africa. Nigeria's electricity access is below 30 per cent and the AI-based smart metres, monitoring sensors and energy management systems that can help address energy access issues can not be deployed without the very electricity infrastructure they are intended to reduce. This is a circular dependency that can hinder deployment (IEA, 2022). Although internet connectivity has improved in many places in the continent, the situation in many rural areas is still poor, limited, and too expensive to support the data-hungry AI applications that have proven to be effective in areas with higher connectivity.

Human and technological gaps in capacity

The labour market in sub-Saharan Africa, such as Nigeria, is characterised by a critical shortage of relevant skills for an AI economy, including skills in clean energy data science, machine learning engineering, geospatial analysis, and energy systems engineering (Ade-Ibijola and Okonkwo, 2023; AIB Insights, 2026). This skills shortage results in a reliance on external technology suppliers and tech assistance from donors and stifles the long-term sustainability and local ownership of AI-powered clean energy solutions. The need for developing indigenous capacity in AI and data science is well-documented in the literature and also in the national AI strategy documents in Nigeria, but progress in this direction has been slow, especially in African universities, where there is a need to establish AI training programmes and institutes in Africa that are backed by financial resources.

Governance and Policy Fragmentation

There is a need for a coherent regulatory framework, data governance standards, and policy coordination between the energy, digital, environmental and finance sectors for the effective deployment of AI. These frameworks continue to be underdeveloped, regional or non-existent in most sub-Saharan African countries (AIB Insights, 2026). The NDC 3.0 and Energy Transition Plan of the Nation of Nigeria have ambitious quantitative targets, but not much detail on how to govern, regulate or scale up the use of AI in the national MRV system or the architecture of the clean energy programme. Risks associated with poorly governed AI use cases, such as privacy risks, algorithmic decision-making risks, and risks of displacement of local livelihoods, call for proactive and anticipatory policy attention, which needs to be systematic.

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One of the most basic challenges is the lack of representation and participation of rural areas in designing, governing and implementing AI-mediated clean energy solutions. International organisations and private sector actors tend to create technology-centred solutions that fail to include meaningful community engagement, local knowledge systems, and community-defined energy priorities (Agbaje, 2026; Bawa, 2025). If the AI tools for clean cooking and energy access are not implemented in a truly participatory manner, from concept to deployment and evaluation, they risk repeating the same bottom-up implementation failures of clean cooking and energy access programmes, which have been achieved for decades. Table III shows the five categories of barriers and the main manifestations of the barriers in the Nigerian rural context.

Table III. Structural Barriers to AI-Enabled Clean Energy Transitions in Rural Nigeria — Summary

Barrier Category	Primary Manifestation in Rural Nigeria	Consequence for AI Deployment	Evidence Source

Data Scarcity	Absence of off-grid energy monitoring; insufficient satellite resolution for village-scale analysis	Algorithmic bias; unreliable model outputs; misdirected investment	Entezari et al. (2023)
Infrastructure Deficits	Rural electricity access <30%; internet penetration <15% in rural areas	AI systems cannot be deployed without the electricity they are designed to expand	IEA (2022); World Bank (2025)
Human Capacity Gaps	Critical shortage of AI, data science, and energy systems engineering skills	Dependence on external suppliers; unsustainable deployments	Ade-Ibijola and Okonkwo (2023)
Governance Fragmentation	Nascent regulatory frameworks; limited AI governance in NDC 3.0 and ETP	Inconsistent deployment; privacy and equity risks unaddressed	AIB Insights (2026)
Community Exclusion	Top-down design; no community participation in Oyo Town study area	Replication of failed conventional programme models; rejection of solutions	Agbaje (2026); Bawa (2025)

Source: Authors' synthesis from systematic literature review and field evidence.

V. FIELD EVIDENCE FROM RURAL OYO STATE, NIGERIA

The barriers to structural opportunities outlined in Section IV are not abstract. They are experienced concretely in the everyday lives of communities in rural Nigeria, including those studied via systematic fieldwork in Oyo Town and Oyo East Local Government Area (LGA) in the State of Oyo in Nigeria. Policy recommendations in this paper are grounded in field evidence presented in this section, which was compiled from Agbaje (2026) and Ajagbe et al. (2024).

