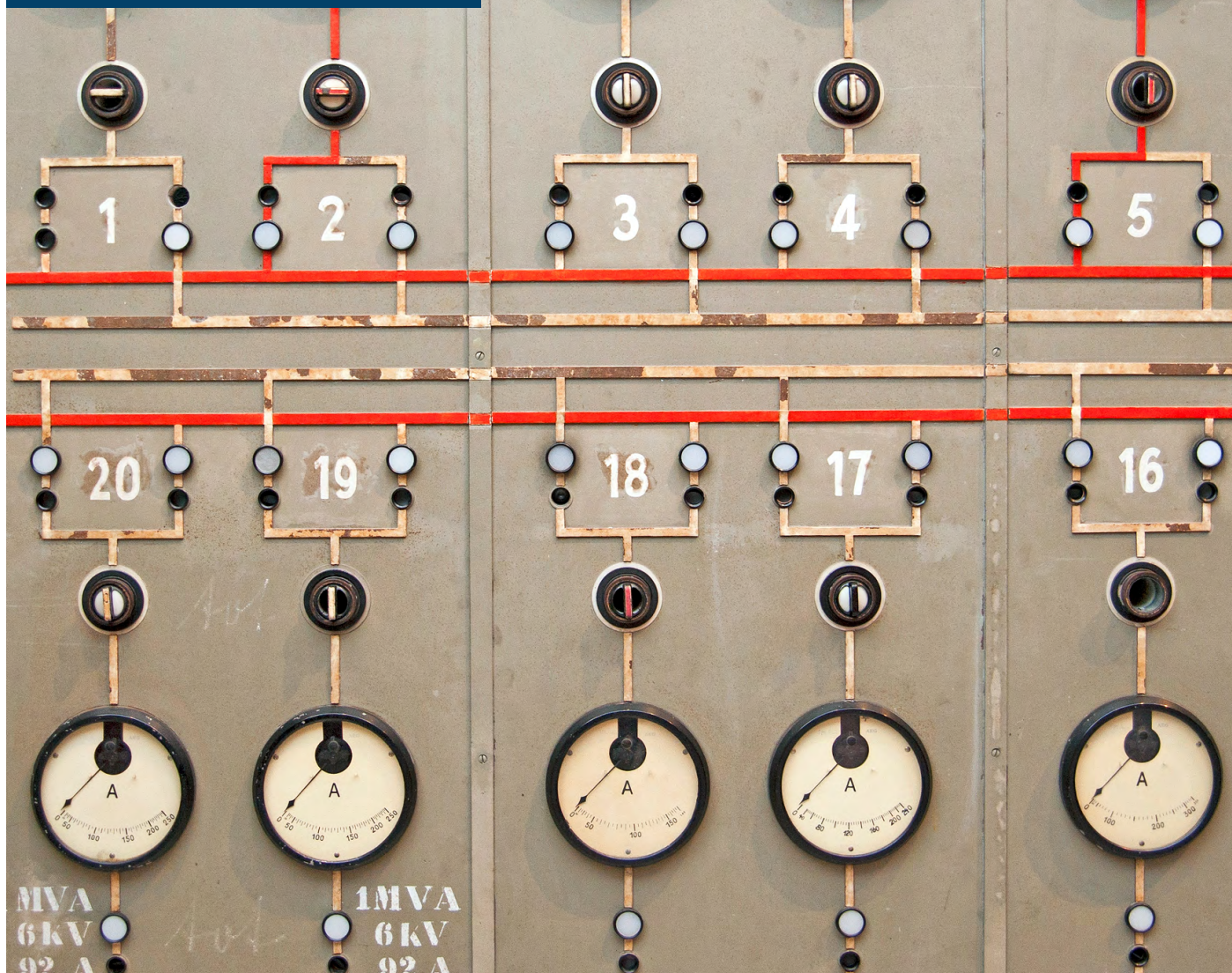


# Special Report

February 2021



## Nuclear Energy in South Africa

JO-ANSIE VAN WYK

African perspectives  
Global insights

# Executive summary

South Africa is regarded as the poster child for nuclear disarmament, nuclear non-proliferation and the peaceful use of nuclear energy. This report sketches the country's historical and contemporary nuclear context. Post-apartheid South Africa set out to build on the non-proliferation and disarmament credentials it accumulated once it had ratified the Nuclear Non-Proliferation Treaty and signed a Safeguards Agreement with the International Atomic Energy Agency in 1991. This signalled the country's intention to apply the peaceful use of nuclear energy to achieve its development needs. Illustrating its commitment to nuclear disarmament, the peaceful use of nuclear energy and nuclear non-proliferation, South Africa joined numerous multilateral nuclear regimes and organisations and signed various international agreements. These normative commitments at the international level were domesticated into South African law and policies, particularly during the Mandela and Mbeki presidencies. Besides formulating and adopting new policies and legislation, South Africa also established new nuclear governance entities, all of which are discussed in this report.

Whereas in the past nuclear governance was aimed at maintaining the country's independence and security against the background of international sanctions, this changed in the early 1990s. Nuclear governance in post-apartheid South Africa is conducted by entities such as the Nuclear Energy Corporation of South Africa (NECSA), the National Nuclear Regulator and the National Radioactive Waste Disposal Institute. Comprehensive import, transit and export regulations have been implemented to prevent nuclear proliferation. However, despite these measures, in 2004 a number of private South African entities were found to be involved in the global nuclear proliferation ring of Pakistani nuclear scientist AQ Khan. One of the consequences of this was a reconsideration of the country's export, transit and import mechanisms and controls.

In 1993 South Africa embarked on the Pebble Bed Modular Reactor project to meet its future energy demands. It was soon clear that the project would not be able to meet this goal owing to the expense and political considerations (which, in hindsight, might have been linked to state capture during Zuma's presidency). However, towards the end of president Thabo Mbeki's second tenure in 2008, Nuclear-1, a nuclear energy build plan, was envisaged and various preparations were made. This included releasing the country's nuclear energy policy in 2008, which set an ambitious nuclear agenda. Among others, it aimed to develop an independent nuclear science, technology and energy sector to meet developmental needs. Concurrently, uranium was declared a strategic resource in 2008, while South Africa was experiencing the first of many subsequent energy crises. Its stated national nuclear agenda did not go unnoticed by the international community. The US, for example, tried to convince South Africa to repatriate its highly enriched uranium (HEU). South Africa instead chose to continue to fulfil its nuclear non-proliferation commitments by converting the SAFARI-1 reactor from HEU to low enriched uranium.



One of the most significant nuclear legacies of apartheid South Africa is the nuclear facilities created during that era. However, facilities such as Africa's first and only nuclear power plant, Koeberg, and the SAFARI-1 research reactor have in recent years reached their end-of-life cycle, requiring urgent investment to secure the extension of their lifespan, as well as additional investment to meet the broader energy demands of the country. These developments coincided with Zuma's nuclear ambitions. He, more than any other post-apartheid president, sought to pave the way for a major nuclear build. His aim was to add a significant nuclear component to the country's energy production. There were parades of preferred bidders, with Russia emerging as a clear favourite. However, as the price tag of the new build became known and cabinet ministers began to oppose Zuma's nuclear plans, it became clear that the programme was a façade for large-scale state capture by Zuma and his patronage network at home and abroad. Eventually, Zuma lost his presidency with the ascendance of Cyril Ramaphosa, who initially opposed the nuclear build plans.

Ramaphosa resuscitated the country's energy expansion plans under the Integrated Resource Plan 2019. In mid-2020 the government issued a tender for a Request for Information (RFI) for the country's next attempt to embark on a nuclear build process, albeit a more cautious one. However, South Africa's plans to meet its future energy demands by expanding the nuclear component of its energy mix face significant challenges in the current economic climate.

Almost a decade of rampant and unhindered state capture has resulted in financial difficulties for the state that have been exacerbated by the severe economic impact of the COVID-19 pandemic. Besides financial difficulties, political interference in state-owned entities such as Eskom and NECSA has resulted in inefficient, ineffective institutions and fragmented nuclear governance. Dwindling nuclear expertise is also expected to have a negative impact on the future of the country's nuclear facilities and expansion plans. Extending South Africa's aging nuclear infrastructure beyond its original lifespan has significant financial and safety implications. However, there is still hope for a more realistic and sustainable approach to South Africa's nuclear build ambitions. The country also has a robust civil society, which provided oversight over nuclear expansion plans. A combination of civic activism, parliamentary submissions and court cases contributed to the termination of Zuma's unaffordable plans and commitments to Russia. It remains to be seen whether the South African public will be as robust in demanding accountable nuclear governance and sustainable and affordable investment when the new expansion plans go beyond the RFI stage.

# Abbreviations & acronyms

AEB	Atomic Energy Board
AEC	Atomic Energy Corporation
ANC	African National Congress
EURATOM	European Atomic Energy Community
IAEA	International Atomic Energy Agency
CEF	Central Energy Fund
CPPNM	Convention on Physical Protection of Nuclear Material
DMRE	Department of Mineral Resources and Energy
DoE	Department of Energy
EIA	environmental impact assessment
FNRBA	Forum of Nuclear Regulatory Bodies of Africa
HEU	highly enriched uranium
IDC	Industrial Development Corporation
INIR	Integrated Nuclear Infrastructure Review
IPPs	independent power producers
IRP 2019	Integrated Resource Plan 2019
LTO	long-term operation
MTCR	Missile Technology Control Regime
NAM	Non-Aligned Movement
NCACC	National Conventional Arms Control Committee
NECSA	Nuclear Energy Corporation of South Africa
NNEECC	National Nuclear Energy Coordination Committee
NNR	National Nuclear Regulator
NPC	South African Council for the Non-Proliferation of Weapons of Mass Destruction
NRWDI	National Radioactive Waste Disposal Institute
NSG	Nuclear Suppliers Group
NWU	Northwest University
PAIA	Promotion of Access to Information Act
PBMR	Pebble Bed Modular Reactor
PIC	Public Investment Corporation
REC	Review and Extension Conference

SAFCEI	Southern African Faith Communities' Environment Institute
SALTO	Safety Aspects of Long-Term Operation
SANEDI	South African National Energy Development Institute
SONA	State of the Nation Address
WMD	weapons of mass destruction

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# Acknowledgment

SAIIA is grateful to the Norwegian Ministry of Foreign Affairs for supporting the Atoms for Africa's Development project.

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## Cover image

Power plant console panel (Wakila/Getty Images)

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# Introduction

The International Atomic Energy Agency (IAEA) verified the complete termination and dismantlement of South Africa's nuclear weapons programme in 1993. This ended decades of international speculation over apartheid-era South Africa's secret nuclear weapons programme. The dismantlement of the programme coincided with the end of the Cold War and the country's democratic transition in the 1990s. Since the IAEA verification process, South Africa has been a vocal campaigner for nuclear disarmament, nuclear non-proliferation and the peaceful use of nuclear energy.

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However, South Africa has also experienced significant energy shortages and power cuts since 2000, which have led to renewed interest in the generation of nuclear energy. A nuclear energy expansion programme could offer significant opportunities in terms of South Africa's efforts to use nuclear energy for peaceful purposes, achieve its own developmental goals, and meet the UN Sustainable Development Goals and the AU's Agenda 2063 development targets. However, this process has not been without challenges.

The first section of this report outlines the nuclear context in South Africa, followed by a discussion of the normative framework that dictates the country's use of nuclear energy for peaceful purposes. The report also reviews nuclear governance in the country and looks at its uranium resources, nuclear facilities and programme. It then addresses the country's current and future needs related to the peaceful use of nuclear energy in its development agenda. The penultimate section focuses on South Africa's challenges and possible solutions, while the final section sets out the main conclusions of this report.

