Africa is Pioneering Nuclear Innovation As it Faces a Dire Electricity Crisis

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To address global electricity demands, Africa is partnering with the International Atomic Energy Agency (IAEA) to support nuclear energy development in developing countries.

Sub-Saharan Africa faces a dire electricity crisis. Over 600 million people—more than 40% of the continent's population—lack access to electricity, a figure projected to rise to 657 million by 2030 without intervention.

The global nuclear renaissance is well underway—evidenced by companies like Oklo, which is now included in the Russell 2000 stocks list. The outlook is based on Oklo's long-term vision, particularly with the Trump Administration's increased focus on AI Revolution data center development powered by nuclear generated electricity.

The World Bank removing its ban on nuclear presents a vital opportunity for developing economies to position themselves as leaders rather than followers in advanced electricity technology.

Developing nations need not be mere consumers of advanced technology but can be innovators, exporters and active participants in providing clean and reliable electricity to billions on the planet who do not yet have access to

electricity or modern amenities.

South Africa was the first country in the world to start commercializing Small Modular Reactor Technology with its Pebble Bed Modular Reactor (PBMR) program, which was suspended around 2010. Having decades of experience in nuclear technology development, South Africa scientists and engineers are sought after all over the world for their knowledge, practical approach to complex engineering projects, and meticulous attention to detail, i.e., the legacy of the PBMR program.

After the PBMR project was put on indefinite suspension in 2010, the expertise that remained in South Africa continued developing Small Modular Reactor (SMR) technology, the High Temperature Modular Reactor (HTMR), as a home-grown solution—a testament to both the dedication of the technical teams and the commercial viability they saw in the technology. This grouping of pioneering technologists and business strategists in South Africa formed Stratek Global as an umbrella organization to bring advanced technologies and combined power mix solutions to market. Stratek Global has recently secured land on which it plans to build a small modular reactor.

Game-Changing Technology for Developing Economies

SMRs represent a paradigm shift in nuclear electricity design. The South African HTMR is specifically engineered to address the unique challenges facing Africa and other developing regions, like vast land areas and lack of water resources. As an example, the HTMR-100's turbine condenser design uses radiator cooling and the reactor's primary circuit is helium cooled—a crucial innovation for a continent where many regions lack access to large inland water bodies.

The smaller size of SMRs thermal and electrical capacity makes the technology an ideal solution for decentralized power generation, addressing one of Africa's most pressing

infrastructure challenges. Instead of requiring thousands of kilometers of new transmission lines—like the 14,000 km needed to unlock South Africa's Northern Cape solar developments—SMRs can be positioned close to their consumers: mines, smelters, municipalities, and industrial facilities.

- This proximity advantage extends beyond simple logistics. By placing generation near consumption, SMRs can free up existing grid capacity, alleviate congestion issues and provide reliable baseload power. For developing economies struggling with electricity security, this represents a path to industrial growth without the massive upfront infrastructure investments typically required.

The fuel supply chain is the TRISO (Tri-structural ISOtropic) coated particles that are a type of nuclear fuel kernel encased in multiple layers of protective materials. These particles are designed to contain radioactive fission products even under extreme conditions, making them highly robust and suitable for advanced reactor designs. The US Department of Energy calls TRISO particles "the most robust fuel on earth."

- TRISO fuel required to fuel advanced nuclear technologies have been completely designed and manufactured in South Africa.
- Recent TRISO recycling development includes a Savannah River National Laboratory (SRNL) project to demonstrate a full-scale TRISO recycling process by 2027.

Additionally, a validation study for Deep Isolation's Universal Canister System (UCS) with Kairos Power's TRISO fuel was completed in May 2025, demonstrating the system's viability for storing, transporting, and disposing of TRISO fuel in deep boreholes and mined repositories.

South African National Nuclear Regulator

South Africa has one of the oldest nuclear regulators in the world. In 1948, the Atomic Energy Act established the Atomic

Energy Board (AEB) with the immediate objective of regulating the uranium industry in South Africa. The AEB later became the Atomic Energy Corporation (AEC). South Africa became a founding member state of the International Atomic Energy Agency in 1957.

For operating reactor power plants, The National Nuclear Regulator (NNR) monitors the licensing conditions, operating technical specifications compliance and maintenance & testing regime compliance and achievement to standards set. It also monitors the modifications and improvement programs to ensure continual improvements to international standards.

- Over the years the South African NNR has shown itself to be a most effective organization, and is well equipped to license large reactors, as well as high temperature gas cooled reactors.

Nuclear installations as defined in the National Act, can only be sited, constructed, operated and decommissioned under a Nuclear Installation License. Operations covered include nuclear medicine facilities in hospitals, and mining operations which deal with radioactive substances such as Uranium.

The Koeberg Nuclear Power Station, located 30 km north of Cape Town, South Africa, is the only commercial nuclear power plant in Africa. It features two pressurized water reactors (PWRs) designed by Framatome of France, with construction starting in 1976. Unit 1 was synchronized to the grid on April 4, 1984, and Unit 2 on July 25, 1985.

Economic Transformation Potential

The economic implications of domestic nuclear manufacturing extend far beyond energy security. Dr. Robert Jeffrey has assessed the economic potential of SMRs and the report revealed “phenomenal” export opportunities that will positively impact South Africa’s balance of payments—a benefit

that would extend to any developing nation establishing nuclear manufacturing capabilities.

Nuclear construction projects in South Africa could contribute as much as 2% GDP growth over the next decade, before the reactors even come online. Unlike solar farms, which offer limited local skills transfer, nuclear projects require extensive engineering fabrication, high-skilled manufacturing, and sophisticated operational expertise. This creates opportunities for reskilling and upskilling across multiple sectors, from welding and construction to advanced engineering and physics.

SMRs enable multiple applications beyond electricity generation, including seawater desalination, nuclear isotope production for medical applications, and research and development activities. This multi-purpose capability means developing nations can maximize their return on nuclear investments while addressing multiple infrastructure needs simultaneously.

"Jobs need electricity. So do factories, hospitals, schools, and water systems. And as demand surges—with AI and development alike—we must help countries deliver reliable, affordable power. That's why we're embracing nuclear energy as part of the solution—and reembracing it as part of the mix the World Bank Group can offer developing countries to achieve their ambitions. Importantly, nuclear delivers baseload power, which is essential to building modern economies," said World Bank Group President Ajay Banga.

For developing economies, this represents a chance to leapfrog into high-technology manufacturing while building domestic expertise that can serve both local needs and global markets. The indoor manufacturing environment for SMR components means these facilities can be established anywhere with appropriate infrastructure and supply chains.

It is important to note that the developed world continues to enjoy the circa 6000+ products that oil and coal continue to contribute to their daily standard of living. Developing nations need to continue to benefit and optimize their oil and coal-based assets, while building nuclear energy simultaneously to secure the future of generations to come.

A Critical Moment for African Innovation

The choice facing Africa and other developing regions is clear: support indigenous innovation now!

For those with the vision to ensure Africa's energy independence while contributing to technologies that could power sustainable development across the Global South, SMRs are positioned as a golden opportunity to invest in the future of young and developing nations.

In an era where electricity security and economic development are inextricably linked, backing small and micro nuclear technologies isn't just good business, it's an investment in a more equitable and sustainable global electricity future.

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