

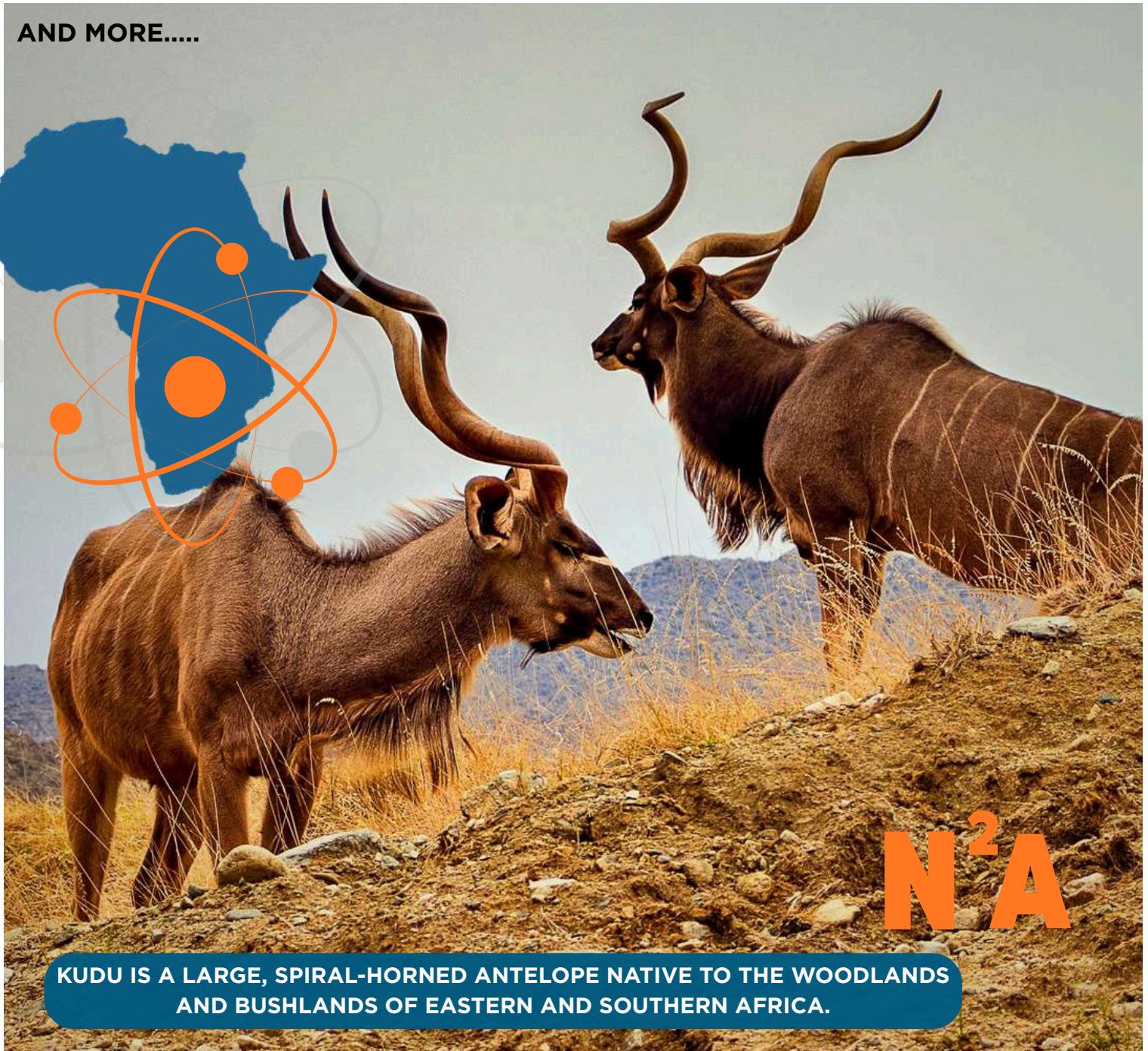
NUCLEAR NETWORK AFRICA

THE WORLD OF NUCLEAR

WHAT ABOUT NUCLEAR WEAPONS IN AFRICA? PRINCY MTHOMBENI

IS “COLD” FISSION POSSIBLE DAVID R.YOUNG

AND MORE.....