# Nuclear context<sup>1</sup>

The origins of South Africa's atomic interests can be traced back to 13 August 1944 when, in the midst of the Second World War, Britain requested the country's assistance in securing uranium for the Manhattan Project. After the Second World War South Africa established the Uranium Research Committee (1946) and Atomic Energy Board (AEB, 1948) internally, and at the international level became involved in the establishment of the IAEA in 1957. It also began to construct the National Nuclear Research Centre and a research reactor in 1961.<sup>2</sup> In 1965 prime minister Hendrik Verwoerd inaugurated the country's first nuclear research reactor, SAFARI-1. However, when the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) opened for signature in 1968, South Africa, which had participated in the negotiations, did not ratify it. In fact, it only did so in 1991.

Between 1969 and 1979 all research on and development of South African nuclear explosive devices was undertaken by the AEB, the predecessor of the Atomic Energy Corporation (AEC). In 1979 this responsibility was transferred to Armscor (a state-owned enterprise), which operated from its so-called Circle facilities 15km from Pelindaba (west of Pretoria), where the AEC was located. The AEC, however, remained responsible for the production and supply of highly enriched uranium (HEU) and for theoretical and development studies on nuclear weapons technology.

South Africa's nuclear explosives programme was officially aimed at peaceful uses until 1977, when the official emphasis changed to developing a strategic deterrent capability. However, in reality, it had been preparing a nuclear test facility in the Kalahari Desert since 1975. These developments were detected by a Soviet Union satellite in August 1977, causing an international outcry against South Africa. By April 1978, when prime minister John Vorster approved a three-phased deterrent strategy for South Africa (see Figure 1) amid growing international isolation, the country continued to deny the existence of its nuclear weapons programme. Despite these denials, the international community was alerted to South Africa's nuclear ambitions on 22 September 1979, when the so-called Vela or Double Flash Incident occurred in the South Atlantic, implicating the country in a nuclear test. The Vela Incident was confirmed as a joint South African-Israeli nuclear test decades later.<sup>3</sup>

South Africa's nuclear ambitions escalated as it faced increasing opposition during the so-called Border War (1966–1991), with its deterrent strategy (see Figure 1) underpinned by the

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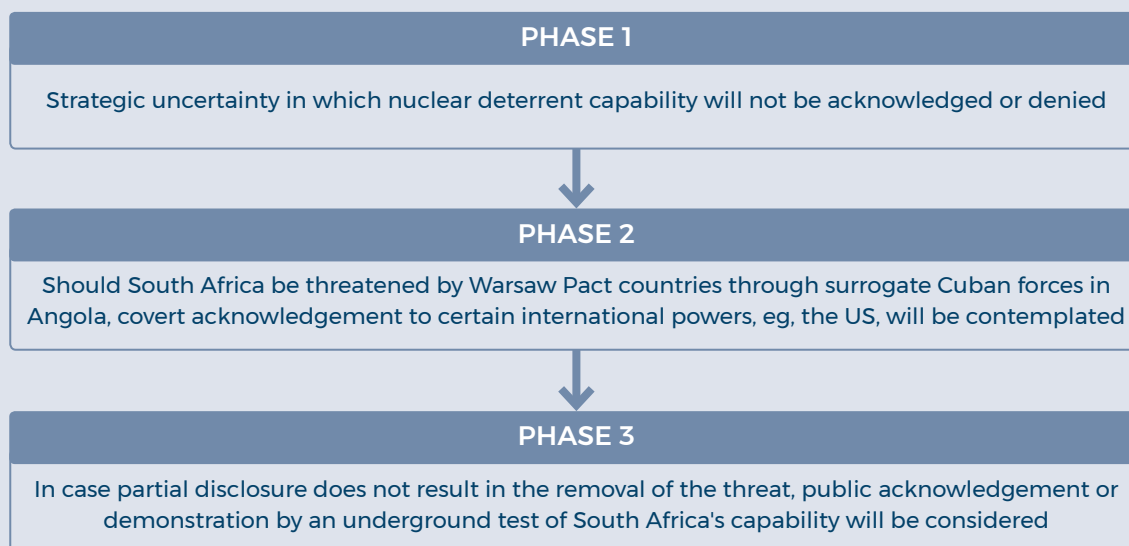
1 This section draws on Jo-Ansie van Wyk, "South Africa's Nuclear Diplomacy, 1990–2010: Securing a Niche Role Through Norm Construction and State Identity" (D Phil Thesis, University of Pretoria, 2013).

2 Nuclear Energy Corporation of South Africa, *2018 Integrated Annual Report* (Pelindaba: NECSA, 2018), 4, <http://www.NECSA.co.za/wp-content/uploads/2019/02/NECSA-Annual-Report-2018.pdf>.

3 "Declassified Documents Indicate Israel and South Africa Conducted Nuclear Test in 1979", *Ynetnews*, August 12, 2016, <https://www.ynetnews.com/articles/0,7340,L-4890545,00.html>.

completion of the country's first nuclear device in 1978. More devices were completed at approximately one per year until 1989. The first aircraft-deliverable vehicle was completed in 1982. Eventually, South Africa produced six nuclear devices during the programme, which was launched during the tenure of Vorster in 1978 and terminated by state president FW de Klerk in 1989.

**Figure 1 South Africa's three-phased nuclear deterrent strategy**



Sources: FW de Klerk, "Matters Relating to Nuclear Non-Proliferation Treaty, Violence, Negotiation and the Death Penalty: Statement by the State President to a Joint Sitting of Parliament, 24 March 1993", *Hansard* (1993): col. 3465-3478; W Stumpf, "Birth and Death of the South African Nuclear Weapons Programme" (Paper, "50 years After Hiroshima" Conference, Unione Scienziati per Disarmo, Castiglione, September 28 - October 2, 1995), <http://www.fas.org/nuke/guide/rsa/nuke/stumpf.htm>

Towards the late 1980s, South Africa's international isolation and the rising human and financial costs of the Border War became untenable. From the mid-1980s the South African government began to engage with the incarcerated Nelson Mandela. However, the Botha government was reluctant to introduce further reforms and continued its hard-line position against the international community and domestic opposition, although the latter was mostly exiled or imprisoned. De Klerk succeeded Botha after the latter suffered a stroke in January 1989, assuming power in August 1989. Barely a month into his tenure, De Klerk appointed a committee to oversee the dismantling of South Africa's nuclear weapons

Towards the late 1980s, South Africa's international isolation and the rising human and financial costs of the Border War became untenable

programme. In addition, he accelerated talks with the African National Congress (ANC), which in February 1990 culminated in the release of Mandela and the unbanning of the country's liberation movements. While talks about South Africa's future constitutional dispensation began, the country was engaging the IAEA on accession to the NPT (1991) and the signing of a Safeguards Agreement. Only in March 1993, just over a year before South Africa's first democratic elections and once the IAEA verification process was completed, did De Klerk make public the extent of the country's nuclear capabilities.

South Africa was one of only a few African states with a nuclear research reactor, and the continent's most advanced in terms of nuclear energy and technology

When the ANC assumed power in 1994 it inherited a country free of nuclear weapons, albeit one that operated a nuclear power station – the Koeberg Nuclear Power Station. South Africa was one of only a few African states with a nuclear research reactor, and the continent's most advanced in terms of nuclear energy and technology.

During President Mandela's tenure, the country's nuclear landscape began to change as new normative frameworks were operationalised through new legislation and institutions. Mandela's successors continued on this trajectory, which signalled a major departure from the apartheid nuclear weapons state towards nuclear governance aligned with international norms and practices. Hence, the remainder of this report focuses on the period since 1994.

# Normative framework and peaceful uses of nuclear energy

Post-apartheid South Africa continues to execute its commitment to universal nuclear norms (ie, nuclear disarmament, nuclear non-proliferation and the peaceful use of nuclear energy) through several international and national instruments such as treaties and its membership of intergovernmental organisations.

## Commitments to international norms via the ratification and/or signature of treaties

One of the first major nuclear-related events for post-apartheid South Africa was its participation in the 1995 Review and Extension Conference (REC) of the NPT. This was the country's first participation in an NPT conference since it had acceded in 1991. The 1995 conference was burdened by the question of the future of the NPT. South Africa, now the celebrated poster child of the three pillars of the NPT, was able to convince signatories to extend the NPT indefinitely. South Africa's successful efforts in this regard added to the country's nuclear credentials and the recognition of its commitment to the normative frameworks on nuclear non-proliferation, nuclear disarmament and the peaceful uses of nuclear energy.

One of the first major nuclear-related events for post-apartheid South Africa was its participation in the 1995 Review and Extension Conference of the NPT

Twenty-five years after the 1995 NPT REC, South Africa's commitment to international nuclear norms is evident in its ratification of various multilateral treaties:

- Statute of the IAEA (1957);
- NPT (1991);
- Agreement between the Government of the Republic of South Africa and the IAEA for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (Comprehensive Safeguards Agreement or Safeguards Agreement, 1991);

- Protocol Additional to the Agreement between the Government of the Republic of South Africa and the IAEA for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (Additional Protocol, 2002);
- Agreement between the IAEA, the Government of the Republic of South Africa and the Government of the United States of America for the Application of Safeguards (1965);
- Agreement between the IAEA, the Government of the French Republic and the Government of the Republic of South Africa for the Application of Safeguards (1976);
- Amendments to Article VI of the Statute of the IAEA (1999, not yet entered into force);
- Amendments to Article XIV A of the Statute of the IAEA (1999, not yet entered into force);
- Convention on the Physical Protection of Nuclear Material (CPPNM, 2007);
- Amendment to the CPPNM (2005, not yet entered into force);
- Comprehensive Nuclear-Test-Ban Treaty (1996, not yet entered into force);
- African Nuclear-Weapon-Free-Zone Treaty (Pelindaba Treaty, 1998);
- Convention on Early Notification of a Nuclear Accident (1987);
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1987);
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (2006);
- Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (2006);
- African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (1990);
- Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil thereof (1973);
- Convention on Nuclear Safety (1996);
- Framework Agreement for International Collaboration on Research and Development of Generation IV Nuclear Energy Systems (2008);
- International Convention for the Suppression of Acts of Nuclear Terrorism (2007);
- Agreement Extending the Framework for International Collaboration on Research and Development of Generation IV Nuclear Energy Systems (2015);
- Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (1963); and



- Treaty on the Prohibition of Nuclear Weapons (Nuclear Weapons Ban Treaty, 2019, not yet entered into force).<sup>4</sup>

This catalogue of South Africa's normative commitments was further strengthened by the country's numerous bilateral nuclear-related agreements. The majority of these (Table 1), except for the one with France to construct Koeberg, was signed after 1990. The explanation for this is the country's international isolation prior to 1990 and its full re-integration afterwards, as well as the complete IAEA verification mentioned earlier. Another explanation is that, prior to 1990 South Africa conducted most of its international nuclear-related interactions in secret while contravening comprehensive international sanctions that prevented this.

