

Artificial Intelligence

A Game Changer for Just Energy Transition in Africa?

This opinion piece is authored by Tamuka Chekero and Noëleen Murray for the Operationalising a Just Transition in Africa (OJTA) research project funded by the International Development Research Centre (IDRC) and collaboratively undertaken by the Centre for the Advancement of Scholarship at the University of Pretoria, the African Research Impact Network and SouthSouthNorth.

Introduction

Africa stands at a crucial juncture in its developmental trajectory, grappling with the twin challenges of sustainable development and energy access. With a burgeoning population and increasing urbanisation, the energy demand continues to escalate. However, this quest for energy must be balanced with environmental sustainability and social equity, encapsulated in the concept of a “Just Energy Transition” (JET). In this quest for JET, Artificial Intelligence (AI) emerges as a transformative force, offering innovative solutions to address these challenges and pave the way for a sustainable energy future in Africa.



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The Concept of a Just Energy Transition

The world is shifting towards renewable energy, but a Just Energy Transition goes beyond flipping a switch. It is about ensuring everyone benefits from this change, with a focus on inclusivity, equity, and environmental sustainability. Imagine a coal miner who has supported their family for years. A Just Transition would not just leave them jobless. It would provide training and support to help them find new opportunities in the clean energy sector. The transition needs to be fair and equitable to everyone involved. If communities feel left behind, it can create resistance and slow down progress. A Just Transition fosters transparency and participation so everyone understands the benefits and has a say in how things unfold. A Just Transition is not just about protecting people from losing their jobs. It is about creating a brighter future with exciting opportunities in areas like solar, wind, and battery storage, empowering marginalised groups by investing in their skills and ensuring they have a seat at the table.



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The Africa landscape

Africa is endowed with abundant renewable energy resources, including solar, wind, hydro, and geothermal. Despite this potential, energy access remains a significant challenge. Over 640 million Africans lack reliable energy sources, with a meagre national average access rate of just over 40% within African Union (AU) member states. This stands in stark contrast to developed regions. The United States, for instance, boasts a per capita energy consumption of 13,000 kWh, while Europe enjoys a comfortable 6,500 kWh. In comparison, some AU member states struggle to reach a mere 180 kWh per capita.

Furthermore, Africa's energy generation profile presents a significant challenge. Fossil fuels, including biomass, dominate the energy landscape, constituting a substantial 77%, and posing serious environmental and health risks. Renewable energy sources like wind power contribute a marginal 0.01%, with solar power accounting for only 2%. Geothermal energy contributes a slightly larger share, ranging from 4% to 5%, while hydropower provides 17%. This heavy reliance on fossil fuels and the limited adoption of

renewable energy technologies pose a formidable barrier to achieving the AU's Agenda 2063 goals. This critical agenda emphasizes universal electricity access as a cornerstone for both personal development and broader socio-economic progress across the continent.

Traditional grid expansion, while a potential solution to electricity shortages, presents limitations. These limitations include slow deployment times and significant upfront costs, particularly in geographically dispersed or remote areas. Furthermore, integrating a growing share of variable renewable energy sources (RES), such as solar and wind power, into the existing grid infrastructure necessitates significant advancements in grid management systems.

These advancements are crucial for effectively handling the inherent variability in power generation associated with weather-dependent RES. Consequently, alternative approaches alongside strategic grid expansion are necessary to achieve a more efficient and sustainable electricity supply. AI technologies, including machine learning, predictive analytics, and optimisation algorithms, offer unprecedented opportunities to accelerate the JET agenda.

Leveraging Artificial Intelligence for Just Energy Transition

In the ongoing quest for a sustainable and equitable energy future, AI emerges as a potential game changer, offering innovative solutions to bridge the gap towards a just energy transition. This innovative approach can bridge the gap towards a sustainable and equitable energy future, leaving no one behind. AI algorithms can analyse real-time data from weather patterns, energy consumption, and grid conditions. This allows for intelligent forecasting, optimising renewable energy generation, and enabling a smoother integration into existing grids.