N²A HIGHLIGHTS

KUDU DESIGN HTMR-100 IS A GENERATION IV HIGH-TEMPERATURE, HELIUM GAS-COOLED SMALL MODULAR REACTOR (SMR) DESIGNED IN SOUTH AFRICA.
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FROM THE EDITOR

Welcome to the September edition of N²A.

There is a growing sense that Africa's nuclear conversation is changing. We are moving beyond asking whether nuclear energy has a place on our continent, and towards asking a much more important question: How can Africa use nuclear technology to build a stronger, more secure and more prosperous future?

This month, we explore that question from several different perspectives.

Dr Ayodele Periola looks at Networking Small Reactors across Africa, exploring the potential for smaller nuclear technologies to work together across the continent and support Africa's growing energy needs.

Princy Mthombeni tackles a question that is often raised when nuclear technology is discussed: What about nuclear weapons in Africa? Her article reminds us of the significance of the Pelindaba Treaty, through which African nations chose to remain a nuclear-weapons-free zone, while making it clear that saying no to nuclear weapons does not mean saying no to the peaceful benefits of nuclear technology.

David R. Young challenges us to think differently in 'Cold' Fission Possible?, asking whether a simple observation about fission could open our minds to new possibilities for Africa's energy future.

Heather Veldhuis
HEATHER VELDHUIS
EDITOR



Finally, I look at Africa's Uranium Opportunity: From Resource to Reactor. Africa has the uranium, the skills, and an emerging nuclear industry. The opportunity is to move further up the value chain and become not just a resource supplier, but a fabricator and exporter of nuclear technology.

Africa's nuclear future is no longer just a conversation. It is an opportunity.

Let's explore it.



A TRISO fuel ball. It contains tiny fuel particles roughly the size of a poppy seed, which contains several protective layers around the uranium fuel. Thousands of these tiny spheres can be packed into a single fuel pebble, the size of a cricket ball. Tiny fuel. Tough coating. Big energy.



***From uranium deep beneath our ground,
To nuclear fuel that travels around,
With small reactors ready to power the way,
Africa's nuclear future could brighten each day.
So let's mine, make, innovate, and explore,
And build Africa's future, not just export the ore!***

WHAT ABOUT NUCLEAR WEAPONS IN AFRICA?

PELINDABA TREATY

PRINCY MTHOMBENI

Pelindaba Treaty: Africa Said No to Nuclear Weapons - But Not to Nuclear Technology.

When I posted about the Pelindaba Treaty, one question stood out in the comments: Why should Africa give up nuclear weapons when some of the world's most powerful countries still have them?

It is a fair question, and the answer begins with history. Africa's ambition to become a nuclear-weapon-free zone dates back to 1961, when the United Nations General Assembly called for Africa to be denuclearised. In 1964, the Organisation of African Unity adopted its Declaration on the Denuclearisation of Africa. The idea was eventually developed into the Treaty of Pelindaba, which was opened for signature in Cairo on 11 April 1996 and entered into force on 15 July 2009.

But Africa was not making this decision in isolation. The Nuclear Non-Proliferation Treaty (NPT), which entered into force in 1970, recognised five states as "nuclear-weapon states": China, France, Russia, the United Kingdom and the United States. The definition applies to states that had manufactured and exploded a nuclear weapon before 1 January 1967.



Princy Mthombeni, an award-winning nuclear communicator writes in her role as a founder and communications lead at Africa4Nuclear

CONTINUED ON PG 05



The NPT's bargain was that states without nuclear weapons would not acquire them, while the recognised nuclear-weapon states committed themselves under Article VI to pursue negotiations towards nuclear disarmament. In 2000, the five also made an "unequivocal undertaking" to accomplish the total elimination of their nuclear arsenals. Yet nuclear weapons remain.

Who has them?

According to the Stockholm International Peace Research Institute (SIPRI), there are currently nine nuclear-armed states: the United States, Russia, the United Kingdom, France, China, India, Pakistan, North Korea and Israel. SIPRI's 2026 assessment says all nine continued to modernise or enhance their nuclear arsenals during 2025.

India and Pakistan were not among the five states recognised by the NPT and never joined the Treaty as nuclear-weapon states. India tested a nuclear device in 1974, while India and Pakistan conducted nuclear tests in 1998. Israel has never publicly acknowledged possessing nuclear weapons, although SIPRI assesses it to have an arsenal. North Korea joined the NPT but announced its withdrawal in 2003.

Then there is South Africa – a particularly important part of this story.