TABLE 1 SOUTH AFRICA'S BILATERAL NUCLEAR-RELATED AGREEMENTS (AS OF JANUARY 2020) <sup>a</sup>		
Party	Agreement	Entry into force
AU	Host Agreement between the AU and the Government of the Republic of South Africa on the Establishment of the Headquarters of the African Commission on Nuclear Energy in the Republic of South Africa	2015
Algeria	Agreement between the Government of the Republic of South Africa and the Government of the People's Democratic Republic of Algeria for Cooperation in the Peaceful Uses of Nuclear Energy	2012
Argentina	Agreement on Cooperation in the Peaceful Uses of Nuclear Energy	Signed 2009, not in force
European Atomic Energy Community (EURATOM)	Agreement between the Government of the Republic of South Africa and EURATOM for Cooperation in the Peaceful Uses of Nuclear Energy	Signed 2013, not in force
China	Exchange of Notes Constituting an Agreement Concerning the Sale of the Beva Nuclear Fuel Fabrication Plant	1999
	Agreement on Cooperation in the Peaceful Uses of Atomic Energy	Signed 2006, not in force
	Agreement between the Government of the Republic of South Africa and the Government of the People's Republic of China on Cooperation in the Field of Civil Nuclear Energy Projects	Signed 2014, not in force
Comprehensive Test-Ban-Treaty Organization	Agreement on the Conduct of Activities including Post-certification Activities, Relating to International Monitoring Facilities for the Comprehensive Nuclear-Test-Ban Treaty	1999
France	Agreement on Cooperation Regarding the Koeberg Nuclear Power Units I and II	1976
	Agreement between the Government of the Republic of South Africa and the Government of the French Republic on Cooperation in the Development of Peaceful Uses of Nuclear Energy	Signed 2014, not in force

<sup>4</sup> Department of International Relations and Cooperation, "Multilateral Agreements Signed by South Africa as in January 2020" (Office of the Chief State Law Adviser, South African Treaty Section, February 10, 2020); Department of Energy, "Nuclear Non-Proliferation", [http://www.energy.gov.za/files/esources/nuclear/nuclear\\_non.html](http://www.energy.gov.za/files/esources/nuclear/nuclear_non.html); National Nuclear Regulator, "International Cooperation", <http://www.nnr.co.za/international-cooperation/>.

<b>IAEA</b>	Agreement between the Government of the Republic of South Africa and the IAEA for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons	1991
	Protocol Additional to the Agreement between the Government of the Republic of South Africa and the IAEA for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons	2002
	Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA to the Government of the Republic of South Africa	2006
	Agreement between the Government of the Republic of South Africa and the IAEA Concerning the Provision of Financial Assistance in Respect of the Improvement of Veterinary Laboratory Capacities in Sub-Saharan African Countries	2012
<b>Joint Institute for Nuclear Research</b>	Memorandum of Understanding between the Government of the Republic of South Africa through its Department of Science and Technology and the Joint Institute for Nuclear Research	2005
<b>Russia</b>	Agreement on Cooperation in the Peaceful Uses of Atomic Energy	2004
	Agreement between the Government of the Republic of South Africa and the Government of the Russian Federation on Strategic Partnership and Cooperation in the Fields of Nuclear Power and Industry	Signed 2014, not in force
<b>South Korea</b>	Agreement between the Government of the Republic of South Africa and the Government of the Republic of Korea Regarding Cooperation in the Peaceful Uses of Nuclear Energy	2011
<b>US</b>	Agreement for Cooperation Concerning Peaceful Uses of Nuclear Energy	1997
	Agreement between the Government of the Republic of South Africa and the Government of South Africa and the Government of the US on Co-operation in Research and Development of Nuclear Energy	2009

a DIRCO, "Multilateral Agreements Signed"

## Membership of nuclear multilateral organisations and regimes

Since 1994 South Africa has reiterated that a 'primary goal' of its foreign policy is to 'reinforce and promote it as a responsible producer, possessor and trader of defence-related products and advanced technologies in the nuclear, biological, chemical and missile fields'.<sup>5</sup> It argues that, in this way, it 'promotes the benefits which non-proliferation, disarmament and arms control hold for international peace and security, particularly to countries in Africa and the Non-Aligned Movement'.<sup>6</sup>

Besides these bi- and multilateral treaties, South Africa is also a member of various multilateral organisations and export control regimes. The UN Office for Disarmament Affairs cites six principal multilateral export control regimes, namely the Zangger Committee,

<sup>5</sup> DIRCO, "United Nations Disarmament Commission", February 13, 2004, <http://www.dirco.gov.za/foreign/Multilateral/inter/undc.htm>.

<sup>6</sup> DIRCO, "United Nations Disarmament Commission".

Since 1994 South Africa has reiterated that a ‘primary goal’ of its foreign policy is to ‘reinforce and promote it as a responsible producer, possessor and trader of defence-related products and advanced technologies in the nuclear, biological, chemical and missile fields’

the Nuclear Suppliers Group (NSG), the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies (Wassenaar Arrangement), the Missile Technology Control Regime (MTCR) and the Australia Group.<sup>7</sup> The country is a member of all these regimes, except the Australia Group.<sup>8</sup> It is also a member of The Hague Code of Conduct against Ballistic Missile Proliferation. In addition, South Africa, along with Ireland, Sweden, New Zealand, Egypt, Brazil, Mexico and Slovenia, is a member of the New Agenda Coalition and the Conference on Disarmament.

South Africa’s membership of these multilateral organisations and export control regimes has several implications. First, it reiterates the country’s normative commitment to nuclear disarmament, nuclear non-proliferation and the peaceful uses of nuclear energy. Second, South Africa is bound by international oversight mechanisms that prevent nuclear recidivism, ie, restarting a nuclear weapons programme. Third, it profits from the economic benefits of so-called dual use goods that its small but advanced nuclear technology sector can accumulate for the country. Finally, but not limited to these aspects, South Africa’s future development of nuclear energy for peaceful purposes has to meet the safety and security standards set by the global institutions it has joined.

South Africa’s future development of nuclear energy for peaceful purposes has to meet the safety and security standards set by the global institutions it has joined

The next section traces South Africa’s early nuclear governance normative development before focusing on the post-1994 period. The significance of the post-1994 period lies, inter alia, in the domestication of the country’s commitment to international normative frameworks on nuclear energy.

<sup>7</sup> UN Office for Disarmament Affairs, “Export Controls”, <https://www.un.org/disarmament/wmd/export-controls/>.

<sup>8</sup> South Africa Council for the Non-Proliferation of Weapons of Mass Destruction, “International Treaties and Agreements”, <https://www.thedti.gov.za/nonproliferation/Links.html>.

# Nuclear governance

South Africa's nuclear governance architecture and institutions were first legislated in 1948, when the AEB was established in terms of the Atomic Energy Act. In 1963 the Nuclear Installations Act came into force, providing for the licensing of nuclear installations by the AEB. The Uranium Enrichment Act followed in 1970, whereby the Uranium Enrichment Corporation was established. The Uranium Enrichment Act provided for the enrichment of uranium by a state-owned corporation separate from the AEB and subject to licensing by the latter. In 1982 the Nuclear Energy Act of 1982 was legislated. The AEC, which succeeded the AEB, was established in terms of the Nuclear Energy Act. The AEC became responsible for all nuclear matters in South Africa, including uranium enrichment. A significant amendment of the Nuclear Energy Act followed in 1988 – the Nuclear Energy Amendment Act – that created the autonomous Council for Nuclear Safety, responsible for nuclear licensing and separate from the AEC.<sup>9</sup>

By 1993, as the country was negotiating its democratic constitution, the Nuclear Energy Act of 1982 was replaced by the Nuclear Energy Act No. 131 of 1993. This secured the autonomy of the Council for Nuclear Safety and provided for the implementation of a safeguards agreement with the IAEA pursuant to the requirements of the NPT, to which South Africa acceded in June 1991.

Besides the secret nature of South Africa's nuclear weapons programme and securitisation of the apartheid state, the nuclear policy framework was predominantly directed at a military and nuclear weapons programme outside international oversight. Hence, post-1994 South Africa's efforts focused on implementing the ruling party's position on nuclear energy and the domestication of the country's international commitments.

## Policies and legislation

South Africa has incorporated its obligations in terms of international agreements, referred to earlier, into its domestic legislation and policy. Various sources inform the South African government's policy on nuclear non-proliferation, arms control and disarmament practices, including acts of Parliament. These acts represent a complete overhaul of South Africa's nuclear energy governance architecture. By 2020 some of this legislation had been amended several times, reflecting new global developments and South Africa's commitment to them. These included the:

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9 International Atomic Energy Agency, "Country Nuclear Power Profiles: South Africa", 2020, <https://cnpp.iaea.org/countryprofiles/SouthAfrica/SouthAfrica.htm>.

- Nuclear Energy Act No. 46 of 1999, which superseded the Nuclear Energy Act of 1993 and established the Nuclear Energy Corporation of South Africa (NECSA), successor to the AEB and AEC;
- National Nuclear Regulator Act No. 47 of 1999, establishing the National Nuclear Regulator (NNR) that superseded the Council for Nuclear Safety;
- National Conventional Arms Control Act No. 41 of 2002;
- Non-Proliferation of Weapons of Mass Destruction Act No. 87 of 1993, as amended in 1995, 1996 and 2005, which enabled the establishment of the South African Council for the Non-Proliferation of Weapons of Mass Destruction (NPC); and
- National Radioactive Waste Disposal Institute Act No. 53 of 2008, endorsing the establishment of the South African National Radioactive Waste Disposal Institute (NRWDI).

Besides these acts, the nuclear sector in South Africa is also governed by several other related acts (see Box 1), including apartheid-era legislation that, ironically, remains relevant today. This legislation shows that nuclear energy in South Africa is subject to comprehensive oversight and regulation by the state while also obliging the state – as the final guarantor of the country's nuclear safety and security – to be compliant with international law.

BOX 1	OTHER NUCLEAR-RELATED LEGISLATION IN SOUTH AFRICA
<ul style="list-style-type: none"> <li>• Anti-Personnel Mines Prohibition Act No. 36 of 2003</li> <li>• Aviation Act No. 74 of 1962</li> <li>• Criminal Law Second Amendment Act No. 126 of 1992</li> <li>• Cross-Border Road Transport Act No. 4 of 1998</li> <li>• Customs and Excise Act No. 91 of 1964</li> <li>• Defence Act No. 42 of 2002</li> <li>• Dumping at Sea Control Act No. 73 of 1980, as amended by Act No. 73 of 1995</li> <li>• Explosives Act No. 15 of 2003</li> <li>• Hazardous Substances Act No. 15 of 1973</li> <li>• Interception and Monitoring Prohibition Act No. 127 of 1992</li> <li>• Internal Security Act No. 74 of 1982</li> <li>• International Trade Administration Act No. 71 of 2002</li> <li>• Maritime Zones Act No. 15 of 1994</li> <li>• Mine Health and Safety Act No. 29 of 1996</li> </ul>	<ul style="list-style-type: none"> <li>• Mineral and Petroleum Resources Development Act No. 28 of 2002</li> <li>• National Environmental Management Act No. 107 of 1998</li> <li>• National Key Points Act No. 102 of 1980, as amended by Act No. 47 of 1985</li> <li>• National Radioactive Waste Disposal Institute Act No. 53 of 2008</li> <li>• National Road Traffic Act No. 93 of 1996</li> <li>• National Strategic Intelligence Act No. 39 of 1994, as amended by Act No. 67 of 2002</li> <li>• National Water Act No. 36 of 1998</li> <li>• Patent Act No. 57 of 1978</li> <li>• Prohibition of Mercenary Activities and Regulation of Certain Activities in Country of Armed Conflict Act No. 27 of 2006</li> <li>• Protection of Constitutional Democracy against Terrorist and Related Activities Act No. 33 of 2004</li> <li>• Protection of Information Act No. 84 of 1982</li> <li>• Space Affairs Act No. 84 of 1993</li> <li>• The Prohibition of Certain Conventional Weapons Act No. 18 of 2008</li> </ul>

Source: NPC, *The Twenty-Fourth Annual Report of the South African Council for the Non-Proliferation of Weapons of Mass Destruction. Report Period: 1 April 2017 – 31 March 2018* (Cape Town: PMG, 2019), 24, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/2017-2018\\_Annual\\_Report\\_of\\_the\\_Non-Proliferation\\_Council\\_2.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/2017-2018_Annual_Report_of_the_Non-Proliferation_Council_2.pdf); Department of Energy, "Nuclear Energy: Core Function", [http://www.energy.gov.za/Nuclear/nuclear\\_core.html](http://www.energy.gov.za/Nuclear/nuclear_core.html).

