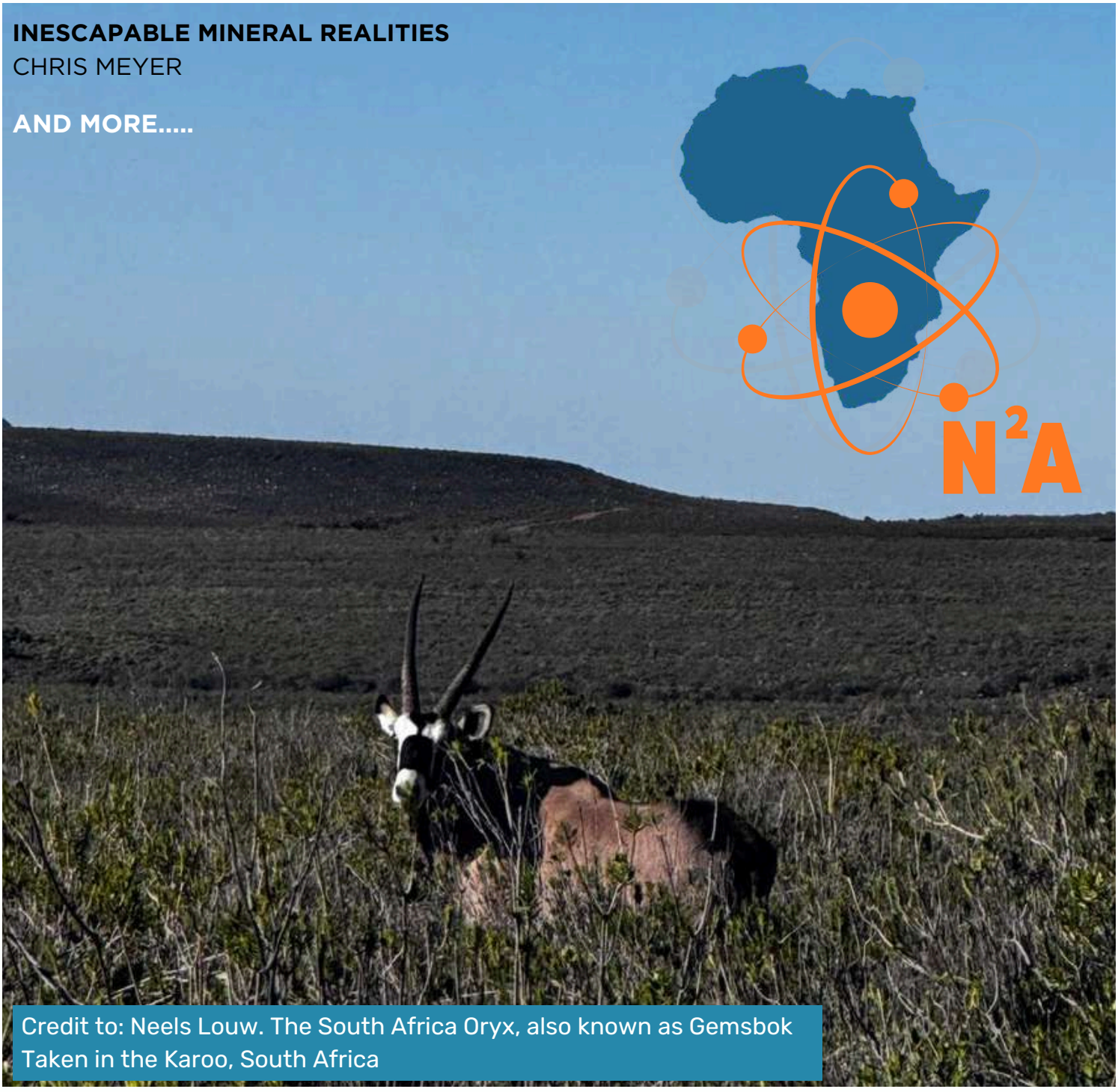
NUCLEAR NETWORK AFRICA

THE WORLD OF NUCLEAR

TAGGING RINO HORNS WITH ISOTOPES: THE RHISOTOPE PROJECT
DR JOHN RANDALL

INESCAPABLE MINERAL REALITIES
CHRIS MEYER

AND MORE.....



