Radioactive waste, small reactors and geopolitics will shape SA's nuclear plans

Even though South Africa's past nuclear plans have been "soiled" by allegations of malfeasance and corruption, Electricity and Energy Minister Kgosientsho Ramokgopa believes it should be pursued as a power source – based on science.

Ramokgopa's department on Thursday hosted a nuclear seminar aimed at making a compelling case for nuclear to remain part of the energy mix.

The seminar included speakers from his department, as well as Eskom, the South African Nuclear Energy Corporation (Necsa) and other domestic organisations, as well as the International Atomic Energy Agency, Russia's state nuclear corporation Rosatom and US nuclear energy company Westinghouse.

The conference comes a few weeks after the minister withdrew a notice in the Government Gazette that would enable the country to move forward in procuring 2 500MW of new nuclear power beyond 2030.
Ramokgopa had issued the notice in January 2024, but subsequently civil society organisations Earthlife Africa and Southern African Faith Communities' Environment Institute (Safcei), and the Democratic Alliance (DA) lodged separate legal challenges over procedural issues.

Ramokgopa, at a briefing in August, said that the arguments raised by Safcei and Earthlife Africa were quite substantive as they relate to public consultations. Safcei and Earthlife Africa in the past managed to block government's 9.6GW nuclear plans, which similarly lacked proper public consultation processes.

Ramokgopa said that government was duty-bound to pull back the 2 500MW determination because the process was "compromised". The withdrawal allows the National Energy Regulator of South Africa to now hold an additional public consultation process – which is a critical step before government pursues any new procurement.

Ensuring that there are no "missteps" in the process means that the case for nuclear can be purely made on science, explained Ramokgopa.

Ramokgopa said that nuclear is "indispensable" to South Africa attaining energy sovereignty and several officials indicated it would help South Africa mitigate against climate change given that it is a low emissions generation technology.

Apart from extending the operations of Koeberg by another 20 years, government is also seeking to build a similar large-scale reactor at either Duynefontein in the Western

Cape or Thyspunt in the Eastern Cape. It also explores the possibility of Small Modular Reactors (SMR) and wants to revive South Africa's Pebble Bed Modular Reactor (PBMR) programme, which was halted in 2010.

Cabinet approval would be required to revive the PBMR programme, News24 previously reported. Eskom is in the process of transferring the PBMR to Necsa.

Sengiphile Simelane, group executive for the power division at Necsa, said that the transfer would hopefully be finalised soon. He noted that a lot of countries are moving toward the use of SMRs. Reviving the PBMR would allow South Africa to pursue opportunities in this space - among these being fuel development. "At some point we even succeeded in producing some fuel that passed some tests in the US," he said.

But Simelane acknowledged that South Africa has lost some years in developing the technology domestically, while other countries like China and Russia have made gains. In this regard, it makes sense for South Africa to find a partner for development – with both parties combining their knowledge to roll out the technology, he said.

For example, if the fuel development is picked up again, then South Africa could offer this in a partnership where the vendor provides a reactor. "We can always negotiate and say that all fuel supply will come from South Africa for that particular reactor and other reactors that will be rolled out in the country in the form of SMRs," he said.

Keith Featherstone, chief nuclear officer at Koeberg, said that it would be good to develop local capacity in the SMR space. "As an operator, I would love to be able to pick up the phone and talk to a Necsa counterpart as a designer or OEM (Original Equipment Manufacturer) of the plant and not have to go talk to someone overseas. There must be something in that for us," he said.

Featherstone added that there could be something South Africa can leverage from its experience in the PBMR, which is worth exploring.

Simelane echoed views that it is important to leverage what the country knows and has achieved from the PBMR. "The long-term goal is to ensure that we do deploy SMRs within the country. And we cannot sit back and look at the world. We are very clear, we can see that the world is moving in the direction," Simelane said.

"If we're leveraging on what we have achieved in the past, and then also looking at gaining something from whoever that we partner with, we think that will give us a good solution going forward," he added.

Who South Africa partners with may carry geopolitical risk, in light of things like the Russian-Ukraine war and nuclear weapons in the Middle East, explained civil nuclear engineer Hügo Krüger. "The vendors, in my view, need to be selected with a geopolitical framework in mind… Because that will come into not direct cost for the project, but it can impact South Africa's foreign trade," he said.

South Africa essentially would get locked into a 40-year (even longer) relationship with the vendor in question, based on the operational life of the plant.

Kruger also shared that any effort toward localisation should also be pragmatic. It is, in my view, much better to buy it (a reactor) like a car, like a turnkey … We cannot re-manufacture, reinvent the wheel. That's a recipe for disaster," he said.

Krüger was not optimistic about the costs of SMRs. Some figures are as high as $10 000 per kilowatt of electricity, making them "unbankable."

I'm not saying this to say don't go for SMRs. But I'm saying the cost that the vendor agrees on has to be the final cost. And we need to be very clear on that."

Radioactive waste

Another consideration of South Africa's new nuclear build plans – whatever the type of reactor – is radioactive waste and its safety, highlighted Dr Vusi Thwala. Thwala is chief nuclear technologist at the National Radioactive Waste Disposal Institute.

Thwala noted that there are current challenges with storage capacity for waste. At Koeberg, the spent fuel is kept on site – which is only a temporary solution. "The site itself is becoming a scrapyard, if you like, and it is not supposed to be like that," he said.

Vaalputs in the Northern Cape has been identified as a site for national radioactive waste disposal. Ideally, Koeberg's spent fuel should be transferred and stored there, while a deep geological repository is developed to be the final endpoint for the waste, Thwala explained.

There are challenges with the development of the repository, related to the cost and size of the facility, he said. As the spent fuel cools down, the size of repository comes down, as does the cost of it. "When the fuel is cooler, the size of the facility gets reduced drastically, so are the economics of the cost of building it," Thwala said.

Featherstone similarly said that the new build strategy must take into account the waste disposal. "'We have to have a waste disposal place for the waste to go to," he said.

"We are doing the temporary storage on site because we don't have the national repository yet. That is something we have to make sure we prioritise because that could be a very big stopper in terms of strategies going forward for new build…" he added.

Featherstone stressed that it is an important point that must be dealt with strategically.

At the closing of the seminar, Ramokgopa said that the plan is to introduce an annual nuclear conference.

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