Machine learning algorithms can optimise energy distribution networks, reducing losses and improving efficiency. AI-powered solutions can enable the integration of renewable energy sources into the grid, addressing intermittency challenges and maximising utilisation. Advanced data analysis using AI can identify communities most in need of energy access, enabling targeted interventions and ensuring that no one is left behind.

AI-powered microgrids can manage distributed renewable energy sources in remote locations, bringing clean energy to off-grid communities. AI can analyse energy consumption patterns, enabling utilities to predict demand and optimise energy distribution. This reduces wasted energy and improves grid stability. As the energy sector transforms, AI can be used to develop training programs for new jobs in renewable energy and related fields. A Just Energy Transition prioritises not just environmental benefits but also social and economic benefits. AI-powered financial products can also facilitate access to financing for renewable energy projects and microgrids, even in underserved communities.



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Africa Embraces AI for a Just Energy Transition

Across Africa, millions still lack access to reliable electricity. But the continent is not just aiming to flip the switch – it is striving for a Just Energy Transition. This means ensuring everyone benefits from the shift towards clean energy, with inclusivity, equity, and environmental responsibility at the forefront. The road ahead has its bumps. Traditional methods can be slow and expensive, especially in remote areas. But things get exciting here: AI is emerging as a game-changer.

In South Africa, Eskom, the national power utility, has implemented AI-powered smart meters for pre-paid electricity customers. These meters collect real-time data on energy consumption. AI algorithms analyse this data to identify vulnerable households at risk of payment shortfalls. This enables targeted interventions and support mechanisms, preventing disconnections and ensuring continued energy access for these communities.

A Kenyan renewable energy company - Enel Green Power - is utilizing AI to integrate solar and wind power into the national grid. AI algorithms forecast energy generation based on weather patterns, allowing for optimised grid management. This reduces the need for fossil fuel backup power plants, promoting a cleaner and more sustainable energy mix for Kenya.

These examples showcase the promising potential of AI in Africa's energy sector. By acknowledging the challenges and highlighting these innovative applications, we can foster a broader discussion on how AI can contribute to a just energy transition across the continent.

Best Practices

AI is buzzing as a potential hero in the fight for equal access to energy. But here is the deal: for AI to truly be a champion, it needs to prioritise affordability and accessibility for low-income communities. Imagine a mobile payment platform for microgrids, powered by AI. This could be a game-changer, allowing people to easily pay for clean energy without breaking the bank. Or maybe an AI-driven system that helps rural households manage their energy use—perfect for saving money and stretching those precious kilowatts further?

But AI's true power goes beyond the initial win. For long-term success, we need to build local expertise. Think of it like this: would it not be awesome if the next generation of AI energy whizzes came from these very communities? We need training programs and partnerships with universities and research institutions to cultivate this local talent.

One could ask the question: why is this local focus so important? AI solutions designed by people who understand the specific challenges of these communities will be far more effective. Local ownership fosters a sense of responsibility and ensures solutions are maintained for the long haul. When communities have a stake in the AI revolution, they can drive innovation that benefits everyone.