Credit to: Neels Louw. The South Africa Oryx, also known as Gemsbok Taken in the Karoo, South Africa

N²A HIGHLIGHTS

Picture Credit: Neels Louw

FROM THE EDITOR

This month marks a special milestone for N²A Nuclear Network Africa: we are proud to celebrate our **first anniversary** and the publication of our 13th edition. Over the past year, N²A has grown into a trusted voice in Africa's nuclear conversation, bringing together experts, industry leaders, and curious readers to explore the role of nuclear energy in shaping the continent's future. Thank you to our contributors, partners, and readers for walking this journey with us. Your engagement has been the driving force behind our growth.

In this celebratory edition, we are excited to feature two thought-provoking pieces. Dr. John Randall takes us into the world of cutting-edge isotope technology in his article, "Tagging Rhino Horns with Isotopes." This innovative approach offers a powerful new tool in the global fight against wildlife trafficking, bridging the disciplines of nuclear science and conservation in a way few imagined possible.

We also present Chris Meyer's insightful article, "Inescapable Mineral Realities." As Africa positions itself at the heart of the global energy transition, this piece reminds us that the future will still be built on mining, minerals, and the complex realities of resource demand.

Complementing these features, our Africa in Focus section offers a round-up of the most significant nuclear energy developments across the continent over the past few months, highlighting momentum, challenges, and opportunities shaping the sector.

Here's to celebrating one year of N²A, and to many more editions of impactful stories that connect nuclear energy to Africa's progress.

Warm regards,

Heather Veldhuis

HEATHER VELDHUIS
EDITOR

The springbok is easily identified by its light brown back, white underparts, and the prominent dark brown stripe that runs along its flanks, separating the two colors. Springbok are known for their social behavior and are typically found in herds.
Picture credit to Neels Louw. Taken in the Karoo, South Africa.

Sandton, a suburb of Johannesburg, South Africa. You can identify the city by its prominent skyscrapers, specifically:

- ***The Leonardo: The very tall, striking building in the center of the image. It is the tallest building in South Africa.***
- ***Michelangelo Towers: The building with the distinctive golden-domed roof to the right of The Leonardo.***

TAGGING RINO HORNS WITH ISOTOPES THE RHISOTOPE PROJECT

DR JOHN RANDALL

I will never forget watching a baby rhino dance on a hot tar road until it was called by its mother, to finish crossing the road. It started in her direction, then turned and came back onto the tar to experience the sensation again. A sighting to cherish!
Unfortunately, others see another value in this youngster's kind.

In 2024, in South Africa, 420 rhinos were poached for their horns. For every 100 rhinos the Kruger National Park had in 2013, 41 were poached between then and 2024. To quote Save the Rhino International, "Rhino populations are at tipping point. We cannot afford to lose any more rhinos".

Conservationists rely on a dozen interventions in the battle to prevent poaching. Until recently, experts have concentrated on dehorning to discourage poaching. Apart from the disfiguring, the main disadvantage is that the horn grows after dehorning – the horn is made of the same material as a human fingernail and, like a fingernail, it is constantly growing – so dehorning is repetitive, with a frequency of 12 to 24 months. In some cases, dehorning has not prevented poaching; in one instance a rhino was poached within a day of being dehorned.

The market for poached rhino horn is in Asia so an ability to track poached horn during the journey from Africa to Asia is valuable.The Rhisotope Project (initiated officially in January 2021) is led by Prof James Larkin, Director of the Radiation and Health Physics Unit at Wits University, and the idea is to embed a cocktail of radioactive isotopes into the horn of rhinos. The isotopes are chosen in the first place to enable tracking (there have been radiation sensors at many ports of entry for many years) and in the second place to identify the origin of a poached rhino, enabling investigation and prosecution.Jessica Babich is the Chief Executive Officer of the project, and the team includes Dr William Fowlds, wildlife veterinarian.

Dr John Randall initially obtained an MSc in Genetics and Poultry Science from the University of Stellenbosch, he developed an interest in Biometrics and obtained an MS in Statistics and Biometry from Cornell University. For 25 years he followed this path. Then he became a Systems Developer for the next 20 years and obtained a PhD in Biometry from Stellenbosch.