South Africa developed six nuclear weapons during apartheid, but dismantled them before joining the NPT as a non-nuclear-weapon state in 1991. The IAEA subsequently verified the termination of the weapons programme.

This history helps explain why Pelindaba matters.

Nuclear physicist Dr Kelvin Kemm standing in front of some of the vaults used to store South Africa's nuclear weapons. For security, each weapon was stored in two parts, that is why there is an A and a B on the doors.

CONTINUED ON PG 06



Pelindaba Treaty

The Treaty prohibits African states from developing, manufacturing, acquiring, possessing, testing or stationing nuclear explosive devices. But it does not prohibit peaceful nuclear activities. Article 8 explicitly protects the use of nuclear science and technology for peaceful purposes and encourages cooperation for Africa's economic and social development. That means nuclear weapons and nuclear technology are not the same thing.

Nuclear science can support electricity generation, medicine, agriculture, industry and scientific research. The Treaty requires peaceful nuclear activities to be subject to appropriate safeguards and verification. The Treaty also created the African Commission on Nuclear Energy (AFCON), whose headquarters are in Pretoria. Its mandate includes promoting the peaceful, safe and secure applications of nuclear science and technology across Africa.

And then there is Diego Garcia.

When the Pelindaba protocols were signed in 1996, Russia sought clarification concerning Diego Garcia, a Chagos Archipelago island controlled by the UK and used as a US military base. Russia later maintained a reservation concerning the applicability of its commitments to the base.

Mauritius enters the picture

The issue remains relevant. In 2025, the UK and Mauritius signed an agreement under which Mauritius would gain sovereignty over the Chagos Archipelago while arrangements would continue for the UK-US military base on Diego Garcia.

The agreement has not yet entered into force because implementing legislation remains unresolved. In March 2026, the UK High Court refused permission for a legal challenge, and the claimants said they intended to appeal. As recently as September 2026, the dispute over implementation remained unresolved.

So, was Pelindaba simply Africa being “disarmed”? The history is more complicated.

Africa made a deliberate regional commitment against nuclear weapons while preserving its right to use nuclear science and technology peacefully. That distinction is perhaps more important today than ever.

A nuclear-weapons-free Africa does not have to be a nuclear-technology-free Africa.

The real question is: what kind of nuclear future does Africa want?



PELINDABA



AFRICA'S NUCLEAR POWER LANDSCAPE.



TOP HIGHLIGHTS SEPTEMBER 2026

Namibia's Etango Uranium Project Moves Closer to Construction and Production

Bannerman completed a \$90 million funding placement, with financing expected to fund Etango through construction and ramp-up as Namibia targets a major new uranium mine.

Niger's Madaouela Uranium Project Gains Fresh Momentum Under New Agreement

Niger and Atomic Eagle signed a mining convention providing legal, fiscal and regulatory stability while establishing frameworks for project financing, offtake and renewed uranium development.

SMRs Gain Global Momentum as IAEA Forecasts Major Growth by 2060

The IAEA's high-case outlook projects up to 284 GWe from SMRs by 2060, equivalent to potentially more than 1 000 reactors worldwide.

Africa's Nuclear Readiness Is Growing as Countries Prepare for Deployment

A September assessment identifies Egypt and South Africa as Africa's most advanced nuclear countries, while Ghana, Uganda, Morocco, Kenya, Algeria and Tunisia build readiness.

Africa Steps Forward as Nuclear Energy Moves From Ambition Towards Action

Africa is seeking a bigger role in the nuclear renaissance, while governments advance financing, regulation, skills, SMRs and projects to meet growing energy demand.

IS “COLD” FISSION POSSIBLE

WHAT A SIMPLE OBSERVATION ABOUT FISSION COULD CHANGE ABOUT AFRICA’S ENERGY FUTURE

DAVID R. YOUNG

Atomic energy provokes hope as well as fear. Hope for what it could bring to mankind and our energy needs. Fear because of unfamiliarity and what appears to be an invisible menace — radiation.

Physicists have learned a great deal about atomic energy and making it safe to use. But there is one observation so simple it is easily overlooked, and it opens a question the nuclear industry has never seriously pursued.

A fission event does not produce heat.

That statement will bother some of you. Of course fission produces heat — you can measure it, you can boil water with it, you can run a turbine. But follow the sequence carefully and something different emerges.