Several government notices, such as Government Notice No. 20 (3 February 2010), include the declaration of certain nuclear-related dual-use equipment, materials and software and related technology as controlled goods, and control measures applicable to such goods. Government Notice No. 21 (3 February 2010), for example, includes an additional declaration of certain nuclear-related dual-use equipment, materials and software and related technology as controlled goods, and control measures applicable to such goods. Government Notice No. 22 (3 February 2010) contains a declaration of certain missile technology and related items as controlled goods, and control measures applicable to such goods.<sup>10</sup>

Except for a few pre-1994 pieces of legislation, it is evident from Table 1 and Box 1 that the golden age of nuclear governance legislation and normative innovation in South Africa took place during the tenures of presidents Mandela and Mbeki. Overall, this period was characterised by the undoing of apartheid-era racially based legislation, and by the country's full re-integration into the international community. More importantly, this period was a precursor of the country's renewed interest in the peaceful use of nuclear technology in particular to meet its increased energy demand and ambition to retain its status as a credible nuclear state. In fact, by 1993, on the eve of the country's democratic transition, it launched the Nuclear Pebble Bed Modular Reactor (PBMR) project. Another reason for the renewed interest was to meet the country's international climate change commitments to reduce its carbon emissions. Geopolitical and normative changes in the wake of the end of the Cold War, the reduction in global nuclear arsenals and an emphasis on the peaceful use of nuclear energy also played a role.

Finally, some of the ANC's most vocal campaigners for South Africa's nuclear disarmament and the peaceful use of nuclear energy, such as Abdul Minty, Aziz Pahad and Trevor Manuel, entered government. There their views, that of the ruling party and the country's post-apartheid commitments could be aligned and legislated. In August 1994, barely four months after South Africa's first democratic elections, the cabinet adopted the country's non-proliferation and arms control policy in order to implement a clear policy on weapons of mass destruction (WMD). This policy declared South Africa's intention to actively participate in various non-proliferation regimes and suppliers' groups, and adopt positions supporting the non-proliferation of weapons of mass destruction to promote international peace and security. It would also use its position as a member of the various suppliers' regimes and of the Africa Group and Non-Aligned Movement (NAM) to 'promote the importance of non-proliferation and to ensure that these controls do not deny developing countries access to advanced technologies required for peaceful purposes and their developmental needs'.<sup>11</sup>

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10 NPC, "Legislation and Regulations: South African Legislation on Non-Proliferation of WMD", 2020, <https://www.thedti.gov.za/nonproliferation/legislation.htm>.

11 NPC, *The Twenty Fifth Annual Report of the South African Council for the Non-Proliferation of Weapons of Mass Destruction. Report Period: 1 April 2018 to 31 March 2019* (Cape Town: PMC, 2019) 2, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation\\_Annual\\_Report\\_2018\\_-\\_2019-Final.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation_Annual_Report_2018_-_2019-Final.pdf).



The South African government adopted the Nuclear Energy Policy for the Republic of South Africa in 2008.<sup>12</sup> It is still the official South African policy document on its nuclear energy expansion plans. The country's nuclear energy development 'is premised on Article IV of the Treaty on the Non-proliferation of Nuclear Weapons (NPT) which affirms South Africa's inalienable right to research, develop, produce and use nuclear energy for peaceful purposes'.<sup>13</sup>

The country's nuclear energy development 'is premised on Article IV of the Treaty on the Non-proliferation of Nuclear Weapons which affirms South Africa's inalienable right to research, develop, produce and use nuclear energy for peaceful purposes'

Hence, the objectives of the Nuclear Energy Policy for the Republic of South Africa include:

- promoting nuclear energy as an important electricity supply option through the establishment of a national industrial capability for the design, manufacture and construction of nuclear energy systems;
- establishing the necessary governance structures for an extended nuclear energy programme;
- creating a framework for safe and secure utilisation of nuclear energy with minimal environmental impact;
- contributing to the country's national programme of social and economic transformation, growth and development;
- guiding actions to develop, promote, support, enhance, sustain and monitor the nuclear energy sector in South Africa;
- attaining global leadership and self-sufficiency in the nuclear energy sector in the long term;
- exercising control over unprocessed uranium ore for export purposes for the benefit of the South African economy;
- establishing mechanisms to ensure the availability of land (nuclear sites) for future nuclear power generation;

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12 Department of Minerals and Energy, "Nuclear Energy Policy for the Republic of South Africa" (DME, Pretoria, June 2008), [http://www.energy.gov.za/files/policies/policy\\_nuclear\\_energy\\_2008.pdf](http://www.energy.gov.za/files/policies/policy_nuclear_energy_2008.pdf).

13 DME, "Nuclear Energy Policy", 6.

- allowing the participation of public entities in the uranium value chain;
- promoting energy security for South Africa;
- improving the quality of human life and supporting the advancement of science and technology;
- reducing greenhouse gas emissions; and
- ensuring skills development related to nuclear energy.<sup>14</sup>

## Nuclear governance and regulating entities

In May 2009, following the national elections that brought Jacob Zuma to power, the Department of Minerals and Energy was split into two new departments, namely the Department of Energy (DoE) and the Department of Mineral Resources. Further restructuring took place after the national elections of 2019, when these departments were amalgamated into the Department of Mineral Resources and Energy (DMRE).

The DMRE plays the most important role in nuclear governance in South Africa. In fact, its stated purpose is to ‘manage the South African nuclear energy industry and control nuclear material in terms of [its] international obligations, nuclear legislation and policies to ensure the peaceful use of nuclear energy’.<sup>15</sup>

Moreover, the DMRE also oversees the<sup>16</sup>

- management and implementation of all matters relating to nuclear safety and technology, as required by legislation and international agreements, in South Africa; and
- implementation of South Africa’s Nuclear Energy Policy in terms of the country’s Integrated Resources Plan.

It also administers South Africa’s nuclear safety, liability and emergency management, and manages and implements the country’s nuclear non-proliferation and radiation security commitments in terms of national legislation and international agreements.<sup>17</sup> The DMRE, in fulfilling South Africa’s nuclear governance obligations, oversees a number of nuclear energy-related state-owned entities (see Table 2).

The DMRE’s functions also include governing South Africa’s commitment to the peaceful use of nuclear energy and non-proliferation. It does this by accounting for and controlling

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<sup>14</sup> DME, “Nuclear Energy Policy”, 9–10.

<sup>15</sup> PMG, “Department of Mineral Resources and Energy Strategic Plan and the 2020–2021 Annual Performance Plan” (Presentation to the Portfolio Committee on Mineral Resources and Energy, Cape Town, May 7, 2020), <https://pmg.org.za/committee-meeting/30156/>.

<sup>16</sup> PMG, “Department of Mineral Resources”.

<sup>17</sup> PMG, “Department of Mineral Resources”.

nuclear material by issuing nuclear authorisations, ensuring domestic government and private sector compliance by conducting inspections and audits, and by regulating the security of nuclear material and nuclear facilities in South Africa.<sup>18</sup>

TABLE 2 DEPARTMENT OF MINERAL RESOURCES AND ENERGY ENTITIES		
Entity	Legislation	Function
NNR	National Nuclear Regulator Act No. 47 of 1999	<ul style="list-style-type: none"> <li>• Protect persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices</li> </ul>
NRWDI	National Radioactive Waste Disposal Institute Act No. 53 of 2008	<ul style="list-style-type: none"> <li>• Long-term management and disposal of radioactive waste in a technically sound, socially acceptable, environmentally responsible and economically feasible manner</li> </ul>
South African National Energy Development Institute (SANEDI)	National Energy Act No. 34 of 2008	<ul style="list-style-type: none"> <li>• Direct, monitor and conduct applied energy research and development, demonstration and deployment, as well as undertake specific measures to promote energy efficiency (EE) throughout the economy</li> <li>• Establish a nationally focused energy research, development and innovation sector and undertake EE measures with a strong relevance to South Africa</li> </ul>
NECSA	National Energy Act No. 34 of 2008	<ul style="list-style-type: none"> <li>• Undertake and promote research on nuclear energy, radiation sciences and technology</li> <li>• Process source, special nuclear and restricted material, including uranium enrichment</li> <li>• Collaborate with other entities</li> </ul>
The Central Energy Fund (CEF) Group of Companies (SOC) Ltd	Central Energy Fund Act No. 38 of 1977	<ul style="list-style-type: none"> <li>• Meet future energy needs of South Africa, SADC and sub-Saharan Africa, including oil, gas, electrical power, solar energy, low-smoke fuels, biomass, wind and renewable energy sources</li> <li>• Manage the operation and development of the oil and gas assets of the South African government</li> </ul>
National Energy Regulator of South Africa (NERSA)	National Energy Regulator Act No. 40 of 2004	<ul style="list-style-type: none"> <li>• Regulate electricity, piped gas and petroleum pipeline industries within South Africa</li> </ul>

Source: Parliamentary Monitoring Group, "Budgetary Review and Recommendation Report of the Portfolio Committee on Mineral Resources and Energy (Vote 26), 22 October 2019", <https://pmg.org.za/taled-committee-report/3951/>

The NNR monitors and enforces regulatory safety and security standards in compliance with the standards set by the IAEA and the International Commission on Radiation Protection. Hence, some of its functions include safety case reviews and assessments, authorisations, compliance assurance inspections, enforcement, drafting of regulatory documents and overseeing of emergency planning and preparedness.<sup>19</sup>

<sup>18</sup> PMG, "Department of Mineral Resources".

<sup>19</sup> NNR, "Our Role and Functions", <http://www.nnr.co.za/our-role-and-functions/>.

Regionally, the NNR participates in technical steering committees and working groups of the Forum of Nuclear Regulatory Bodies of Africa (FNRBA), whose purpose is to<sup>20</sup>

[p]rovide for the enhancement, strengthening and harmonization of the radiation protection, nuclear safety and security regulatory infrastructure and framework among the members of FNRBA; and to provide for mechanisms for the FNRBA to be an effective and efficient internationally recognized forum for the exchange of regulatory experiences and practices among the nuclear regulatory bodies in Africa.

The forum comprises 34 member countries on the continent. South Africa plays a leading role in the FNRBA, which was given impetus by the coming into force of the Pelindaba Treaty. The NNR coordinates Technical Working Group (TWG) 3, which focuses on regulatory infrastructure for nuclear power plants. A total of 17 countries are represented: Burkina Faso, the Democratic Republic of Congo, Egypt, Ethiopia, Ghana, Kenya, Libya, Morocco, Namibia, Niger, Nigeria, Senegal, South Africa, Sudan, Tanzania, Tunisia and Uganda.<sup>21</sup> TWG3 members have all been engaging with the IAEA to assess their readiness to embark on a nuclear power programme, or have expressed their interest in doing so.<sup>22</sup>

## Breaking from the past: South Africa's nuclear non-proliferation export control policy

The post-1994 government has tried to undo the historical legacy of the country's nuclear weapons programme. As Africa's most advanced nuclear science and technology country, South Africa has the largest nuclear-related and dual-use goods industry on the continent. In a departure from its former secret military nuclear weapons programme, it has positioned itself as a 'reliable and responsible supplier, recipient, producer and end user of sensitive goods and technologies'<sup>23</sup> for the peaceful use of nuclear energy. To achieve this, it legislated the Non-Proliferation of WMD Act as its primary nuclear non-proliferation legislation and the basis for its policy on non-proliferation, arms control and disarmament (see Box 2).

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20 Forum of Nuclear Regulatory Bodies of Africa, *Charter of the Forum of Nuclear Regulatory Bodies of Africa (FNRBA)* (Vienna: IAEA, 2009), <https://gnssn.iaea.org/main/FNRBA/SiteAssets/CoreDocuments/CHARTER%20FNRBA%20ENG-FR.pdf>.

21 NNR, "International Cooperation", <http://www.nnr.co.za/international-cooperation/>.

22 Laura Gil, "Is Africa ready for Nuclear?", IAEA, September 3, 2018, <https://www.iaea.org/newscenter/news/is-africa-ready-for-nuclear-energy>.