When he was a boy, on the family farm, the Xhosa farmworkers gave him the nickname of Vundla, the Xhosa language name for the Cape Hare: He said that he was given the nickname "because I was to be found, asleep, by the side of the road". He says that: "Apparently, I'd set out from home, walk until I got tired, then lie down and take a nap. When one walks in the veld in the Eastern Cape one can disturb a Vundla (they're nocturnal) and it will jump up and race away."

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The isotopes embedded in a rhino's horn are apparently selected to exploit their characteristics. For example, if traces of Cesium 137 are included, this radioisotope's half-life of about 30 years, it would ensure that the horn is traceable for the remainder of the animal's life. Just so, Cobalt 60 might be included because it decays with two gamma rays with different energies (which, in turn, are different to the energy of Cesium 137's gamma ray).

These rays will generate a characteristic display on detection equipment. If only these two isotopes are embedded, the three gamma-ray peaks they generate would identify the rhino (or rhinos) marked with this mixture. Note that the isotopes used have not been identified – after all, different isotopes might be used at different locations – all that is known officially is that more than one isotope is used.

The main purpose of the embedded radioisotopes is (in Prof Larkin's words) "to devalue the horn in the eyes of end-users".The rhino should not be harmed, nor should any other animal the rhino might encounter.Fortunately, detection equipment is extremely sensitive, implying that implanting small amounts is sufficient for the signature of the embedded isotopes to be evident – but the smaller the amount embedded, the smaller the dose delivered to biological tissues.

Biological organisms can tolerate small doses. The initial steps of the project were scientific investigations designed to investigate the effect of isotopes embedded in rhino horns. Questions addressed included investigating whether isotopes migrate from the horn into the body of the rhino (No) and whether treated rhinos exhibit symptoms known to be associated with extreme exposure to radioactivity (No).

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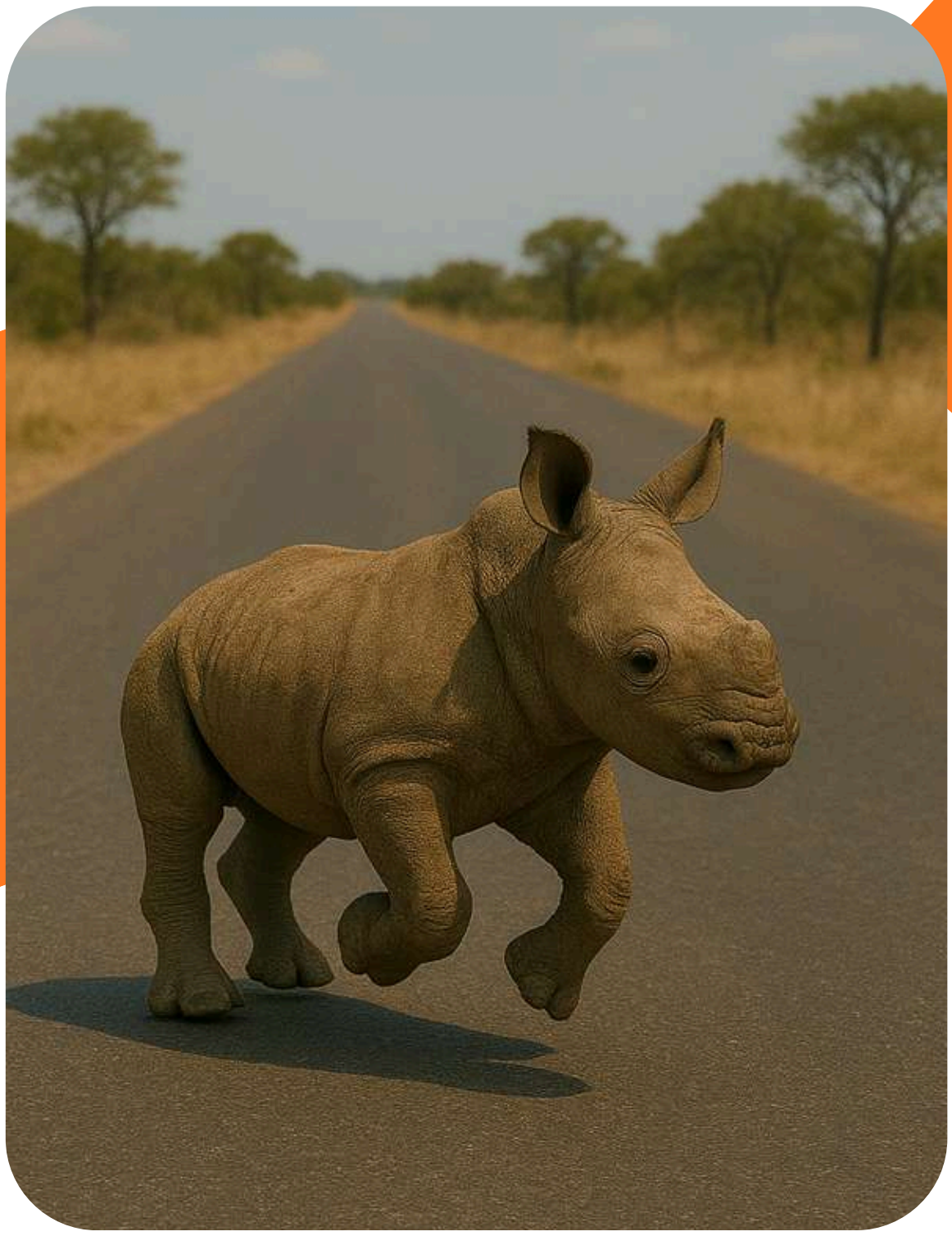
Prof James Larkin is treating a rhino horn