When a single atom of uranium splits, it produces two heavy fragments carrying positive charges of +20 to +40 each, flying in opposite directions at 12 000 kilometres per second — fast enough to travel from Cape Town to Nairobi in one third of a second. Meanwhile, a burst of gamma radiation departs at the speed of light, free neutrons carry their own kinetic energy, and a cloud of electrons stripped from the fragments is left behind at the fission site.

Every one of these is organised, directional energy. None of it is heat.

Heat from where?

Heat appears only when those fragments slam into surrounding matter. The kinetic energy transfers to the fuel’s atomic lattice, the atoms vibrate, and that vibration is what we call thermal energy. This happens within micrometres of the fission site, in less than a nanosecond.

It is so fast and so local that it is easy to mistake the heat for a product of fission. It is not. It is a product of collision.



David R. Young is the founder of the Spectrum Energy Research Foundation. With a background in engineering and over twenty years as a building designer, he brings a systems perspective to energy research — asking how things are built, not just how they’re theorised. His research began with the creation of a series of detailed interactive charts mapping which materials control energy at each band of the electromagnetic spectrum — and where that control breaks down. The patterns those charts revealed led directly to the research path explored in this article. He is also the author of a book series found at FreedomSeries.one. The Foundation’s work and interactive charts are published at spectrumenergy.one

So why do we build reactors around heat? Because we inherited the design from coal. Coal was burned, to heat water into steam, which spun turbines to generate electricity.

Then we developed atomic energy and engineered it to do the same thing — create heat. But with atomic energy, at least five distinct energy bands are present.

The gamma rays? Absorbed by shielding and discarded. The beta particles? Stopped by barriers. The light? Uncollected. About 70% of the thermal energy is wasted in the steam cycle, and the electromagnetic energy is never harvested at all.

Once you see that heat is caused by collision, could you imagine a system where these fragments are used without hitting anything?

CONTINUED ON PG 09

CONT.... FROM PG 08

If you intended to directly capture the energy from a fission event, how might you design it? You would need a very thin film of fuel so the fragments can exit before they thermalise. You might ask whether the uranium atoms can be aligned so the fragments fly in a predictable direction — and scientists have shown that when nuclear spins are oriented, fission fragments do tend to emit directionally. Getting them lined up reliably is the engineering challenge, but it is not impossible.

Perhaps a positive electric field could be used to decelerate those fast-moving, positively charged fragments, converting their kinetic energy directly to electricity without a thermal step. Meanwhile, the stripped electrons left at the fuel surface flow through a separate circuit.

Further out, crystal structures can convert gamma to lower frequencies, and thermoelectric materials handle what thermal energy remains. Each band harvested through its own pathway, integrated into one reactor structure.

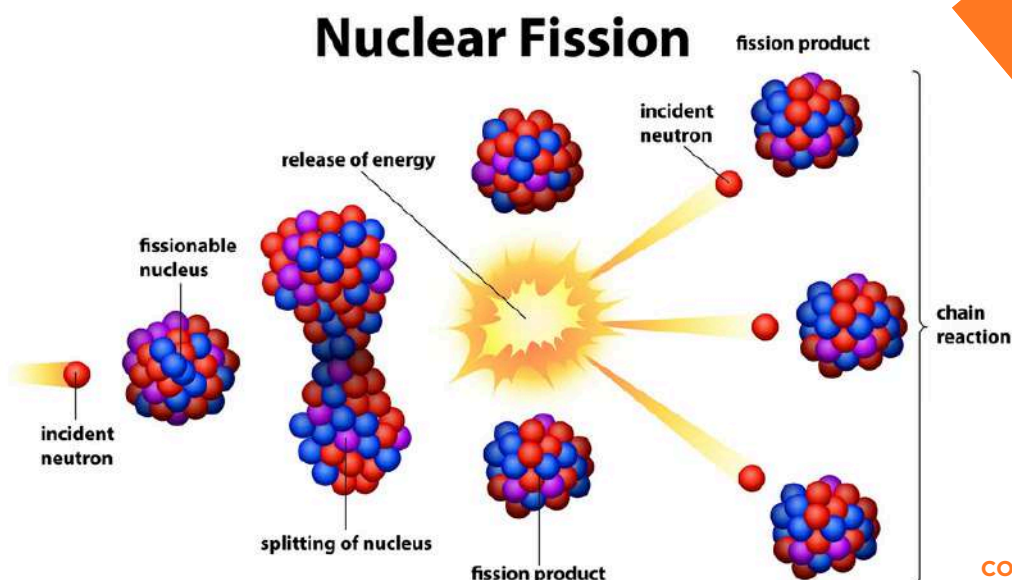
‘Cold’ Fission

Compared to conventional reactors running at 300° to 600° Celsius, this system would target only 10 to 15 percent of fission energy becoming heat. Relating that to our human sense of temperature, we might call it warm. But since the ideal target is no heat at all, I call it Cold Fission.