23 NPC, *The Twenty Fifth Annual Report of the South African Council for the Non-Proliferation of Weapons of Mass Destruction. Report Period: 1 April 2018 to 31 March 2019* (Cape Town: PMC: 2019), [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation\\_Annual\\_Report\\_2018\\_-\\_2019-Final.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation_Annual_Report_2018_-_2019-Final.pdf).

## BOX 2 SOUTH AFRICA'S POLICY ON NON-PROLIFERATION, ARMS CONTROL AND DISARMAMENT

South African policy on non-proliferation, arms control and disarmament practices can be summarised in the following statements by the government:

- since the adequate protection of rights to life and security of the person against repression and acts of aggression is fundamental to the well-being and to the social and economic development of every country; and
- since it is the duty of every government to protect and safeguard the rights of its people; and
- since every responsible country has the right to acquire arms to equip and defend itself against acts of aggression; and
- since the Republic is a responsible member of the international community and will not trade in arms with states engaged in repression, aggression and terrorism; and
- since the Republic is engaged in various aspects of the trade in weapons and related materials, equipment, technology and services; and
- since South Africa utilises its position as a State Party to Treaties, as a member of the Control Regimes and of the Africa Group and NAM to promote the importance of non-proliferation, disarmament and arms control and to ensure that these controls do not become the means whereby the developing countries are prevented from obtaining access to the advanced technologies which they require for their development; and
- since it is vitally important to ensure accountability in all matters concerning arms trade, therefore;
- it is South Africa's declared national interest in conjunction with its international obligations and commitments, particularly as these relate to non-proliferation, disarmament and arms control, and the implementation of international humanitarian law, to exercise due restraint in the transfer and trade in weapons and related materials, equipment, technology and services.

In a competitive international market it is important that South Africa and its related industry is regarded as a responsible and reliable supplier of weapons and related materials, equipment, technology, aid and services. The government will support the export initiatives of the related industries by permitting it to contract and honour obligations that have been duly approved. However, the government reserves the right to prohibit or withdraw such support at any time, should it be in conflict with South Africa's national or international interests.

South Africa acknowledges the need for consistency and effective interaction between the control authorities and the broad scope of industry. Trade in weapons/armaments/defence equipment and related materials, equipment, technology and services form an integral part of South Africa's foreign, defence, trade and industrial policies and initiatives.

In respect of activities related to WMD, South Africa prohibits:

- the conduct of nuclear explosions and tests in South Africa;
- any person, whether for offensive or defensive purposes, to be or become involved in any activity or with goods that contribute to WMD programmes;
- any person to be or become involved in any dual-use goods or activities that could contribute to WMD:
  - » with countries, individuals, groups, undertakings and entities subject to restrictions imposed by the UN Security Council acting under Chapter VII of the UN Charter; and
  - » with countries, individuals, groups, undertakings and entities involved in international terrorism, including non-state actors.

Source: Department of Trade and Industry, "National Policy on Non-Proliferation, Disarmament and Arms Control", <https://www.thedti.gov.za/nonproliferation/policy.htm>

Moreover, the Non-Proliferation of WMD Act controls and manages matters relating to the proliferation of such weapons in South Africa. The act, for example, prohibits<sup>24</sup>

- the conduct of nuclear explosions and tests in South Africa; and
- any person to be or become involved in any activity or with goods that contribute to WMD programmes; any person to be or become involved in any dual-use goods or activities that could contribute to WMD with countries, individuals, groups, undertakings and entities subject to restrictions imposed by the UN Security Council acting under Chapter VII of the UN Charter; and involved in international terrorism, including non-state actors.

South Africa's promulgation of the Non-Proliferation of WMD Act is significant for a number of reasons. Firstly, the legislation generated some diplomatic and security benefits for the country. Through the act, South Africa – after entering the NPT in 1991 – illustrated its commitment to global nuclear non-proliferation. Secondly, by adopting the act South Africa prepared itself for membership of other nuclear export control regimes, such as the MTCR

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<sup>24</sup> Republic of South Africa, "Non-Proliferation of Weapons of Mass Destruction Act No. 87 of 1993", *Government Gazette* 337, no. 1159 (July 2, 1993), [https://www.gov.za/sites/default/files/gcis\\_document/201504/act87of1993.pdf](https://www.gov.za/sites/default/files/gcis_document/201504/act87of1993.pdf).



and the NSG, which it joined in 1995. Thirdly, the act enabled the South African government, through the NPC, to maintain control over the import and export of dual-use and sensitive goods.

South Africa employs two governance mechanisms or institutions to control and regulate its nuclear exports, imports and controlled goods in transit, namely the Council for the Non-Proliferation of Weapons of Mass Destruction (NPC) and the National Conventional Arms Control Committee (NCACC). The minister of trade and industry appoints the members of the NPC, whereas a higher state authority, ie, a statutory committee of cabinet and the president, appoints the members of the NCACC. The NCACC is not under discussion here as, in terms of section 4 of the National Conventional Arms Control Act, the functions of the NCACC include 'the regulation of development, manufacturing and transfer of conventional arms in South Africa'.<sup>25</sup>

In South Africa all transfers of listed technologies, equipment and material require permits issued by the NPC, established in terms of the Non-Proliferation of WMD Act (as amended in 1995 and 1996), administered by the minister of trade and industry. In terms of the act, the NPC, 'on behalf of the State protect[s] the interests, carr[ies] out the responsibilities and fulfil[s] the obligations of the Republic with regard to non-proliferation'.<sup>26</sup> In addition to this, the functions of the NPC are also to control and manage all activities relating to non-proliferation and to supervise and implement South Africa's compliance with international conventions, treaties and agreements related to non-proliferation affairs and issues.

As the NPC oversees the implementation of South Africa's nuclear export control policy in compliance with South Africa's international commitments, it has produced a 94-page document, "Internal Compliance Programme for Industry", on guidelines for the South African industry.<sup>27</sup> This document outlines South Africa's non-proliferation policies, legislation, mechanisms, control processes and permit application procedures. It also outlines the multilateral nuclear export control regimes in which the country participates and lists all controlled goods and activities in terms of South African legislation.<sup>28</sup>

South Africa has strict measures in place to regulate the import, transit and export of dual-use goods. Notwithstanding these stringent checks and balances, the country was unable

## South Africa has strict measures in place to regulate the import, transit and export of dual-use goods

25 Republic of South Africa, "National Conventional Arms Control Act No. 41 of 2002", *Government Gazette* 452, no. 24575 (February 20, 2003), [https://www.gov.za/sites/default/files/gcis\\_document/201409/a41-020.pdf](https://www.gov.za/sites/default/files/gcis_document/201409/a41-020.pdf).

26 Republic of South Africa, "Non-Proliferation of Weapons of Mass Destruction Act".

27 NPC, "Compliance and Enforcement: Internal Compliance Programme (ICP) for Industry", <https://www.thedti.gov.za/nonproliferation/compliancepgm.htm#1>.

28 NPC, "Compliance and Enforcement".

to prevent the involvement of South African private entities and citizens in the global nuclear proliferation network of AQ Khan (a Pakistani nuclear scientist and head of that country's nuclear agency), which operated between 1970 and 2004.

Khan's arrest on 31 January 2004 confirmed the diplomatic and security challenges and threats posed by global illicit nuclear proliferation networks. Considered the 'father' of Pakistan's nuclear weapons programme, Khan's nuclear black market spanned the globe and involved actors from more than 30 states, comprising several entities and individuals of different nationalities.<sup>29</sup> It included illicit trade in nuclear equipment, expertise, goods, weapons and nuclear material by, among others, Germany, Iraq, Japan, Libya, Malaysia, The Netherlands, North Korea, Spain, South Korea, Switzerland, Turkey, the UK and the United Arab Emirates. The Khan network also operated in several African states, including Côte d'Ivoire, Egypt, Mali, Mauritania, Niger, Nigeria, South Africa, Sudan and Tunisia.<sup>30</sup>

South African involvement in this global nuclear proliferation ring continues to cast a long shadow over the country's post-apartheid nuclear commitments, as well as nuclear security and safety

South African involvement in this global nuclear proliferation ring continues to cast a long shadow over the country's post-apartheid nuclear commitments, as well as nuclear security and safety.<sup>31</sup> It learnt a number of valuable lessons from this. Besides amendments to the Non-Proliferation of WMD Act in 1995 and 1996 to accommodate changes in the global non-proliferation environment and South Africa's resultant obligations, the Khan incident also offered an opportunity to improve policies and regulations. In 2004 the NPC launched a comprehensive review of South Africa's domestic legislation, policies, control mechanisms, processes and procedures, infrastructure and human resources. This was aimed at maintaining the 'alignment of South African controls with national interests and international obligations and best practice' regarding nuclear energy.<sup>32</sup> The review was completed during the 2012-2013 financial year.<sup>33</sup> However, almost five years passed before further steps were taken. During the 2018-2019 financial year, a task team, consisting of Department of Minerals and Energy (previously the DoE) and Department of Trade and Industry officials, was established to review South African controls on the non-proliferation

29 South African Government, "A Minty on the Illicit International Nuclear Weapon Proliferation Network", September 11, 2007, <https://www.gov.za/minty-illicit-international-nuclear-weapons-proliferation-network>.

30 International Institute for Strategic Studies, *Nuclear Black Markets: Pakistan, AQ Khan and the Rise of Proliferation Networks: A Net Assessment* (London: IISS, 2007), 43-50, 65-88.

31 Jo-Ansie van Wyk, "South Africa and the Global Nuclear Bazaar: Norms and State Identity in the Nuclear Export Control Regime", *Strategic Review for Southern Africa* XXXIV, no. 1 (2012), 45-69.

32 NPC, *The Twenty Fifth Annual*, 7-8.

33 NPC, *The Twenty Fifth Annual*, 7-8.

of WMD. The task team's report is still under consideration by both departments.<sup>34</sup> In 2018 the government issued updated notices to reflect domestic and international changes regarding nuclear science and technology.<sup>35</sup>

Despite the setback to South Africa's reputation as a non-proliferation advocate owing its connection with the AQ Khan network, the country remained a relatively active importer and exporter of controlled goods, attesting to its strong nuclear science and technology base. During 2018 and 2019, for example, the NPC, as outlined in Table 3, received a significant number of applications for the import, export and transit of controlled goods.

	<b>FY2016/17</b>	<b>FY2017/18</b>	<b>FY2018/19</b>	<b>Total</b>
<b>Imports</b>	73	84	91	<b>157</b>
<b>Exports</b>	96	77	104	<b>173</b>
<b>Transit</b>	0	0	1	<b>1</b>
<b>Total</b>	<b>169</b>	<b>161</b>	<b>196</b>	<b>526</b>

Source: South African Council for the Non-Proliferation of Weapons of Mass Destruction, *The Twenty Fifth Annual Report of the South African Council for the Non-Proliferation of Weapons of Mass Destruction. Report Period: 1 April 2018 to 31 March 2019* (Cape Town: PMG, 2019), 17, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation\\_Annual\\_Report\\_2018\\_-\\_2019-Final.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation_Annual_Report_2018_-_2019-Final.pdf)

As Table 3 shows, there was a gradual increase in the number of applications received by the NPC between 2016 and 2019. Controlled goods' exports increased 25.96% year-on-year between 2017/2018 and 2018/2019. This is a significant improvement compared to the 21.87% decline between 2016 and 2018.<sup>36</sup>

Figure 2 provides details of categories of applications for export permits received. Between 2016 and 2019 the NPC received 12 export permit applications relating to nuclear goods.

Figure 3 shows that all applications within the nuclear control goods area, as well as one dual-controlled application, were issued by the NPC.

Figure 4 indicates the number of successful import applications per control area. When comparing figures 3 and 4, it is clear that South Africa remains a net importer of nuclear control goods. Whereas the NPC issued 12 export permits between 2016 and 2019, it approved 53 nuclear-related import applications during the same period. The NPC did not publish any details about these applications, or the controlled goods imported and exported.