CONT.... FROM PG 5

The Rhisotope Project is a collaborative effort, involving the International Atomic Energy Agency (IAEA) and Rosatom (which played the crucial role of founding sponsor). Locally, the South African Nuclear Energy Corporation (NECSA) supplies the radioactive isotopes and several South African wild animal reserves are involved, particularly the Unesco Waterberg Biosphere.

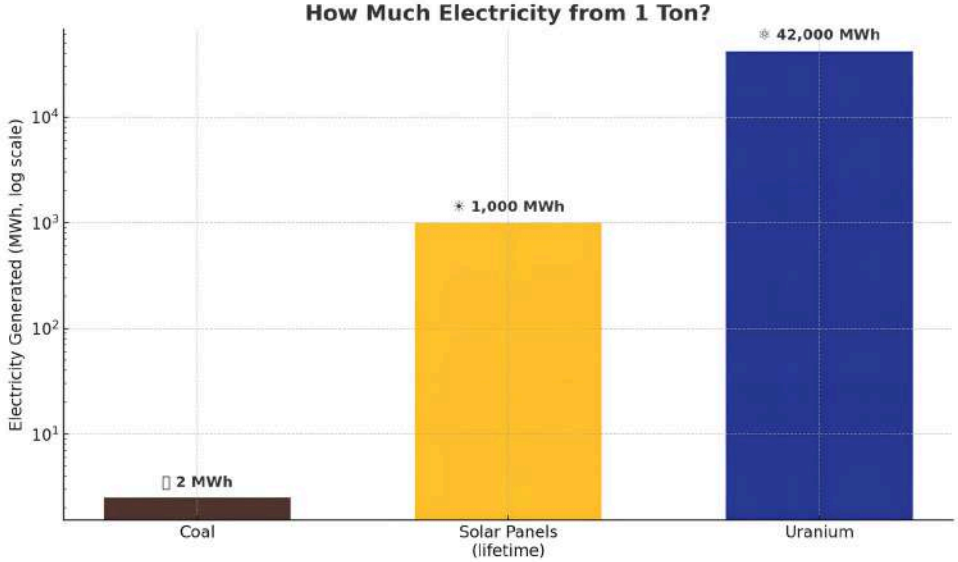
I do not know the life story of that baby rhino I observed all those years ago, perhaps it was poached in later life, but it is pleasing that the effort to protect it and its kind from poaching has been stepped up a notch.

Picture of a baby rhino "dancing" on a hot tarred road in the Kruger National Park (as imagined by ChatGPT)



HOW MUCH ELECTRICITY FROM 1 TON?