The research behind this concept does not invent new physics. It draws new conclusions from existing observations — conclusions that were always available but never pursued because heat has been the main focus of engineers and designers.

For Africa, the implication is direct. The continent’s energy needs are growing rapidly. Many communities that need power most urgently are far from grid infrastructure, and far from the water sources that conventional reactors require. A reactor that is smaller, needs no water cooling, and extracts far more from its fuel could reach places that today’s designs cannot serve.

South Africa has a proud history in nuclear engineering. The pebble bed reactor programme produced world-class expertise that now works across several continents. The knowledge needed to advance nuclear energy already exists in this country. Less fuel, less waste, more energy. The fuel is already providing this spectrum of energy. It just needs to be harvested.



CONTINUED ON PG 10

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How does a single element perform across the energy spectrum?

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6 C Carbon	RADIO Insulator	→	INFRARED Absorber	→	X-RAY Conductor	→	GAMMA Diffraction
29 Cu Copper	RADIO Conductor	→	INFRARED Reflector	→	UV Converter	→	GAMMA Transparent
82 Pb Lead	RADIO Conductor	→	INFRARED Converter	→	VISIBLE Absorber	→	GAMMA Absorber

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NETWORKING SMALL REACTORS ACROSS AFRICA

DR AYODELE PERIOLA

The role of Small Modular Reactors (SMRs) is crucial in future energy systems. In comparison with conventional reactors, Small Modular Reactors have the benefits of reduced costs and excellent deployment opportunities. The deployment of SMRs that do not require water for cooling is especially appealing for developing contexts such as Africa. An example of an SMR that does not require water for cooling is the High-Temperature Modular Reactor (HTMR). The realisation and technology maturation of SMRs such as the HTMR are beneficial for a significant number of vertical applications and are receiving increasing attention. In this regard, vertical applications are high-power-demand use cases and scenarios. Beyond these vertical applications, SMRs are modern power workhorses that can be easily deployed and integrated into the grid.

As electric grid power workhorses, SMR models can play a significant role in addressing the challenge of power security. This is especially important in Africa. The current Global events in the ongoing US-Iran conflict pose significant challenges to energy security. This is because of the unexpected chokehold that has arisen concerning the availability of diesel and gas. This is especially important for cases where gas- and diesel-fired power plants are relied on for power generation. Such gas and diesel-fired power plants have to play a critical role in supporting peak demand, mitigating load shedding and providing back-up for intermittent renewable systems. Therefore, the introduction of SMRs in geographically distributed arrays will enable the realization of a resilient grid at national and regional levels.

The deployment of multiple SMRs in geographically distributed arrays is beneficial as it enables the addressing of energy security across multiple points, in different sovereign grids. Such an approach, though feasible with modern technologies, is yet to receive significant consideration in developing regions such as the African continent.

However, it has been recognised that SMR Construction across Africa is critical and will definitely come about at a great pace. This was clearly indicated by the recent conference that was held in Kigali in Rwanda from 18-21 May of 2026.

CONTINUED ON PG 12



Dr Ayodele Periola is a lecturer in the Department of Electrical, Electronic and Computer Engineering at the Cape Peninsula University of Technology. Dr Periola's research interest is in Computing and Communication Systems which focus on the design of intelligent computing systems that incorporate communication networks. The research conducted in this area has a significant societal impact because of its focus on the design of solutions that enable future internet-enabled applications.



National Network Operations Centre in Centurion, South Africa. This centre controls telecommunications traffic. It was installed over 25 years ago by Questek.





