



AFRICAN NARRATIVES

Implications of East African Countries' Shift Towards Nuclear Energy: Opportunities and Risks Amid Economic and Technological Challenges



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Main Points

- Several African countries have recently shown increased interest in nuclear power plant projects for electricity generation.
- In 2023, four East African countries—Uganda, Rwanda, Kenya, and Tanzania—took steps to develop nuclear power plants. This shift is driven by a need to substantially increase national electricity generation capacity, but the nuclear path presents several risks.
- Most agreements signed by African countries pursuing nuclear power plants are with Russia through the Rosatom group, followed by the United States and other Western countries like Germany, South Korea, and Canada.
- Key risks include technological, political, and economic dependence on countries supporting nuclear power. While France, South Korea, and China are involved in a limited number of nuclear plant projects, Russia is significantly expanding its role as a nuclear plant developer in Africa, having signed nuclear cooperation agreements with 18 African countries.
- Many African nuclear projects are highly vulnerable to risks due to limited national expertise and substantial technological reliance on developed countries.



Abstract

Interest in nuclear energy has grown in East Africa recently, as countries seek to satisfy increasing electricity demand and foster economic growth. In 2023, four countries in the region—Uganda, Rwanda, Kenya, and Tanzania—initiated the development of nuclear power plants. These countries anticipate that nuclear energy will provide stable and clean electricity, reducing carbon emissions compared to sources like coal.

Russia has become a prominent player in this area, having signed nuclear cooperation agreements with 18 African countries by 2019. Russia offers low-interest, long-term financing for

these projects, providing substantial technical and security support to ensure their sustainability, while simultaneously aiming to expand its regional influence.

However, these nuclear ambitions face significant challenges, including the high cost of building nuclear plants, limited technical expertise, and security concerns in some African countries. Renewable energy sources like solar, wind, and geothermal offer potentially cheaper and safer alternatives, raising questions about the long-term viability of nuclear energy in these countries.





Introduction

Nuclear energy has gained considerable attention in four East African countries grappling with rising electricity demand amidst strong economic growth that requires more stable and reliable energy. Uganda has announced plans to construct a 2,000 MW nuclear power plant north of Kampala, with the first 1,000 MW unit expected online by 2031. Rwanda has signed an agreement to build a nuclear reactor, and in Kenya, construction of the first nuclear plants is projected to begin in 2027, according to an energy sector platform. Tanzania's decision to utilize nuclear reactors for electricity generation, announced during the second Russia-Africa summit, surprised many.

Leaders of these countries view nuclear energy as a vital tool for reducing carbon emissions by providing clean, reliable, and continuous electricity, unlike intermittent renewable sources. However, some experts consider nuclear energy a risky proposition for these African countries due to the high costs of construction, operation, and maintenance, as well as potential commissioning delays, which can strain financial resources through high-interest borrowing. These countries should explore alternative approaches to achieve their goals, with abundant renewable energy resources in Africa potentially offering a safer and more cost-effective option without the safety risks and financial burdens of nuclear energy.

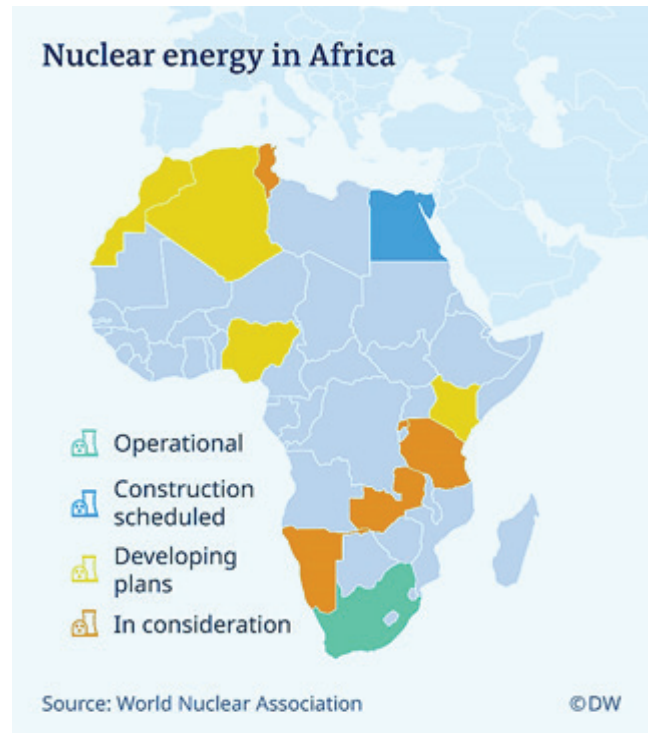


The Appeal of Nuclear Energy in East Africa

East Africa, one of the continent's fastest-growing regions in terms of population, is experiencing a surge in electricity demand. Between 2013 and 2017, the region's average growth rate was double the African average. Coupled with strong economic growth, with Sub-Saharan Africa's GDP increasing from 14% in 2000 to 21% in 2022, this population growth necessitates greater electricity generation. Nuclear power reactor construction is among the proposed solutions East Africa⁽¹⁾.