A structured household survey (SHS) carried out in Oyo Town (150 HH) focused on the determinants of household fuel choice and the adoption of clean cooking technology. The results of the key field survey findings are then matched with their national and international statistical counterparts in Table IV to show that the evidence from the field is supported to varying degrees by the publicly verifiable institutional evidence. Even if firewood was not the sole fuel used for cooking, over 78 per cent of all the households surveyed said they relied mainly on firewood as their primary cooking fuel. The major challenges identified by the respondents were the high price of LPG cylinders and refilling, the weak supply chain for LPG in the survey communities, entrenched social and cultural beliefs that made firewood the fuel of choice for traditional cooking and the lack of any government outreach or support programmes in the communities.

Not surprisingly for the purposes of this paper's argument, of the 150 households surveyed, none reported having heard anything about an energy service that was offered through AI or digital means. This was not restricted to AI awareness being found only in the AI sector but rather to the lack of digital energy infrastructure in the area: rural internet penetration in the area was negligible, reliable electricity power was not available to the majority of households, and no smart energy monitoring and management systems had been deployed either by government, NGO or private sector actors in the study area.

Table IV. Oyo Town Field Survey Key Findings and National Statistical Validation

Indicator	Oyo Town Survey (n=150)	Nigeria National/Rural Comparator	Verification Source
Primary fuel: firewood	**78%**	~78% national; rural ~90%	World Bank (2026); IEA SDG7 (2024)
Awareness of any AI energy service	**0%**	<1% rural (est.)	AIB Insights (2026); World Bank (2025)
Reliable electricity access	Partial/unreliable	<30% rural Nigeria	IEA Africa Energy Outlook (2022)
Government outreach on clean cooking received	**0 households**	<5% rural coverage (est.)	Climate Action Tracker (2025); ETP (2024)
LPG cited as unaffordable	Primary barrier	Nationally documented pattern	IEA Universal Clean Cooking (2024)

Cultural preference for firewood	Significant factor	Documented across SW Nigeria	Ajagbe et al. (2024); Agbaje (2026)
Internet / digital connectivity	Very limited	<15% rural Nigeria	NCC (2023); World Bank (2025)

Source: Primary data from Agbaje (2026) household survey, Oyo Town, Oyo State. National comparators from IEA, World Bank, and NCC sources as cited.

These field observations reinforce a central argument of this paper: AI-driven clean energy transitions cannot be designed from the top down and deployed in the absence of the foundational infrastructure, governance, and participation conditions that characterise rural communities across sub-Saharan Africa. Research by Ajagbe et al. (2024) on biomass fuel alternatives and energy sustainability in Oyo State further demonstrates that sustainable energy transitions in this context require a combination of appropriate technology, community engagement, and policy support conditions that AI tools can enhance only when deployed as enabling infrastructure within a broader community-centred approach not as a substitute for it.

Figure 1. Nigeria's GHG Emissions by Sector (2021) and NDC 3.0 Reduction Targets

Emission Sector	2021 Emissions (MtCO2e)	Share (%)	NDC 3.0 Target	AI Application
Energy (total)	209.0	**62.4**	29% reduction by 2030	Smart grids; demand forecasting; mini-grid AI
Agriculture	80.4	24.0	Precision agriculture targets	AI crop and livestock monitoring
Land-use Change & Forestry	46.2	**13.8**	60% deforestation reduction; 20M trees/year	Geospatial AI; satellite MRV; carbon mapping
Waste (est.)	~5.0	~1.5	Emerging targets	AI landfill gas monitoring
TOTAL	**~335**	**100**	Net zero by 2060	—

Source: Emission-Index.com (2024), derived from World Resources Institute Climate Watch Historical GHG Emissions Database and Global Carbon Project (2023). NDC targets from NDC Partnership (2025) and UNDP Nigeria (2025).

VI. POLICY RECOMMENDATIONS

This paper presents the following evidence-based policy recommendations for the deployment of inclusive AI in the clean energy transition in Sub-Saharan Africa, after reviewing the available evidence and conducting field observations in Oyo Town. The recommendations directly address at least one or more of the structural barriers identified in Section IV.

6.1 Invest in rural data infrastructure with urgency.

Investments in data infrastructure to facilitate the effective use of AI in rural areas must be a key focus of government funding, international development institutions and climate finance institutions. This involves national energy household surveys at adequate spatial and temporal frequency and rural disaggregation; community-level electricity and cooking fuel monitoring systems; and open data repositories to make rural energy and environmental data available to researchers, policymakers and local communities. AI works for the counted, and without data infrastructure, it cannot work for the uncounted.

