Why are Developing Economies Pursuing Small Modular Reactors?

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December 11, 2025

Resurgence of nuclear generated electricity is occurring in South Africa to serve over 565 million Sub-Saharan Africans lacking electricity access.

The global electricity debate has reached a critical impasse. While developed nations debate the finer points of renewable electricity portfolios, like how much profit is being made, billions of people in the world remain trapped in electricity poverty. For half of the world's people living on less than $10 per day—and particularly the 565 million Sub-Saharan Africans without electricity—the conversation about electricity must be grounded in pragmatism, not ideology.

The US has recently signed an economic and Defense Partnership with the Kingdom of Saudi Arabia that includes civilian nuclear energy.

South Africa expects to lift the care and maintenance status of its Pebble Bed Modular Reactor (PBMR) by the first quarter of next year or even earlier. Alternative sources of stable, continuous electricity, in this instance provided by SMR units, will benefit as environmental trends increasingly move towards green technologies. These technologies, because of cost and price trends, will become increasingly economic and

cost-effective in the future.

A comprehensive economic impact study of South Africa's small modular reactor (SMR) deployment strategy, undertaken by one of the authors of this report, reveals what is at stake when developing nations pursue practical electricity solutions that can generate continuous, uninterruptable and emission free electricity. The findings offer a compelling blueprint for how SMR technology could transform not just electricity access, but entire economies.

Nations need dispatchable electricity. What is often forgotten is that all developed and developing nations require dispatchable electricity to maximise economic growth and efficiency. The purpose is to maximise benefits for their citizens by raising their standard of living, reducing unemployment and poverty. Dispatchable electricity means that sufficient electricity is available immediately on demand by businesses and the public, 24 hours a day, 365 days a year. Energy sources must first be examined on their ability to meet this criterion. Using South Africa as the example, the primary alternative electricity sources that need to be examined are:

- Firstly, renewable energy sources in the form of wind and solar that are renowned for their unreliability and unpredictable intermittency, and,
- Secondly, fossil fuels in the form of coal and gas, and
- Thirdly, nuclear power.

The Reality Check Beyond Wind and Solar

When visiting a modern hospital or airport, consider everything you see that didn't exist 200 years ago: the plastic chairs, synthetic fabrics, medical devices, computer components, pharmaceuticals, and countless other products. Many of which are essential for maintaining one's own family and home. Now ask yourself: can any of these items be manufactured by a wind turbine or solar array?

The answer exposes a fundamental flaw in current electricity discourse. Oil, gas, and coal aren't just fuel sources—they're raw materials for petrochemicals, plastics, pharmaceuticals, fertilizers, construction, infrastructure and thousands of essential products. The modern world's material foundation depends on hydrocarbons as manufacturing feedstock to support the supply chain for those essential products.

This distinction matters enormously for developing economies. While wealthy nations can afford to experiment with intermittent renewable sources, backed by existing infrastructure and capital reserves built as a result of the use of fossil fuels now being shunned, developing countries need reliable, continuous power to build industries, create jobs, and lift people from poverty. These policies being set have all the requirements to set a global economic reality of keeping the rich developed world rich and the poor developing world poor. In practice, the "green" policies in the richer countries will negatively affect the economic growth of both the developed world and the developing world.

The resurgence of nuclear-generated electricity is occurring in many countries. The reasons are not difficult to find. The benefits of nuclear power have shown themselves in many ways. Nuclear has proven itself to be: Safe, there have been very few injuries. It is environmentally benign, has very small land use, discharges no pollutants and produces little waste. It is reliable and has a capacity factor of over 90%. It is energy-dense and scalable. It is economical with a long life and low running costs. South Africa's Koeberg Power Station has had a long life and is one of the most economical power stations in the country. It is a foundation for other applications, and its Safari reactor is a world's major commercial producers of medical and industrial radioisotopes.