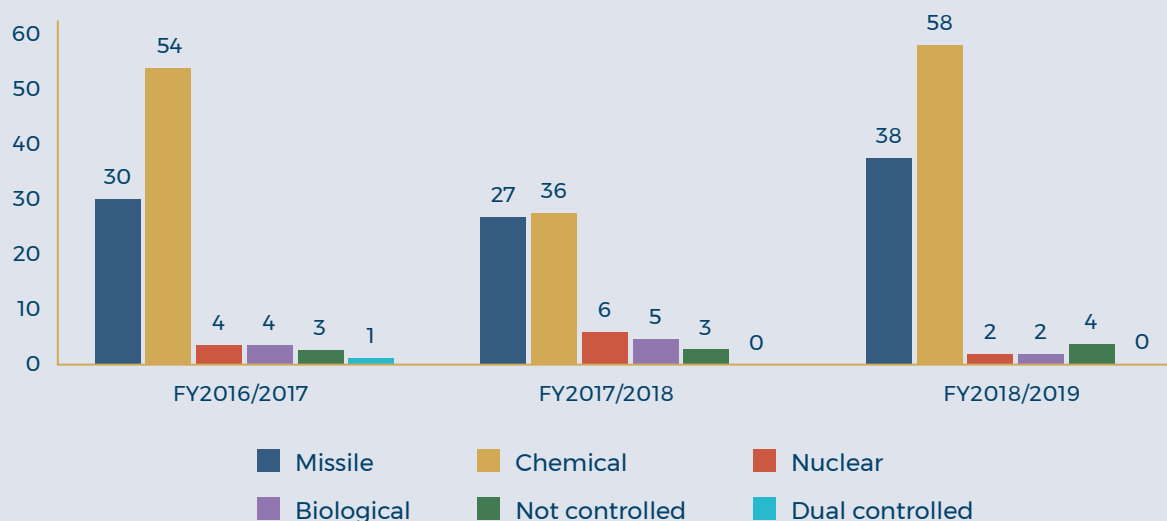
<sup>34</sup> NPC, *The Twenty Fifth Annual*, 7-8.

<sup>35</sup> NPC, *The Twenty Fifth Annual*, 3.

<sup>36</sup> NPC, *The Twenty Fifth Annual*, 3.

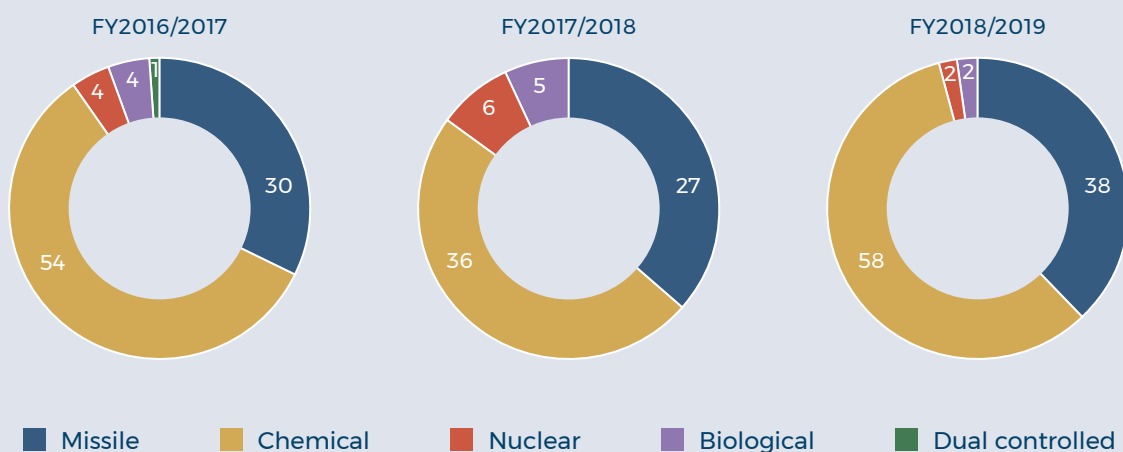
Albeit small compared to other countries, South Africa's private sector nuclear exports and imports take place against a background of strict oversight and control, in compliance with the country's international commitments.

**Figure 2 Total export permit applications received per control area, 2016–2019**



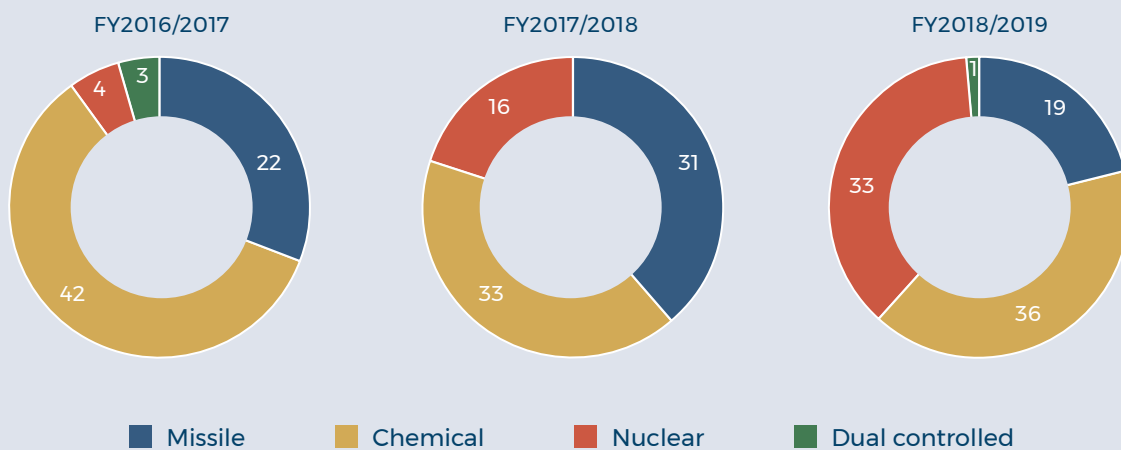
Source: NPC, *The Twenty Fifth Annual Report of the South African Council for the Non-Proliferation of Weapons of Mass Destruction. Report Period: 1 April 2018 to 31 March 2019* (Cape Town: PMG, 2019), 18, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation\\_Annual\\_Report\\_2018\\_-\\_2019-Final.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation_Annual_Report_2018_-_2019-Final.pdf)

**Figure 3 Total export permits issued per control area, 2016–2019**



Source: NPC, *The Twenty Fifth Annual Report of the South African Council for the Non-Proliferation of Weapons of Mass Destruction. Report Period: 1 April 2018 to 31 March 2019* (Cape Town: PMG, 2019), 20, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation\\_Annual\\_Report\\_2018\\_-\\_2019-Final.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation_Annual_Report_2018_-_2019-Final.pdf)

Figure 4 Total import permits issued per control area, 2016–2019

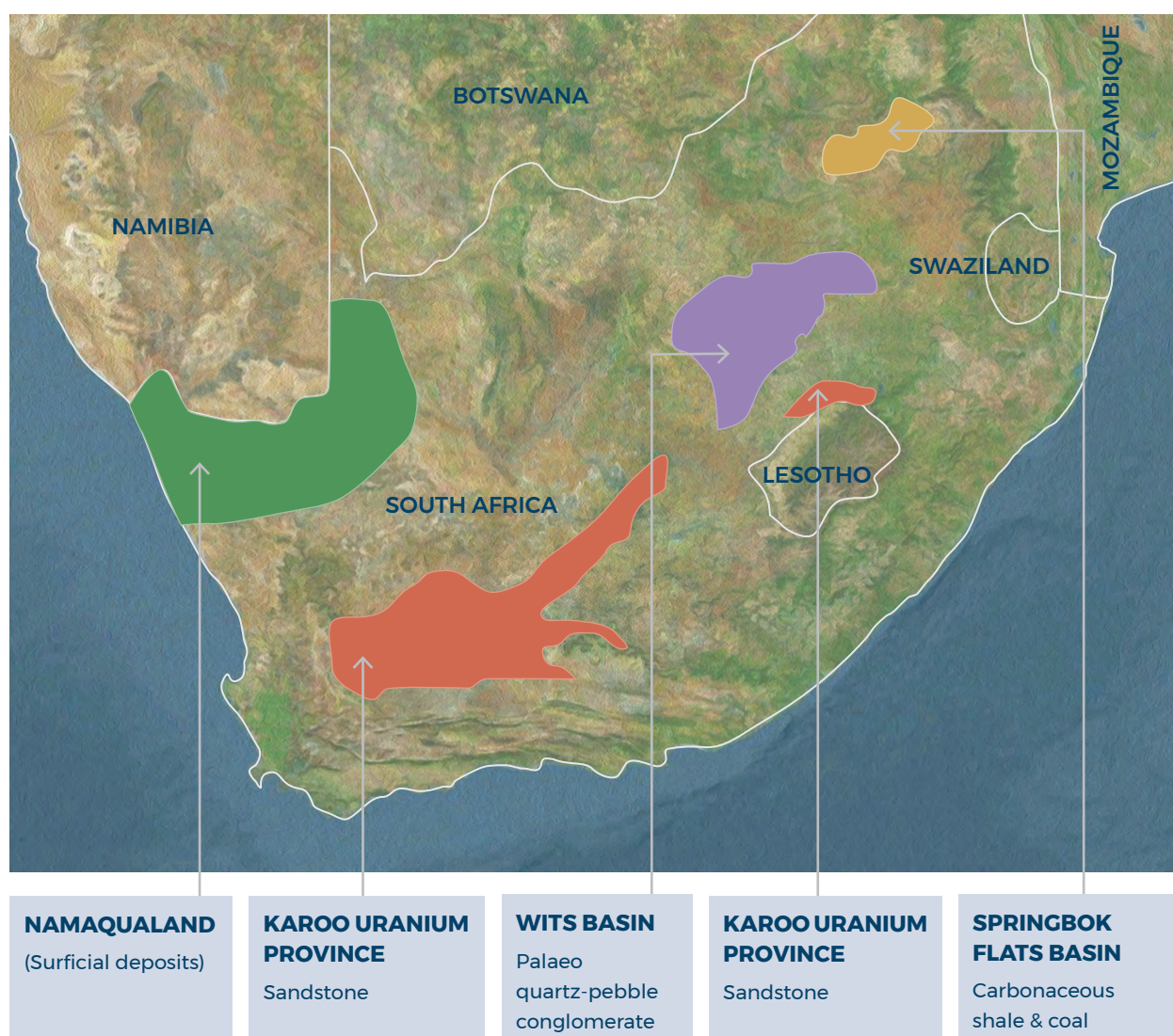


Source: NPC, *The Twenty Fifth Annual Report of the South African Council for the Non-Proliferation of Weapons of Mass Destruction. Report Period: 1 April 2018 to 31 March 2019* (Cape Town: PMC, 2019), 21, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation\\_Annual\\_Report\\_2018\\_-\\_2019-Final.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/Non-Proliferation_Annual_Report_2018_-_2019-Final.pdf)

# The gift of gold: South Africa's uranium resources

South Africa is richly endowed with uranium deposits that are predominantly mined as a by-product of gold. Some of these uranium deposits, most notably those in Namaqualand and the Karoo Uranium Province, are not found alongside gold (See Figure 5).

Figure 5 Major uranium deposits in South Africa



Source: Abdul O Kenan, "Council for Geoscience: An Overview of Uranium in South Africa" (Presentation, UN Framework Classification for Uranium, Johannesburg, November 10–14, 2014), [https://www.unece.org/fileadmin/DAM/energy/se/pp/unfc/UNFC\\_ws\\_SouthAfrica\\_Nov2014/07-Abdul.Kennen-South\\_Africa.pdf](https://www.unece.org/fileadmin/DAM/energy/se/pp/unfc/UNFC_ws_SouthAfrica_Nov2014/07-Abdul.Kennen-South_Africa.pdf)



South Africa is richly endowed with uranium deposits that are predominantly mined as a by-product of gold

Globally, South Africa ranks fifth – after Australia, Kazakhstan, Canada and Russia – in terms of its uranium reserves.<sup>37</sup> Table 4 outlines the country's uranium resources and production, whereas Figure 5 shows the location of its main uranium deposits, with the richest uranium mines in the north of the country.