Dignitaries attending the SMR Conference in Kigali, Rwanda, from 18-21 May 2026

Centralised Observability



However, SMR deployment raises new challenges for centrally realised observability and control. The requirements for array observability and control arise from the need to ensure optimal operation. In the event that sub-optimal and near-optimal operation is deemed obtainable, the realisation of observability and control requirements serves to ensure operational consistency and stability. In addition, it is crucial to note that such a deployment does not pose nuclear safety risks. This reality is important to counter the public and policy notions that nuclear systems are not safe. The current nuclear climate in 2026, and the frameworks of the International Atomic Energy Agency, provide rigorous standards and certification guidelines to mitigate against a nuclear disaster. Given that there has been no known nuclear leakage related disaster in the past decade, it can be inferred that adherence to the guidelines of the IAEA has proved effective, from a safety perspective. Therefore, there is no risk portended from the manner of deployment i.e., geographically distributed arrays of Small Modular Reactors.

Vast areas of Africa



The deployment in the form of geographically distributed arrays has challenges requiring operational-data monitoring and data-driven control. This is necessary to ensure optimal and consistent power output in its operation. The operational-data monitoring and data-driven control capability are realisable via the vertical integration of communication networks.

This integration presents new possibilities and a potential for alleviating the public concerns regarding the safety of nuclear systems. It also assures the municipalities which acquire Small Modular Reactors of the ability of the systems to ensure the proactive execution of operational procedures.

Given the ongoing maturation of internet penetration and communication network use in Africa, the vertical integration of geographically distributed arrays of small modular networks has performance monitoring benefits. A centralised performance monitoring is the focus in this discussion. Furthermore, it allays any public concerns about such a deployment strategy. The SMR as a future power workhorse fits within this strategy, as it supports ubiquitous deployment without requiring water for cooling.

Centralised Performance Monitoring

A centralised performance monitoring capability can be realized via advances in computing and networking. A central entity in this context is a centralized display system achieved via large screens. Such screens enable the projection of the operational status of each deployed SMR. Monitoring centre use enables quick fault spotting, thereby ensuring a rapid response. They also enable the large-scale monitoring of system assets. Such screens, with dimensions of tens of metres, are beneficial when connected to distributed networked computing systems. The operation of such centres will be in line with relevant standards such as ISO 11064 (Control Room Ergonomics), ISO 9241 (Human-Computer Interface), IEC 61968 (integration interfaces for power cyber-physical systems), and IEC 62351 (cyber-security concerns).

In conclusion, the role of the Small Modular Reactor in Africa, with models such as the HTMR being primary power-system workhorses, can be integrated into grids of different countries or into different points of a central regional bloc grid system. It is also recognized that an integration of the HTMR into the national-scale and regional-scale communication networks provide a new frontier for vertical integration. This results in new innovation approaches and opportunities, while addressing the salient aspects of addressing the energy security in developing contexts and the Global South described by Africa.

AFRICA'S URANIUM OPPORTUNITY: FROM RESOURCE TO REACTOR

HEATHER VELDHUIS

Africa has something the world's growing nuclear industry needs: uranium.

But what if Africa's opportunity goes far beyond mining and exporting the raw material? What if the continent could take its uranium, process it, fabricate nuclear fuel, and then use that fuel in reactors designed, built, and maintained in Africa? That is where the real opportunity begins.

The nuclear industry is entering a new period of growth. The International Atomic Energy Agency continues to increase its projections for future nuclear capacity, while Small Modular Reactors (SMRs) are opening up new possibilities for countries that may not need, or be able to afford, a traditional large nuclear power station. For Africa, this could be a very important moment.

From uranium exporter to nuclear fabricator

Africa has significant uranium resources, and exploration and mine development are progressing in several countries. Namibia and Niger have been particularly active in recent months.

In September, Namibia's Etango uranium project moved closer to construction after securing about \$ 90 million in funding. The project is now moving towards a Final Investment Decision and could become a significant new uranium producer.

In Niger, a new Mining Convention signed this month has created a framework for the Madaouela uranium project to resume, including arrangements for financing and future uranium offtake. These developments are important, but they also raise a bigger question:

Why should Africa simply export uranium and then buy back the finished nuclear products from somewhere else?



Heather Veldhuis holds a Bachelor's degree, majoring in Industrial Psychology and Sociology and is Editor of N²A (Nuclear Network Africa) Digital Magazine. Through her work in nuclear training development, communications, and now project management for Stratek Holdings, she focuses on the human and process side of nuclear energy, exploring how people perceive, understand, and engage with complex technologies

The nuclear fuel cycle is complex and highly regulated, but the principle is simple. The more stages of the value chain that can be developed locally, the more opportunity exists for African businesses, engineers, scientists, manufacturers and investors. This means jobs. It means skills. It means technology. It means manufacturing capability. And potentially, it means exports.