Numbers That Transform Nations

The economic analysis of SMR deployment, yet to be formally

released, demonstrates transformative potential:

- **GDP Impact:** Within two decades of operation, an SMR program would contribute approximately R74 billion (roughly $4.3billion USD) annually to GDP, representing 1.1% of South Africa's baseline GDP. This is significant growth for the economy. It is an economy-altering development.
- **Employment Creation:** The program would generate, within ten years of becoming operational, over 33,000 direct jobs and over 154,000 indirect jobs. The following decade, it will have created almost 350,000 jobs within two decades, supporting over 1.4 million people. These aren't temporary construction positions, but sustained employment in high-skill manufacturing, engineering, and operations.
- **Skills Development:** Unlike fossil fuel extraction or installations of wind turbines or solar panels, nuclear technology demands—and develops—a highly skilled workforce. An SMR program would create a permanent increase in technical capabilities, helping retain talent while attracting international expertise.
- **Trade Balance:** Long-term projections show an ongoing current account surplus of approximately R8 billion ($9.4 billion USD) annually, as exported SMR units and associated services generate hard currency for the developing economy.
- **Tax Revenue:** Annual tax generation would exceed R19 billion ($1.1 billion USD), with annual remuneration associated with these jobs approaching R33 billion ($1.9 billion USD)—funds that fuel further development, education, and healthcare improvements.

Why Small Modular Reactors?

Traditional large-scale nuclear plants require massive upfront capital, decade-long construction periods, and proximity to major grid infrastructure. For developing economies like South Africa, these barriers are often insurmountable. Countries in Africa are exceptionally large, a fact that is little known and often overlooked by so-called overseas experts.

SMRs offer a different pathway to electricity. Modern designs—such as helium-cooled, graphite-moderated reactors using advanced fuel configurations—exemplify the advantages:

- **Scalability:** Units can be deployed incrementally, matching investment capacity and demand growth. A typical rollout could envision four domestic units annually within years of initial deployment, rising to eight exported units within two decades.
- **Flexibility:** Smaller SMR units can be located closer to demand centers, reducing transmission losses and infrastructure costs. They're ideal for industrial process heat applications, such as powering chemical facilities or electricity generation in regions far from existing power stations.
- **Safety:** Passive safety features and simpler designs reduce operational risks. Modern SMR designs incorporate inherent safety characteristics that make them particularly suitable for nations building nuclear expertise.
- **Industrial Development:** Unlike imported renewable components, SMR programs build domestic manufacturing capacity. A comprehensive SMR initiative creates an entire nuclear industry value chain: development, engineering, design, and manufacturing.

The Megaproject Precedent

History validates this approach. South Africa's Richards Bay development, Sasol's coal-to-liquids technology, Petro SA's gas-to-liquids technology, and automotive industry growth each transformed regional economies. SMR deployment compares favorably with projected employment to be 340,000 jobs and dependent population supporting 1.4 million people, while offering superior balance of payments outcomes.

These megaprojects succeeded because they addressed real needs with practical technology, creating sustainable industries rather than dependency on imported solutions.

Building a Nuclear Industry

SMRs represent more than power generation, they're platforms for industrial development. A national SMR program involves the construction and operation of units for domestic markets and export, alongside the development of a local nuclear industry with significant local content.

The construction phase includes substantial localization to ensure regular long-term supply by original equipment manufacturers. This creates an entire value chain encompassing development, engineering, design, and manufacturing, significantly enlarging the manufacturing base of the economy.

The operational phase generates ongoing expenditures in wages, fuel acquisition (including nuclear fuel production), maintenance, and subcontracted services—creating permanent economic activity rather than boom-and-bust cycles associated with construction-only projects.

For countries with uranium reserves, SMRs offer additional opportunities. The technology and skills developed can extend to uranium enrichment industries, producing nuclear fuel domestically and for export, adding considerable value to natural resources.

The Path Forward

For the 565 million Sub-Saharan Africans without electricity, and billions more worldwide trapped in electricity poverty, the choice is clear. They cannot afford to gamble for their future on renewable infrastructure of wind turbines and solar panels, which are intermittent and undermine industrial development. The full lifecycle economic cost of renewable electricity projects does not support the needs of growing economies and keeps these countries trapped as consumer nations in perpetual debt cycles.

SMRs offer developing economies what they need most: reliable

baseload power that builds domestic capability, creates quality employment, and establishes technology platforms for future growth. The alternative—continued electricity poverty or dependency on imported sources of energy for transportation and electrification—condemns billions to economic stagnation.

The question isn't whether developing nations should pursue nuclear technology. It's whether wealthier developed nations will support or obstruct that pragmatic choice. Electricity policy must serve people, not ideology. For the billions of people living on less than $10 daily, that's not just good policy, it's a moral imperative. The path to prosperity runs through reliable electricity. Small modular reactors can light that way.

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