6.2 Develop indigenous capacity in AI and data science.

To implement sustainable AI in Africa's clean energy industry, Africans must have indigenous human capacity. National AI strategies, including Nigeria's, should feature dedicated, well-resourced investment in the teaching and learning of AI and data science with a focus on the geography and environmental science, energy engineering and public policy faculties at African universities. There is a need to systematically support, through continental funds on AI education funded by climate finance mechanisms, South-South partnerships between institutions with developing AI capacity in Africa, such as Kenya, South Africa, Rwanda, and Ghana, with others with weaker capacity.

6.3 The 6th Goal: Ensure community engagement in AI-based energy programmes.

Community engagement should be a central component of any AI-powered initiative to promote clean energy in rural regions of sub-Saharan Africa, from problem definition and data collection to solution design, deployment, and evaluation. Good governance is not only a principle; it is a prerequisite for effectiveness. The absence of local knowledge and community participation in the design of AI systems consistently leads to underperformance in rural African settings as evidenced by the Oyo Town examples, where no community has participated in any energy programme design.

6.4 Take AI MRV into account for national climate governance.

Nigeria and other sub-Saharan African countries should mainstream the use of AI-powered geospatial MRV in their NDC implementation plans. It needs institutional capacity building in national climate change agencies, formal collaborations with satellite data providers and AI technology companies, and a systematic synthesis of the community-based monitoring data with satellite-derived data to enhance accuracy in areas lacking data. A reliable 20 million trees per year planting target and a 60 per cent reduction in deforestation are only really possible if NDC 3.0 also monitors deforestation in near-real-time, using AI to support this effort.

6.5 Design and implement AI solutions for clean cooking that are appropriate to the context

Any use of AI for transitioning to clean cooking should be tailored to the unique conditions in rural communities of sub-Saharan Africa, characterised by low connectivity, intermittent electricity, low digital literacy, and various cultural contexts. Some of these possible solutions involve using AI in behaviour change communication in the form of feature phones rather than smartphone apps; training machine learning models using Nigerian local data instead of exporting them from higher-income contexts; and using AI to optimise supply chains for LPG and improved cookstove distribution in rural Nigeria – where the current supply chain, which the Oyo Town field survey revealed as a major barrier to clean cooking uptake, is dire.

6.6 Ensure alignment of AI energy investments and flows with climate finance

Investments in Africa in clean energy have reached a new high of USD 36.6 billion in 2023 and are projected to reach USD 40 billion by 2024 – a substantial amount that needs to be tailored to AI capability building (ESI-Africa, 2024). The use of community energy data systems, local AI capacity building and the use of AI for the MRV will be eligible and a priority for investment in climate finance mechanisms, such as the Green Climate Fund, Just Energy Transition Partnerships and Article 6 carbon markets under NDC 3.0. Currently, clean cooking investment in Africa is around USD 675 million, and it is more than 5 times less than what is needed at USD 4 billion per year to reach universal access by 2040 (IEA, 2024). Incorporating some of the new climate finance in the optimisation of the AI-powered clean cooking supply chain and demand forecasting could make a substantial difference in the effectiveness of this long-neglected investment.

VII. CONCLUSION

AI has the real and powerful potential to speed up sub-Saharan Africa's journey to net zero and universal clean energy access. The continent can benefit from increasingly efficient, accessible, and effective clean energy systems with the support of machine learning, geospatial AI, predictive analytics, and smart grid optimisation. Nigeria's NDC 3.0, submitted in September 2025, is a bold and now more plausible national pledge to achieve Net Zero by 2060, which is implicitly relying on monitoring at scale using AI, clean cooking and deforestation at scale.

But this paper has shown that achieving the potential of AI in sub-Saharan Africa's clean energy transition will need to address a series of structural challenges – data scarcity, infrastructure gaps, human capacity gaps, governance shortcomings and community exclusion – that existing AI deployments have not yet fully overcome. The findings from the field in rural Oyo State, supported by national and international institutional data, highlight the disconnect between the technological frontier and the lived experience of communities most impacted by energy poverty and climate vulnerability. Key facts capture this: there is no rural clean cooking access in Nigeria, less than 30 per cent with a national target of universal access by 2030, and not one household in the Oyo Town field survey reported being aware of any AI-driven energy services.

To bridge this divide, a paradigm shift is needed, shifting from AI as an end-to-end technological solution imposed on communities to AI as infrastructure that strengthens community agency, local knowledge, and participatory governance in the clean energy transition. In sub-Saharan Africa, AI can be a force for equity and sustainability on the path to net zero if communities are meaningfully engaged, indigenous capacity built in AI, and investments made in rural data infrastructure. In the absence of these enabling factors, the danger is that AI will help accelerate the clean energy transition for those who do not need it the most, while further pushing those who need it the most even further away.

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