South Africa has a head start

South Africa is particularly interesting because it already has decades of nuclear experience, including the operation of Koeberg and a history of developing advanced reactor and TRISO fuel technology. The country also has an engineering and manufacturing base capable of supporting sophisticated industrial projects. **CONTINUED ON PG 14**

This is where South Africa's private nuclear sector could become increasingly important. Pretoria-based Stratek Holdings is enhancing and furthering a strategy for the continued development and building of the HTMR-100, a high-temperature, helium-cooled, pebble-bed Small Modular Reactor, designed to produce 35 MWe of electricity as well as high-temperature process heat. The technology has its roots in South Africa's earlier Pebble Bed Modular Reactor programme and uses TRISO fuel, a type of fuel designed to retain radioactive material within multiple protective layers.

Stratek's vision extends beyond the reactor itself. The company is uniquely positioned to develop an integrated South African nuclear offering that can encompass fuel, the SMR, implementation and ongoing maintenance, creating the potential for an African nuclear technology and manufacturing value chain rather than simply importing completed reactors. That distinction matters. A reactor is not just a reactor. Behind it sits an enormous ecosystem of materials, fuel, engineering, manufacturing, control systems, construction, maintenance, training and specialised services.

The opportunity is bigger than electricity

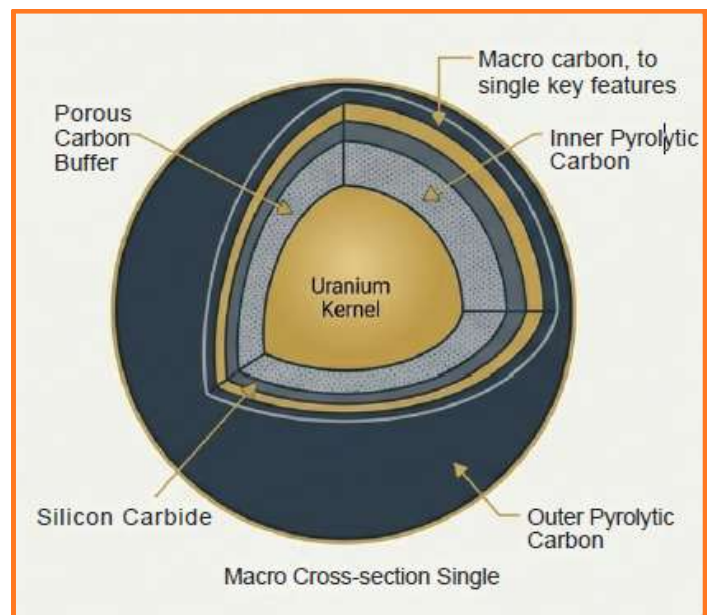
Africa's electricity demand is expected to grow substantially in the coming decades. A September 2026 assessment of African nuclear readiness noted that electricity demand across the continent could triple by 2050, while newer technologies such as SMRs could provide greater flexibility for countries developing nuclear programmes.

But nuclear power can do more than produce electricity. High-temperature reactors can potentially provide process heat for industry. Nuclear energy can support mining, desalination, hydrogen production and other energy-intensive activities. This is particularly relevant to Africa, where many industrial operations are located far from major electricity infrastructure. A smaller, modular reactor that can be manufactured, transported and installed closer to where energy is needed could change the way we think about power generation.

The time to build the value chain is now

The global nuclear industry is already thinking about the fuel supply chain of the future.

CONTINUED ON PG 15



TRISO Fuel: Each tiny fuel particle has multiple layers of ceramic and carbon-based material surrounding the uranium fuel. These layers act as miniature barriers designed to retain radioactive material, even at very high temperatures.



The latest IAEA and OECD-NEA uranium outlook indicates that identified uranium resources are sufficient to support projected future nuclear demand, but resources still need to be developed into producing mines. New uranium projects can take many years to move from discovery to production.

That means today's decisions matter. If Africa waits until the world urgently needs more nuclear fuel, it may find itself competing in a market where others have already built the processing, manufacturing, and technology capability. But if African countries and businesses invest now, the continent has the opportunity to move up the value chain.

Instead of simply saying "We have uranium," Africa can say: "We can turn uranium into fuel. We can manufacture the technology that uses it. We can build the infrastructure around it. We can operate it. And we can export our expertise to the world." That is a very different proposition.

