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S.E.T. for socio-economic growth

Nuclear power can meet Africa's and AI's energy demands

Opinion piece by Prof Bismark Tyobeka, principal and vice-chancellor of the North-West University (NWU)

Their power and potential are sometimes more than the imagination can fathom. They inspire awe and wonder, fear and trepidation. They are as misunderstood as they are revered. And, as bedfellows, artificial intelligence (AI) and nuclear energy might just be the partnership Africa needs to alleviate its energy deficiencies and realise its energy potential.

Or, as nuclear energy expert Prof Bismark Tyobeka, principal and vice-chancellor of the North-West University (NWU), states: "It is a match made in heaven."

Prof Tyobeka has a point. When one of the defining technological forces of the 20th century converges with the undisputed technological phenomenon of the first 25 years of the 21st, the possibilities are difficult to ignore.



Large-scale AI data centres require massive amounts of electricity and, whether now or in the foreseeable future, the continent will have to start building them. The current baseload supplies in most African countries will not suffice.

One of the prevailing concerns about nuclear energy is safety. Another is a lack of understanding of how the technology works.

At the risk of severely oversimplifying electricity generation, very little has changed during the past century and more. Water is heated sufficiently to create steam, which spins a turbine connected to a generator. In the case of nuclear energy, radioactive material provides the heat.

Splitting the atom, it is not.

Let's look at safety. Although nuclear accidents loom large in the public imagination, the historical record is less catastrophic than many assume.

In more than 70 years of generating electricity from nuclear power, three accidents have come to define the debate: Three Mile Island in the United States in 1979, Chernobyl in the former Soviet Union in 1986 and Fukushima Daiichi in Japan in 2011.

Three Mile Island caused no deaths or injuries, while Fukushima caused no acute radiation injuries or deaths among workers or the public. At Chernobyl, two workers died in the initial explosion and 28 plant employees and firefighters died from acute radiation syndrome during the following weeks. That places the immediate death toll directly attributable to the three accidents at approximately 30.

That figure does not tell the entire story. The World Health Organisation (WHO) has estimated that Chernobyl could ultimately result in as many as 4 000 additional cancer deaths among the most heavily exposed groups. Fukushima's evacuation also had serious health and social consequences, even though no deaths from acute radiation exposure were recorded.

New technologies, Prof Tyobeka argued, could make an already tightly regulated industry safer still.

"AI is a game changer," he said. "It can potentially enhance the safety features of nuclear power-plant designs. It can help us optimise the efficiency of nuclear power plants. It can also help us make rapid decisions across the entire nuclear value chain."

Safety comparisons must also account for how much electricity each source produces. "Deaths per terawatt-hour" measures the estimated number of deaths caused by accidents and air pollution for every terawatt-hour (TWh) of electricity generated.

A widely used comparison places coal at approximately 25 deaths per TWh, oil at 18 and natural gas at three. The corresponding estimates are about 0.04 for wind, 0.03 for nuclear and 0.02 for solar. Put differently, coal is associated with more than 800 times as many deaths per unit of electricity as nuclear power.

The precise figures vary between studies, particularly for the safest energy sources, but the conclusion remains consistent: nuclear, wind and solar are vastly safer than fossil fuels.

That safety record matters because the demand for dependable electricity is about to intensify.

During his public lecture, *AI and Nuclear Power: Powering a Smarter, Sustainable Future*, Prof Tyobeka acknowledged that both technologies remain controversial. Yet he argued that their convergence could help answer one of the most urgent questions of the digital age: where the immense quantity of reliable, low-carbon electricity required by AI will come from.

"These two fields are converging to address one of the world's most pressing energy challenges: delivering reliable, clean and secure electricity for a sustainable future."

The equation is unforgiving. The more sophisticated AI becomes, the more electricity is required to train models, process information and keep hyperscale data centres operating without interruption.

"The need for more electricity therefore immediately accompanies our advances in artificial intelligence," he said. "We do not only need electricity; we need clean electricity."

Nuclear power offers firm, round-the-clock generation, while small modular reactors (SMRs) and microreactors could bring it closer to the facilities that need it. Unlike conventional plants, their smaller footprint allows them to be deployed incrementally and, potentially, nearer to data centres, mines and industrial hubs.

“SMRs and microreactors are particularly well suited because their size allows them to be deployed almost anywhere. They can be built in factories,” said Prof Tyobeka.

The relationship also works in reverse. AI could improve the design and operation of nuclear plants by accelerating reactor-core simulations, detecting anomalies and enabling predictive maintenance. Through digital twins—virtual models fed with information from physical plants—operators could identify deterioration before equipment fails.

“You do not replace things only after they have broken; you can predict what should be changed and when.”

For Africa, however, the opportunity extends far beyond supplying servers. Reliable electricity could support mining, mineral processing, manufacturing, hydrogen production and desalination while strengthening the digital economy.

“Everyone sees growth in Africa, but growth cannot happen without energy security,” he said. “You cannot attract investment where there is no energy security. We are holding Africa back if we do not make major investments in these technologies.”

The continent’s critical-mineral wealth adds another dimension. Prof Tyobeka sees potential for SMRs in the Democratic Republic of the Congo (DRC), Zambia, South Africa (SA), Namibia and Guinea, where dependable power could allow more minerals to be processed closer to where they are mined.

The barriers are considerable. Regulation has to keep pace with new reactor configurations, financing must be mobilised, supply chains strengthened and scarce specialist skills developed. Public trust will be just as important.

“People do not trust AI as we sit here. People do not trust nuclear power as we speak. How do you secure buy-in from such suspicious people? Transparency is key.”

He called for government, regulators, development-finance institutions, banks, investors, universities and industry to act together. Localisation, he argued, must be part of the bargain so that deployment creates jobs and builds enduring African capability.

“Nuclear power can enable Africa’s AI and industrial future. We have seen that the need is real and the opportunity is now.”

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The opinions expressed above are those of Prof Bismark Tyobeka, Principal and Vice-Chancellor of the North-West University (NWU). He writes in his own capacity, and his views do not necessarily reflect the views of the [Executive Committee](#) or [members](#) of the NSTF.