Nuclear reactors' attractiveness stems from the ability of a single large reactor to significantly increase electricity generation capacity. Theoretically, the technology can produce continuous electricity regardless of weather, season, or time of day. Historically, nuclear energy has also been perceived as a symbol of advanced technical status and national prestige. This perception persists even as economically strong countries like Italy and Germany (Europe's largest economy) have recently decommissioned their nuclear reactors.

In mid-April 2023, Berlin announced the closure of its last three nuclear reactors—Isar 2, Emsland, and Nekarwestheim 2—to prioritize renewable energy by 2035. Key factors influencing Germany's decision included the 2011 Fukushima disaster in Japan, the 1979 Three Mile Island accident in the United States, and the 1986 Chernobyl disaster in Ukraine.



Why Are African Countries Turning to Nuclear Energy?

In Africa, where less than 40% of people, or fewer than one in every two Africans, have access to electricity, according to the World Bank, public authorities are trying to diversify supply sources to meet the growing demand for electricity. Alongside the infrastructure for hydroelectric power, which is often in short supply during periods of low water levels, countries like South Africa heavily rely on coal to provide supplies, with coal far outpacing nuclear energy, which accounts for only 5% of their energy supply⁽²⁾.

1 Nuclear Workforce Advancement in East Africa: Opportunities for Global Collaboration, <https://www.nuclearbusiness-platform.com/media/insights/nuclear-workforce-advancement-in-east-africa-opportunities-for-global-collaboration>

2 Is Africa Ready for Nuclear Energy?, <https://www.iaea.org/newscenter/news/is-africa-ready-for-nuclear-energy>

In recent years, the continent has turned to solar energy, which accounts for only about 1% of production in the ECOWAS region, for example. When it comes to hydroelectric power, Africa has significant strengths in the Nile, Niger, and Congo basins, but hydroelectric energy has its own limitations, especially due to increasingly severe droughts and limited available sites, according to Claire Kerbol, author of “Emergencies for Sustainable Nuclear Energy,” published in 2023.

While solar energy is another alternative, particularly for countries lacking good hydraulic irrigation systems, the use of nuclear energy remains a topic of debate in Africa. According to Claire Kerbol, even though Africa has untapped uranium mines, it has not exploited them to meet its own needs. The nuclear physics expert believes that the continent could benefit from the industrial development of Small Modular Reactors (SMRs) with medium power (150-250 MW) to replace fossil fuel power stations. The advantage of these small reactors lies in their standardization and compact size, from mass production in factories to fuel processing, recycling, and waste management.

She then recommends the use of Fast Neutron Reactor (FNR) technology, allowing for the economical use of uranium resources, which is what we call sustainable nuclear energy (resource preservation and minimal waste production). This is seen as the only relatively short-term solution.

Challenges of Africa's Nuclear Ambition

Africa's nuclear ambition faces several significant challenges that continue to hinder nuclear energy projects on the continent. These challenges include the following:

1. Financial Capacity

The cost of building a nuclear power plant with a capacity of 1 gigawatt currently exceeds 5 billion dollars, a sum that surpasses the GDP of many African countries. Most, if not all, African nations are unable to secure this amount, especially amid the exacerbating global economic crisis, which has affected all countries. African economies are already burdened by debts and debt servicing, with many

struggling to meet their obligations. For example, the cost of constructing Egypt's nuclear plant, consisting of four reactors, is around 28.5 billion dollars.

2. Technical Expertise and Infrastructure

Nuclear countries hold the technical expertise required to operate and maintain nuclear plants and associated infrastructure. This expertise is not available to non-nuclear countries aspiring to join the nuclear club. Furthermore, the infrastructure in these countries is generally underdeveloped, requiring additional costs and efforts to improve efficiency, develop infrastructure, and train national staff who will manage, operate, and maintain the nuclear project. Achieving this is only possible through the company responsible for executing the project.

3. Fragility, Instability, and Security of Nuclear Projects

Many African countries aspiring to possess nuclear power plants face political and security challenges that characterize their environments as fragile, insecure, and unstable. This is incompatible with the presence of nuclear projects and increases the risks associated with owning them. There is the fear of nuclear plants falling into the hands of violent non-state actors who could misuse or sabotage them, potentially causing catastrophic radiation disasters.

4. Political and Economic Dominance

Many African countries have suffered from colonial political and economic dominance. Once any of these countries enters the nuclear club, it loses any chance of freeing itself from this dominance. The host country is always subjected to the control and influence of the country executing the nuclear project. This is especially true since the executing country retains critical management, operation, and maintenance expertise, giving it the power to control the **host country's policies**⁽³⁾.

3 Ochuko Felix Orikpote, Nuclear fission technology in Africa: Assessing challenges and opportunities for future development, Nuclear Engineering and Design, Volume 413, November 2023

Russia and the African Nuclear Project

The country that has been the most assertive in promoting itself as an international developer of nuclear power plants is Russia. In 2019, it had already signed nuclear cooperation agreements with 18 African countries, with many more countries following suit in recent years. To bypass the high costs, Russian nuclear developers offered financing at relatively low interest rates, with repayment starting several years after construction begins and continuing for decades afterward. The downside of this arrangement is that these countries develop a long-term dependence on Russia for one of their core needs: providing electricity. The situation has become riskier due to the uncertainty surrounding Russia's ongoing full-scale war in Ukraine. The consequences of this war could lead to a complete overhaul of the Russian state, potentially disrupting and ending projects already underway, while also leading to the loss of all the financing and resources invested up to that point.