A future worth investing in

The nuclear renaissance is not only about governments building power stations. It is about creating an entire industrial ecosystem. For South Africa, that means an opportunity for the private sector to work alongside government, regulators, universities, manufacturers and investors. It means developing young engineers and scientists. It means giving existing manufacturing companies a pathway into the nuclear supply chain. It means investing in specialised skills and infrastructure. And it means looking at uranium not simply as a mineral, but as the beginning of a much larger economic opportunity.

Africa has the resources. South Africa has nuclear experience, engineering capability and a history of innovation. Now we need the investment, partnerships and ambition to connect the dots.

The future of nuclear energy is being built today.

Africa should not just supply the fuel for that future. It should produce it.

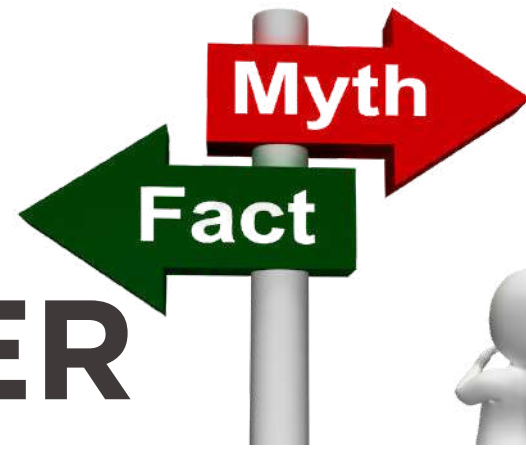


The Rössing Uranium Mine is the world's longest-running operating open-pit uranium mine. Located in the Namib Desert near Arandis and Swakopmund in the Erongo Region of Namibia, the massive asset has been producing uranium oxide (yellowcake) continuously since 1976.



Yellowcake being produced in South Africa for export (also known as urania) is a coarse, powdered uranium ore concentrate that represents an intermediate milestone in the processing of uranium. Containing roughly 70% to 90% uranium oxides (yellowcake is U_3O_8), it serves as the global feedstock for nuclear fuel production.





MYTH BUSTER



MYTH:

Africa can mine uranium, but surely we need the rest of the world to do the clever stuff.

FACT:

Africa has uranium, nuclear expertise, and advanced engineering capability. The opportunity is to build more of the value chain locally.

N²A VERDICT

Africa doesn't lack the ingredients. The challenge is the funding to build the kitchen.

MYTH:

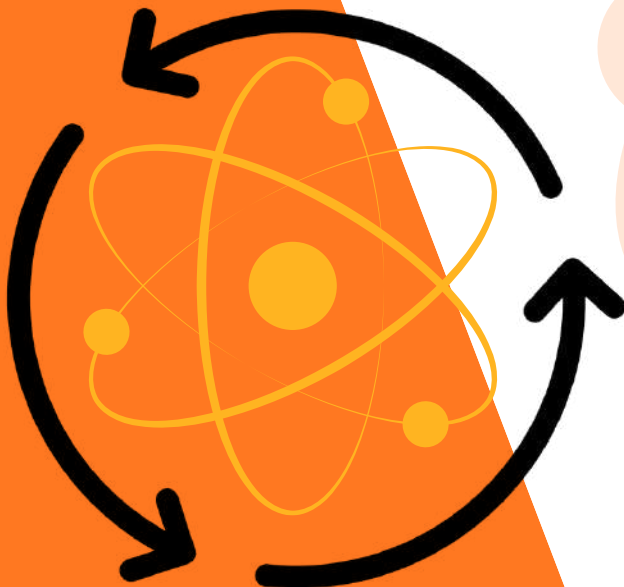
Africa would have to invent everything from scratch to build its own nuclear industry.

FACT:

Africa can build on existing global technology through partnerships, training, localisation and local manufacturing.

N²A VERDICT

We don't need to reinvent the reactor. We did that already! We need to manufacture more of it.



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Any person who has influence and a role to play in representing any Nuclear-Related Developments to advance nuclear power in Africa. or in any international entity, which can contribute to the development of Africa's nuclear energy capability is encouraged to be part of this great journey.

Any company, ranging in capability from a nut and bolt to the most sophisticated piece of equipment, should join the journey now.

N²A IS AN INDEPENDANT PUBLICATION

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