TABLE 4 SOUTH AFRICA'S URANIUM RESOURCES AND PRODUCTION, 2017						
Uranium resources			Uranium production			
Reasonably assured resources (RAR)			2016	2017		
(ktU)	%	Rank	(tU)	(tU)	%	Rank
322.4	5.6	5	382	257	0.4	12

Source: Latest available official figures from the South African government, obtained from KJ Tshetlhanyane, "Uranium", 2019, in *South Africa's Minerals Industry 2017/2018* (Pretoria: DMR, 2019), 79

Uranium production began in 1952, reaching peak production (6 000 tonnes a year) in the early 1980s. South Africa's uranium production decreased by 32.5% (381.7tU) in 2016 to 257.5tU in 2017 in response to an oversupplied market and lower gold production in the country.<sup>38</sup> Hence, its uranium export sales also decreased by 22%, from ZAR 780/kg (\$58.91/kg) in 2016 to ZAR 608/kg (\$45.92/kg) in 2017, resulting in a 45% drop in uranium sales revenue to ZAR 170 million (\$12.8 million) in 2017.<sup>39</sup>

## A declared strategic mineral

Then energy minister Alex Erwin announced in February 2007 that the South African government had declared uranium a 'strategic mineral' to secure its future supply. This was in preparation for the development of a local nuclear industry ahead of the release of the country's nuclear energy policy (the 2008 Nuclear Energy Policy) and its uranium mining and beneficiation strategy.<sup>40</sup> It followed Mbeki's announcement during his 2007 State

37 KL Revombo, "Energy Minerals Overview", in *South Africa's Minerals Industry 2017/2018* (Pretoria: Department of Mineral Resources, 2019), 56.

38 Tshetlhanyane, "Uranium", 79–80.

39 Tshetlhanyane, "Uranium", 82.

40 South African Government, "Erwin A: Economic Investment and Employment Cluster Media Briefing, 12 February 2007", <https://www.gov.za/erwin-economic-investment-and-employment-cluster-media-briefing-february-2007>.

of the Nation Address (SONA) that his administration was expediting work on ensuring ‘greater reliance on nuclear power generation’.<sup>41</sup>

South Africa’s Nuclear Energy Policy of 2008 states that the country ‘shall endeavour to implement, or obtain interests in, the complete nuclear fuel cycle’ through uranium mining and milling to secure its nuclear fuel supply.<sup>42</sup> Moreover, the policy also envisages uranium conversion and enrichment, fuel fabrication, the reprocessing of used (irradiated) fuel and recycling of fissile materials, and government’s acquisition and management of strategic uranium stockpiles.<sup>43</sup>

Table 5 outlines South Africa’s uranium requirements. As the country embarks on a nuclear power expansion programme and nuclear build, these requirements are set to rise, justifying its declaration of uranium as a strategic mineral.

TABLE 5 SOUTH AFRICA’S URANIUM REQUIREMENTS FOR POWER GENERATION, 2017							
Nuclear electricity generation 2016		Reactors operable 2016		Uranium required 2016	Reactors operable 2017		Reactors operable 2017
Billion TWh	% of power	No	MWe	(tU)	No	MWe	tU
15.1	6.7	2	1830	304	2	1830	279

Source: Latest available official figures from the South African government, obtained from KJ Tshetlhanyane, “Uranium”, in DMR, *South Africa’s Minerals Industry 2017/2018* (Pretoria: DMR, 2019), 79

Uranium has been a contentious mineral since the dawn of the atomic age. South Africa’s nuclear past continues to meddle in the present. Two examples illustrate this. The first is the issue of apartheid South Africa’s HEU stockpile, while the second links uranium to state capture during the Zuma presidency.

## Obama’s promise and South Africa’s highly enriched uranium

One of the legacies of the country’s nuclear weapons programme is its possession of HEU. Since the dismantlement of the programme, the international community has speculated about the country’s remaining HEU stockpile, reportedly totalling ‘several hundreds’ of kilograms.<sup>44</sup> The issue has been complicated by the South African government’s position that ‘[d]etails regarding the uranium stockpiles are classified and therefore cannot be disclosed publicly’.<sup>45</sup> A second factor that contributes to speculations about the existence,

41 “Full Text of Mbeki’s State of the Nation Address”, *IOL*, February 9, 2007, <https://www.iol.co.za/news/politics/full-text-of-mbekis-state-of-nation-speech-314525>.

42 DME, *Nuclear Energy Policy for the Republic of South Africa* (Pretoria: DME, June 2008), 25, [https://www.nrwdi.org.za/file/policy\\_nuclear\\_energy\\_2008.pdf](https://www.nrwdi.org.za/file/policy_nuclear_energy_2008.pdf).

43 DME, *Nuclear Energy Policy*, 18, 26–27.

44 Nuclear Threat Initiative, “Civilian HEU: South Africa”, July 1, 2019, <https://www.nti.org/analysis/articles/civilian-heu-south-africa/>.

45 PMG, “Minister of Energy: Reply to Question 1807 (NW2199E)”, August 2012, [https://pmg.org.za/question\\_reply/342/](https://pmg.org.za/question_reply/342/).

size and possible use of the stockpile relates to South Africa's declared inventory to the IAEA in 1991, as a part of its Initial Safeguards Declaration. While the precise amount of HEU remains classified, it has been reported that 600-800kg HEU was placed under IAEA Safeguards.<sup>46</sup>

Another issue relates to SAFARI-1's use of HEU. South Africa obtained 33kg of HEU from the US for the operation of the 20MW SAFARI-1 reactor in the late 1960s and early 1970s. To comply with its own nuclear non-proliferation commitments, the country, with the assistance of the US, successfully completed the conversion of SAFARI-1 from HEU to LEU use in 2008, making South Africa the first radioisotope producer to complete the conversion process. This conversion is a pre-condition for the supply of radioisotopes by some international markets and today there is no remaining nuclear reactor in South Africa that uses HEU.<sup>47</sup>

In 2011 South Africa repatriated 6.3kg HEU spent fuel to the US, maintaining that the remaining stockpile had been used for the operation of SAFARI-1 to produce medical isotopes. In a letter dated 16 August 2011 US President Barack Obama nudged his South African counterpart, saying that it would be 'a highlight' of the 2012 Nuclear Security Summit in Seoul 'if you [Zuma] were to announce that South Africa will blend down' all its HEU to produce LEU for medical isotope production.<sup>48</sup> In a subsequent letter in 2013, Obama again tried to persuade Zuma to surrender the country's HEU stockpile, stating it was his 'strong hope' that Zuma would be able to announce at the Nuclear Security Summit in The Hague in 2014 'that South Africa will dispose of all its remaining spent HEU fuel'.<sup>49</sup> In return, Obama offered to provide South Africa with 350kg LEU, promote the South African medical isotope industry, and dispatch a team of experts to South Africa. Obama also stated that Zuma's decision should 'build on and enhance South Africa's legacy of nuclear leadership'.<sup>50</sup>

Zuma did not budge, as he was focused on realising his administration's nuclear expansion plans and leading South Africa into the BRICS fold. In addition, he concluded several agreements (later overturned by a South African court) with vendor countries. Uranium also played a role in state capture and nuclear power expansion plans under Zuma. In April 2010 Oakbay Resources and Energy obtained an 74% interest in Dominion (Klerksdorp), a subsidiary of Canadian firm Uranium One in which a mining subsidiary, ARMZ Uranium Holding Co, of the Russian state-owned nuclear company Rosatom had a sizeable share, and renamed it Shiva Uranium. Besides the involvement of Atul Gupta, a member of the family accused of orchestrating grand-scale corruption involving Zuma and his close

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46 Nuclear Threat Initiative, "Civilian HEU"; "Break-in at Nuke Facility 'Covered Up'", *News24*, July 13, 2012, <https://www.news24.com/News24/Break-in-at-uke-facility-covered-up-20120713>.

47 PMG, "Budget Vote Address by Minister of Energy to National Council of Provinces", April 19, 2010, <https://pmg.org.za/briefing/18826/>.

48 Barack Obama, "Letter to Jacob Zuma", *Washington Post*, August 16, 2011, [https://www.washingtonpost.com/r/2010-2019/WashingtonPost/2015/03/13/Foreign/Graphics/Obama-Zuma-2011.pdf?tid=a\\_inl\\_manual](https://www.washingtonpost.com/r/2010-2019/WashingtonPost/2015/03/13/Foreign/Graphics/Obama-Zuma-2011.pdf?tid=a_inl_manual).

49 Barack Obama, "Letter to Jacob Zuma", *Washington Post*, December 12, 2013, [https://www.washingtonpost.com/r/2010-2019/WashingtonPost/2015/03/13/Foreign/Graphics/Obama-Zuma-letter-2013.pdf?tid=a\\_inl\\_manual](https://www.washingtonpost.com/r/2010-2019/WashingtonPost/2015/03/13/Foreign/Graphics/Obama-Zuma-letter-2013.pdf?tid=a_inl_manual).

50 Obama, "Letter to Jacob Zuma", 2013.

## Uranium also played a role in state capture and nuclear power expansion plans under Zuma

circle, Zuma's son, Duduzane, also had a considerable share in the company. They may have been instrumental in seeking government investment from the Public Investment Corporation (PIC), the state-owned investment entity that manages the state's investment portfolio worth ZAR 1.8 trillion (\$244 billion). Initially, when the sale was announced, Oakbay indicated that it had secured financial assistance from the Industrial Development Corporation (IDC), also a state-owned entity. In the end, the PIC investment did not materialise, but Oakbay did manage to secure a loan of ZAR 250 million (\$34 million, or 90% of the purchase price) from the IDC. The loan was meant to be repaid by 2013. Due to non-payment and the accrual of interest, Shiva's debt to the IDC increased to ZAR 377 million (\$51 million), with only ZAR 20 million (\$1.8 million) of the debt paid to the IDC by early 2014. The IDC eventually reduced the interest rate of the loan and converted the debt into a 3.6% share of Shiva Uranium.

It has subsequently emerged that the Guptas' controversial acquisition of Shiva Uranium dovetailed with Zuma's nuclear expansion plans, casting a shadow over the Russian-South African nuclear agreement. South Africa and Russia had signed a 'strategic partnership' agreement in 2014, securing South Africa's acquisition of Russian nuclear reactors for its nuclear power expansion plans.

## Apartheid's nuclear legacy: South Africa's nuclear facilities

Another significant legacy of South Africa's nuclear past is the country's nuclear facilities and installations. These include Koeberg, Pelindaba (the location of the historical weapons programme and the current NECSA headquarters), iThemba LABS and the Vaalputs Radioactive Waste Disposal Facility.