Rosatom," Russia's nuclear giant, is the global leader in the nuclear industry. Russia controls a major share of the global nuclear market, as 22 of the 25 nuclear power projects being implemented around the world are currently handled by "Rosatom." The company owns and operates several specialized subsidiaries, including European firms like the German "Nukem," fully owned by "Rosatom." European nuclear projects rely heavily on "Rosatom" and its subsidiaries⁽⁴⁾.

Thus, it can be said that Russia possesses exceptional nuclear capabilities, which allow it to win the competition for nuclear project contracts, especially in Africa. By 2019, Russia had signed nuclear cooperation agreements with 18 African countries, and this number has recently increased with agreements with Mali, Niger, and Burkina Faso, with negotiations ongoing with other countries.



In an effort to dominate the African nuclear market, Russia offers effective solutions to the challenges facing nuclear projects in Africa, especially regarding the issue of financing. Russia provides countries wishing to work with them long-term loans at relatively low interest rates, with repayments starting only after several years of project implementation. For example, Russia provided Egypt with a \$25 billion loan to build its nuclear plant, at an interest rate of 3% annually, to be repaid over 22 years, starting in 2029.

Regarding the lack of technical expertise and the modest infrastructure, Russia provides significant support to develop the capabilities of the countries it contracts with in these areas. As for the fragility, instability, and security of nuclear projects, Russia has

4 Why Africa relies on nuclear energy rather than solar energy?, <https://www.dw.com/en/why-africa-relies-on-nuclear-energy-rather-than-solar-energy/a-67152544>

developed its military and security tools in Africa, from “Wagner” to the “African Legion,” and Russia’s security services are seeing growing demand across Africa. As for political and economic dominance, Russia has made a point of distancing itself from intervening in internal political affairs, offering generous economic packages that are relatively free from the exploitative colonial logic of the West, addressing many concerns about dominance and control.

The West’s Reluctance to Meet Africa’s Nuclear Energy Demands

Despite Africa having multiple sources for generating electricity, such as hydropower, geothermal energy, fossil fuels, biomass, solar power, and wind, nuclear energy remains the most effective solution to address the continent’s energy crisis. Even though Africa has vast reserves of uranium ore, essential for nuclear energy production, Western powers, who monopolize the nuclear energy industry, have long been reluctant to localize nuclear energy in the developing world, especially in Africa. This reluctance stemmed from the absence of Russia, the strongest competitor in this field, from the African scene, as it was preoccupied with rebuilding its economic capabilities. Meanwhile, its other competitors were less capable, and African countries faced significant challenges in establishing nuclear power plants.

However, Russia’s strong return to the African continent, alongside the growing capabilities of other competitors such as China and South Korea, has forced Western nations to accept the challenge. They have dropped their reservations about localizing nuclear energy in Africa and entered the competition by offering more favorable terms. For example, French company “EDF,” American company “NuScale Power and Regnum Technologies,” Chinese National Nuclear Corporation, South Korean “KEPCO,” and Russian “Rosatom” are all vying to secure the contract for building the first nuclear power plant in Ghana.

Potential Future Energy Mix in East Africa

Given the financial risks and high costs, and as demonstrated by global experiences, it typically takes ten years or more to establish a new nuclear plant, from project approval to electricity generation. Therefore, East African countries must explore alternatives for electricity production.

In the next decade, solar, wind, and medium-sized geothermal power plants are likely to dominate the expansion of electricity generation capacity in East Africa, as they are much cheaper in comparison. Additionally, the typical construction timelines are significantly shorter than those for nuclear or large hydroelectric projects. Take hydropower generation, for example, which uses the natural flow of moving water to generate electricity. This energy source has been the most important in East Africa for decades, but building more dams takes time and is sometimes controversial. However, large projects using this technology are still being developed. One such example is the Julius Nyerere Hydroelectric Power Station in Tanzania, with a capacity of 2,115 megawatts.

Solar power—converting sunlight into electricity—currently has a very low footprint in the region. However, it is now one of the cheapest forms of electricity generation. Most countries in the region have vast areas suitable for harnessing this resource. Although the region does not have wind resources in the Earth’s oceans or mid-latitude regions, wind farms are being considered in certain places, such as the operational wind farm at Lake Turkana in Kenya. East Africa is also home to the Great Rift Valley and volcanic activity in some areas, offering opportunities for geothermal energy. This technology converts intense heat underground, associated with fractures in the Earth’s crust, into electricity. This is already a leading electricity generation method in Kenya and could be developed elsewhere.

Given all these factors, investing in large, expensive nuclear construction projects with uncertain completion timelines, which may end up being far more costly than expected, simply doesn’t seem worth it in the end.