Energy source	Energy source	Notes & assumptions
Uranium (natural)	**≈ 40–45 GWh**	Once-through Light Water Reactor (typical modern burnup ~45 GWd/tHM). Accounting for enrichment & conversion losses, 1 ton of **natural** uranium yields ~40–45 million kWh of electricity.
Coal	**≈ 2,300–2,800 kWh** (≈2.3–2.8 MWh)	Bituminous coal ~20–25 MJ/kg; modern plant electrical efficiency ~35–40%. Result: ~2.3–2.8 kWh per kg → ~2.3–2.8 MWh per ton.
Solar panels (by mass of panels installed)	**≈ 35–44 MWh per year** → (≈ 0.9–1.1 GWh over 25 years)	Rule of thumb: ~20 kg per 400 W module ⇒ **1 ton panels ≈ 20 kW** nameplate. With 20–25% capacity factor (good African sun): annual output = 20 kW × 8,760 h × 0.20–0.25 ≈ **35–44 MWh/yr**. Over 25-year life: **~0.9–1.1 GWh**.



- ***Note that the Y-axis in the diagram is exponential, so the blue uranium bar is 100 times higher than the Yellow Solar bar.***

Uranium's energy density is extraordinary: ~15,000–20,000× more electricity per ton than coal.

Solar is equipment, not fuel: a ton of panels keeps producing each year; over its life, that ton yields about 1 GWh, far above a single ton of coal, but well below a ton of uranium fuel used in a reactor.

The exact figures shift with plant efficiency, solar capacity factor, fuel quality, and reactor cycle—but the orders of magnitude hold and make for a compelling visual.

INESCAPABLE MINERAL REALITIES

CHRIS MEYER

Until quite recently, the idea of replacing all fossil fuels such as, coal, petrol, and natural gas, utterly and completely with renewables has been popular: especially in the USA and Europe. That is, until 11 January 2023 when a senior fellow of the Manhattan Institute, Mike Mills, began to point out some logical flaws of this dream, in a talk given to the Skagen Conference in Norway entitled, "The energy transition delusion: inescapable mineral realities". Mills, a physicist by training, began what can only be described as a demolition derby. He started by explaining the implications of trebling the share of wind and solar in the world's energy system, from the present 3% to 10%. Now, that doesn't seem like much, until one realises that would still account for only 10% of the world's energy.

That was the beginning of his theme: that changes in energy will be slower than many people would like, and that replacing fossil fuels completely with renewables is simply not practical. The main reason he gave was the implications of the cost of metals: there are simply not enough economically mineable reserves of the metals and minerals needed to make all the photoelectric cells, wind turbines, and batteries needed to replace fossil fuels before 2050. Put another way, production rates of the different minerals, especially copper, graphite, cobalt, nickel and rare earths, will need to expand anywhere between 700 % to 4000 % above present rates; merely to replace just one generation of the photoelectric cells, wind turbines and batteries for electric cars, that are needed to replace fossil fuels before 2050.

Chris Meyer has a BSc (Hons) in Chemistry, from the University of Stellenbosch. After graduating, he taught science in a high school for three years, and found that he really enjoyed explaining Science in layman's language. He then went on to the Council for Scientific and Industrial Research (CSIR) as an information officer. Some time later he moved to the South African Bureau of Standards (SABS) as a technical publicity specialist, and then technical reviewer. He became interested in the history of nuclear and renewable energy while writing a book "Is Chernobyl dead? Essays on energy: renewable and nuclear", published in 2011.

CONTINUED ON PG 09

Wind Turbine base

CONT.... FROM PG 08

Hundreds of new mines would be needed to meet the requirements of such an energy transition.Which is precisely why it will not take place: Mills predicts that the energy transition will not be about replacing hydrocarbons, and that it will be a much slower process than many are predicting today. Today Mills is no longer in the spotlight. Very few people remember his comment that the extensive use of wind energy in Germany can only approach being economic if that country has access to cheap Russian gas.

But Dr Simon Michaux, is still in the spotlight, and actually predates Mills. An Australian geologist/mineralogist working in Finland's Geological Survey, he had the bright idea of sitting down and working out just what it would need, in terms of minerals, metals and energy generation, to replace all the fossil fuels in the world. His answer was astounding. If new power plants based on solar, wind and batteries were to play a key role in replacing fossil fuel-generated power, then more than 500 000 would be needed. And the amount of copper required by renewable technologies, to replace fossil fuels by 2050 is six times current production. CONTINUED ON PG 10

As Steven Sidley's article in the Daily Maverick put it, in an excellent summary of Michaux's key points; "Renewable energy has a brutal problem, and no one knows how to solve it." Sidley pointed out that we would also "need to develop more than 300 new mines in the next 25 years - which is not geologically, economically or logistically feasible." He added; "the picture for other critical base minerals required by alternative energy tech (lithium, cobalt, nickel, vanadium, etc) is equally dismal."