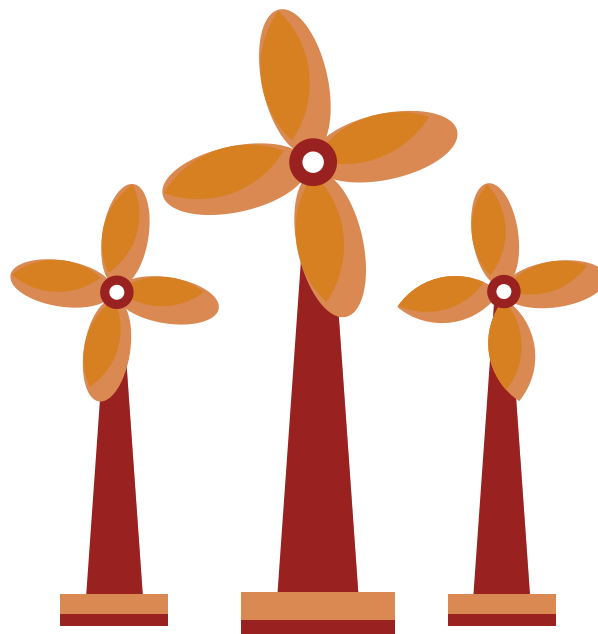
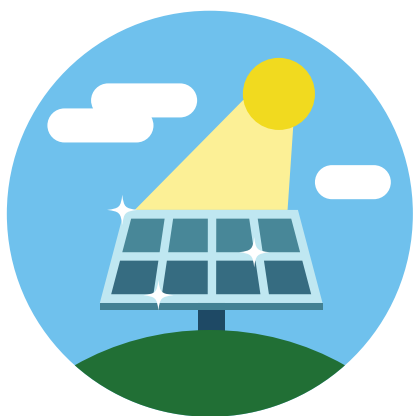
We have talked about making AI affordable and building local expertise, but there's another key ingredient for success: collaboration. Successful AI implementation necessitates enhanced collaboration between stakeholders, particularly within local communities. Governments, private companies, NGOs, and local communities all bring unique expertise to the table. When they work together, AI solutions are more likely to be effective and address community needs. Rolling out and keeping AI systems running smoothly requires a team effort. Collaboration ensures everyone has a stake in the success of its utilisation. By including local voices, we can ensure AI solutions are culturally sensitive and truly benefit the communities they serve. Imagine this: a local village elder working alongside an AI engineer to develop a smart meter system that respects traditional energy practices. Now that is powerful. By fostering collaboration, we can ensure AI serves as a tool for empowerment, not exclusion, hence JET.

Challenges and Opportunities

Even though AI offers significant promise for a just energy transition in Africa, its widespread adoption faces several hurdles. One key challenge lies in data availability. Limited access to comprehensive and high-quality data on energy consumption patterns, infrastructure conditions, and weather data across the continent hinders the development and training of effective AI models.

Regulatory barriers present a notable challenge in the adoption of AI technologies within the energy sector across many African countries. The existing regulatory frameworks concerning data privacy, security, and ownership may not be adequately tailored to accommodate the specific needs of AI applications. For instance, in Zimbabwe, the possession of Starlink internet connectivity at the household or corporate level is currently prohibited by law. The Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ), the country's telecommunications regulator, has cautioned that individuals and businesses involved in the distribution and promotion of equipment for accessing Starlink Internet services may face legal repercussions, including arrest. This lack of clarity within regulations can engender uncertainty and deter investment in AI solutions.

Furthermore, capacity constraints within the African energy sector can limit the effective utilisation of AI. A shortage of skilled personnel with expertise in data science, machine learning, and AI engineering can hinder the development, deployment, and maintenance of AI-powered solutions.



Ethical Considerations and the Way Forward

Artificial Intelligence holds immense promise as a game-changer for achieving a Just Energy Transition in Africa. It holds the potential to offer exciting possibilities. However, its success hinges on the following:

- **Data Relevance:** AI models must reflect local realities, such as energy consumption patterns and infrastructure limitations, to avoid exacerbating inequalities.
- **Social and Cultural Fit:** Solutions should consider traditional practices, cultural values, and economic realities to ensure community acceptance.
- **Local Ownership:** Building local data science expertise, fostering community participation, and collaborating with local stakeholders are crucial for long-term sustainability.

By prioritising local context, AI can be a powerful tool for a just energy future. Data collected can inform further development of targeted and culturally appropriate AI solutions. We hope this blog sparks a conversation – let us explore AI's potential for a Just Energy Transition in Africa!

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