Wind Turbine Base - note the amount of steel!

CONT.... FROM PG 09

Michaux's stats astounded the Finnish government when he first presented them. His presentations, starting in 2022, and his later media talks still astound all who hear them, as they utterly and completely demolish something that millions of Europeans and Americans desperately wish to believe: that fossil fuels can be completely replaced by renewable technologies before 2050.

Needless to say, Michaux's stats and their implications should be carefully considered in South Africa where we are considering replacing many of our older, end-of-life coal-powered power stations with renewables.

The unspoken implication is that, if renewables cannot replace fossil fuels, more nuclear will be needed. That is reality. It is time to face reality.

The work crew at the Wind Turbine base

AFRICA IN FOCUS: RECENT MOVES IN NUCLEAR ENERGY

Africa's nuclear landscape is gaining fresh momentum through ambitious developments, from new power stations to strategic partnerships.

South Africa Moves Forward on New Power Station
In early August 2025, South Africa's Minister of Environment confirmed that final environmental authorisation had been cleared for the construction of a 4,000 MW nuclear power plant at Duynefontein, adjacent to the existing Koeberg facility. Eskom must complete all further regulatory duties. Authorities have emphasised the role of nuclear power in delivering stable baseload power alongside variable renewables, as the country strives to reduce its dependence on coal. Read more -> South Africa pushes ahead with new Cape nuclear plant

SMRs Poised to Transform African Energy
At a July Nuclear Energy Innovation Summit in Rwanda, experts agreed that small modular reactors (SMRs) could ignite Africa's energy transition, provided supporting infrastructure keeps pace. Countries including Egypt, Ghana, Uganda, Nigeria, Rwanda, Kenya, and South Africa are actively committing to or exploring SMR deployment, along with larger reactor builds like Egypt's El Dabaa project. Read more ->SMRs 'hold immense promise' for Africa

Russia Strengthens Nuclear Ties with Mali
In June 2025, Russia and Mali signed an agreement aiming to bolster cooperation in sectors including nuclear energy, highlighting plans to construct a low-power Russian-designed nuclear plant. This reflects Russia's growing footprint in the Sahel's nuclear ambitions. Read more -> Russia and Mali sign trade deals, eye nuclear energy cooperation

Nigeria's Institutional Capacity Builds Amid Nuclear Strategy Shifts
In May 2025, the Nigeria Atomic Energy Commission (NAEC) and the International Atomic Energy Agency (IAEA) collaborated to launch a five-day regional training course, focused on the financial analysis of large-scale energy projects, including nuclear power, using the IAEA's FINPLAN tool. Read more -> nigatom.gov.ng.

From megaprojects like South Africa's Duynefontein station to nimble SMR strategies across the continent, Africa's nuclear trajectory is accelerating, driven by diverse partnerships with Russia, China, the IAEA, and Korea, tailored to national energy needs and geopolitical landscapes. All the while we hold the capabilities within our own country to meet these same national energy needs.

COULD MINI NUCLEAR POWER BE THE FUTURE?

Stratek Global's Director of Commercial Affairs, Olivia Vaughan, and Author Ronald Stein talk to David Nazar on the benefits of SMR's

Small Modular Reactors, or SMRs, are compact nuclear reactors that promise to revolutionise energy generation. Think of them as the miniature cousins to towering conventional plants like San Onofre or Diablo Canyon. Designed with lower power output, simpler safety systems, and modular construction, SMRs can be rapidly transported and installed, often in sites unsuitable for traditional reactors. Their proponents emphasize enhanced safety due to reduced operating pressures and built-in passive systems.

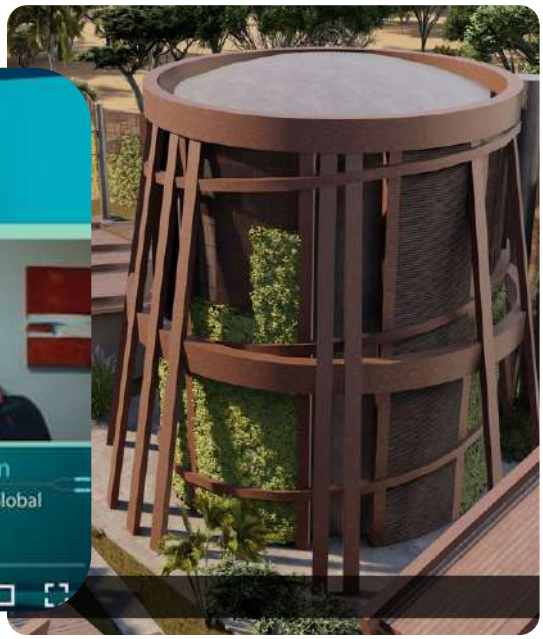
PBS reporter David Nazar explores these advantages in a compelling interview: watch it here.

His coverage sheds light on how SMRs might overcome limitations of older nuclear designs and integrate into diverse local grids and industries (e.g., heating, manufacturing).

Across the globe, momentum is building. In the U.S., Google has struck a landmark deal with the Tennessee Valley Authority (TVA) and Kairos Power to build a 50 MW Generation IV SMR, using molten salt technology. Google will purchase clean energy credits, aiming for operation by 2030. TVA has also filed the first-ever U.S. utility permit for a civilian SMR at the Clinch River site, targeting about 175,000 homes powered by 2032. Meanwhile, in the UK, Rolls-Royce is spearheading government-backed efforts to deploy modular nuclear systems for clean and scalable energy.

Yet challenges remain. Upfront costs, complex licensing, and public perception hurdles could slow SMR adoption. Still, experts argue that with design standardization, strong policy support, and smart investments, SMRs are poised to become a key tool in the transition to sustainable, resilient energy.

Click Here to view



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WHATS UP WITH WASTE?

On 25 July 2025, South Africa's National Nuclear Regulator (NNR) officially granted a nuclear licence to the National Radioactive Waste Disposal Institute (NRWDI), authorising it to manage and operate the Vaalputs National Radioactive Waste Disposal Facility, located in the Northern Cape Province. This facility, operational since 1986, serves as the country's repository for low-level radioactive waste generated by the nuclear, industrial, medical, and agricultural sectors—previously overseen by the South African Nuclear Energy Corporation (Necsa) under NNR licensing.

NRWDI was formed under the 2008 National Radioactive Waste Disposal Institute Act and officially launched in 2014, with statutory authority for the disposal of radioactive waste. It submitted its application for the Vaalputs operational licence in 2019. Following a "comprehensive and systematic review," NNR concluded that NRWDI met all regulatory requirements under section 21 of the National Nuclear Regulator Act and sections 30(1) and (8) of the NRWD Institute Act, as stated by NNR designate executive Thiagan Pather.

The licence authorises NRWDI to:
Receive low-level radioactive waste in approved packaging;
Temporarily store such waste in shielded areas within the facility reception hall;
Transfer radioactive materials and contaminated equipment to other authorised locations;
Dispose of low-level waste in engineered near-surface trenches

NNR will maintain oversight through inspections, audits, and safety reviews to ensure continued compliance with health, safety, and environmental regulations.
This licence transfer not only legitimises NRWDI's operational control over Vaalputs but also aligns institutional responsibilities with South Africa's national radioactive waste strategy.

Read More Here → Regulator approves South African waste facility licence transfer.

Deputy Minister of Energy and Electricity, Samantha Graham-Mare at a Nuclear Woman's Day function at University of the Witwatersrand

Vaalputs National Radioactive Waste Disposal Facility, located in the Northern Cape Province

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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.

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www.stratekglobal.com

Editor: Heather Veldhuis

Email: heather@stratekglobal.com

Cell: +27 (0)83 625 0316

Submit your article or topic for consideration in our next N²A edition.

heather@stratekglobal.com

Rachel has been involved with Stratek Global and our nuclear projects for over 10 years. She handles sales and marketing functions related to conferences, meetings, brochures and publications like N²A