### Koeberg Nuclear Power Plant

Following a 1976 agreement between South Africa and France, French nuclear consortium Framatome built Koeberg, which consists of two reactors with a total capacity of 1 860MW. As Table 6 outlines, these reactors have been operational since April 1984 (Koeberg 1) and July 1985 (Koeberg 2), later than originally scheduled due to the ANC's bombing of Koeberg on 18 December 1982.<sup>51</sup>

Reactors	Operator	Type	Purpose	Net capacity (MWe)	Operational Since	Years in operation (in 2020)	Planned closure	Years in operation since inauguration at planned closure date
SAFARI-1 (Pelindaba)	NECSA	Pool-type research reactor	Research	20	March 1965	55	2030	65
Koeberg 1 (Cape Town)	Eskom	Pressurised water reactor	Power generation	930	April 1984	36	2024	41
Koeberg 2 (Cape Town)	Eskom	Pressurised water reactor	Power generation	930	July 1985	35	2025	40
<b>TOTAL</b>				<b>1 862</b>				

Source: World Nuclear Association, "Nuclear Power in South Africa", 2019, <https://www.world-nuclear.org/information-library/country-profiles/countries-o-s/south-africa.aspx>; Nuclear Energy Corporation of South Africa, "SAFARI-1: About", <http://www.NECSA.co.za/services/safari1/>; NECSA, 2018 *Integrated Annual Report* (Pelindaba: NECSA, 2018), 46, <http://www.NECSA.co.za/wp-content/uploads/2019/02/NECSA-Annual-Report-2018.pdf>

<sup>51</sup> Jo-Ansie van Wyk, "Nuclear Terrorism in Africa: The ANC's Operation Mac and the Attack on the Koeberg Nuclear Power Station in South Africa", *Historia* 60, no. 2 (2015): 51-67.

Located north of Cape Town, Koeberg supplies approximately 6% of South Africa's electricity demand.<sup>52</sup> Koeberg's reactors will reach their 40-year end-of-life design in 2024. According to the Integrated Resource Plan (IRP 2019), the plant's design life and nuclear safety licence will be extended for another 20 years, until 2044.<sup>53</sup> This means that the lifespan of Koeberg's two reactors will effectively total 60 years each. According to the South African government, this extension 'is critical for continued energy security'.<sup>54</sup>

In September 2019, and at the request of the NNR, the IAEA conducted a pre-Safety Aspects of Long-Term Operation (SALTO) peer review of Koeberg.<sup>55</sup> A previous pre-SALTO peer review had been conducted in 2015. The IAEA peer review team included international experts from Belgium, Brazil, the Czech Republic, Japan, France, Romania, Sweden, the UK and the US, and two IAEA staff members. The team concluded that good progress has been made in terms of the 2015 pre-SALTO review, including the<sup>56</sup>

- implementation of a water chemistry programme aligned with IAEA safety standards supporting aging management for safe long-term operation (LTO);
- implementation of a surveillance programme to monitor both reactors' vessel embrittlement under operation for all relevant plant conditions and LTO; and
- use of a simulator of mechanical, electrical, chemistry and radiation protection processes to improve staff performance and plant safety in these areas.

### BOX 3 LONG-TERM OPERATION OF NUCLEAR POWER PLANTS

'Long term operation (LTO) of nuclear power plants is defined as operation beyond an established time frame determined by the license term, the original plant design, relevant standards, or national regulations. As stated in IAEA safety standards, to maintain a plant's fitness for service, consideration should be given to life limiting processes and features of systems, structures, and components (SSC), as well as to reasonably practicable safety upgrades to enhance the safety of the plant to a level approaching that of modern plants.'

Source: IAEA, "IAEA Concludes Long Term Operational Safety Review at South Africa's Koeberg Nuclear Power Plant", September 16, 2019, <https://www.iaea.org/newscenter/pressreleases/iaea-concludes-long-term-operational-safety-review-at-south-africas-koeberg-nuclear-power-plant>

52 DME, *Nuclear Energy Policy*, 13.

53 DME, "Integrated Resource Plan (IRP 2019)", *Government Gazette* 652, no. 42784 (October 18, 2019), 17, 21, 40, 52, 57, <http://pmg-assets.s3-website-eu-west-1.amazonaws.com/191018IRP2019.pdf>.

54 Department of Mineral Resources and Energy, *Annual Performance Plan 2020/21* (Pretoria: DMRE, 2020), 20, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/DMRE\\_APP\\_2020-21\\_V\\_9\\_2.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/DMRE_APP_2020-21_V_9_2.pdf).

55 IAEA, "IAEA Concludes Long Term Operational Safety Review at South Africa's Koeberg Nuclear Power Plant", September 16, 2019, <https://www.iaea.org/newscenter/pressreleases/iaea-concludes-long-term-operational-safety-review-at-south-africas-koeberg-nuclear-power-plant>.

56 IAEA, "IAEA Concludes Long Term".

The peer review team also recommended that Eskom, the owner-operator of Koeberg, ensure the long-term safety of the nuclear power plant by:<sup>57</sup>

- empowering plant management and staff with all necessary mandates and processes, including adequate resources to achieve safe LTO in a timely manner;
- adequately planning and implementing impressed current cathodic protection of the reactor containment, including tests with a mock-up to further improve corrosion prevention; and
- developing and implementing a knowledge management programme.

A comprehensive IAEA SALTO peer review of Koeberg is expected to be conducted in September 2021.<sup>58</sup> This review will determine South Africa's compliance with IAEA Safety Standards and recommend improvements to achieve compliance. It will also strengthen public and international confidence in Koeberg's operations and support licensing for its long-term operation.

## Nuclear Energy Corporation of South Africa

Located at Pelindaba, west of Pretoria, NECSA was established as a public company under the 1999 Nuclear Energy Act, and is completely state-owned. NECSA's main functions are to conduct and promote research and development in the field of nuclear energy and radiation sciences and technology, and to process source material, special nuclear material and restricted material.<sup>59</sup> In addition, the South African Nuclear Energy Policy of 2008 directs NECSA to investigate the entire nuclear fuel cycle to re-establish viable fuel cycle facilities, and to 'serve as the anchor for nuclear energy research, development and innovation' in South Africa.<sup>60</sup>

NECSA SOC Ltd consists of four subsidiaries.

- NTP Radioisotopes SOC Ltd, consisting of subsidiaries AEC Amersham SOC Ltd, NTP Logistics SOC Ltd, NTP Radioisotopes (Europe) S.A., and GammaTec NDT Supplies. The latter consists of three more subsidiaries, namely GammaTec Aseana NDT Supplies, GammaTec Middle East General Trading LLC and Lectromax Australia.
- Pelchem SOC Ltd, consisting of Limited Electronics South Africa SOC Ltd and Ketlapela Pharmaceuticals. Pelchem is the only producer of fluorochemicals in the Southern Hemisphere.

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57 IAEA, "IAEA Concludes Long Term".

58 IAEA, "IAEA Concludes Long Term".

59 DME, *Nuclear Energy Policy*, 13.

60 DME, *Nuclear Energy Policy*.



Hence, the company's mandate is to<sup>61</sup>

manufacture and supply fluorochemicals for local and global markets, retain, maintain critical technology, Intellectual Property and strategic capabilities and skills relating to production of hydrofluoric acid and fluorine gas required for plastics, consumer products, electronics, petrochemicals, stainless steel, mining, and the nuclear fuel cycle among others.

- Arecsa SOC Ltd (Dormant).
- Cyclofil SOC Ltd (Dormant).<sup>62</sup>

NECSA owns and operates the 20MW research reactor, SAFARI-1. Like the Koeberg 1 and 2 reactors, SAFARI-1, a research reactor inaugurated in 1965, is also pushed beyond its original life cycle. The South African government has established a ministerial task team to investigate the acquisition of a new multi-purpose reactor project to replace the aging SAFARI-1 research reactor by 2030.<sup>63</sup>

Since 2016 NECSA has been experiencing operational, financial and governance challenges, and is now considered 'technically bankrupt'.<sup>64</sup> Lapses in safety procedures resulted in the NNR's shutdown of NECSA's NTP radioisotope plant, one of the world's largest commercial producers of the medical isotope Molybdenum-99, in November 2017. Besides the year-long shutdown of the NTP, NECSA also experienced governance challenges such as the suspension of NTP and NECSA board members, and conflicts between NECSA management and board members. Besides an intervention by the then minister of energy to take over direct control of NECSA, the auditor-general raised concerns about inadequate financial provisions for the decommissioning and dismantling of SAFARI-1. Moreover, he noted that NECSA's poor financial governance (which included a failure to report to Parliament) had affected the operation and profitability of the entity. The NTP's production of radioisotopes typically contributes approximately 50% to the NECSA group's annual revenue, but it was lost owing to NECSA's mismanagement of the situation.<sup>65</sup>

## iThemba LABS

The iThemba Laboratory for Accelerator Based Sciences (iThemba LABS) operates the only cyclotron facilities in Africa, and is the largest accelerator facility in the southern hemisphere. iThemba's accelerators are used to accelerate charged particles for basic nuclear physics research, radioisotope production, radiobiology research related to particle

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61 NECSA, *2018 Integrated Annual Report*, 70.

62 NECSA, *2018 Integrated Annual Report*, 8.

63 DMRE, *Annual Performance Plan 2020/21*, 5.

64 "Pulane Kingston (Chair of NECSA Board), Letter to Sahlulele Luzipo, Chair of Portfolio Committee on Mineral Resources and Energy", *Moneyweb*, October 17, 2019, <https://www.moneyweb.co.za/wp-content/uploads/2019/11/NECSA-Board-Update-17-October-20191.pdf>.

65 Chris Yelland, "NECSA, Chairman and CEO on the Ropes ...", *EE Publishers*, December 2, 2018, <http://www.ee.co.za/article/necsa-board-chairman-and-ceo-on-the-ropes.html>.

therapy, and applications such as radiation hardness testing of electronic components used in satellites and detector calibrations.<sup>66</sup>

As a research facility, iThemba LABS (see Table 7) has established a wide network of international scientific collaboration with international research laboratories.

TABLE 7 ITHEMBA LABS INTERNATIONAL RESEARCH COLLABORATION		
Institution	Country	Nature of collaboration
CERN	Switzerland	Access to major research facility
JNIR	Russia	Student training and project equipment development
SOLEIL and CNRS	France	Access to equipment and student co-supervision
FAIR-GSI	Germany	Scientific collaborations: antiproton and ion research
RIKEN	Japan	Technical staff training and transfer of expertise
LEGNARO and ICTP	Italy	Technical project development and student support
BNL	US	South African institutional consortium: iThemba LABS

Source: iThemba LABS, "International Collaborations", April 2018, <https://tlabs.ac.za/wp-content/uploads/2018/04/International-Collaborations.pdf>

iThemba LABS has also signed a number of MoUs with South African and international partners in Botswana, Romania, Sweden, Algeria, Hungary and the Czech Republic. Besides these, it collaborates with various African institutions.

## Vaalputs Radioactive Waste Disposal Facility

Initially, NECSA operated the national repository for low- and intermediate-level nuclear waste at Vaalputs in the Northern Cape. This was commissioned in 1986 for waste from Koeberg and is financed through fees paid by Eskom. In 2008 Vaalputs became the national radioactive waste disposal facility, and continued to be managed by NECSA until 2014 when the NRWDI was established in terms of the National Radioactive Waste Disposal Act. Some low- and intermediate-level waste from hospitals, industry and NECSA itself is disposed of at NECSA's Pelindaba site.

The NRWDI, a state-owned entity, now manages the Vaalputs facility and is responsible for, among others, disposing of all categories of radioactive waste in South Africa, managing orphaned radioactive waste, and maintaining a national radioactive waste database.<sup>67</sup>

One of the main objectives of the NRWDI is the establishment of a Centralised Interim Storage Facility for high-level radioactive waste, particularly spent nuclear fuel, and the

<sup>66</sup> iThemba LABS, "About iThemba", <https://tlabs.ac.za/about/>.

<sup>67</sup> DMRE, *Annual Performance Plan 2020/21*, 129–130.

capture and maintenance of a national radioactive waste database. A published report on the inventory and location of all radioactive waste in the country is also envisaged.<sup>68</sup>

The Radioactive Waste Management Fund Bill is expected to be tabled in the 2020/21 financial year. The purpose of the bill is to secure the financial sustainability of the NRWDI, which is currently funded by the DMRE.<sup>69</sup>

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68 Portfolio Committee on Mineral Resources and Energy, *Report on the Strategic Plan 2020–2025, Annual Performance Plan for 2020/2021 and the Budget Vote No. 34 of the Department of Mineral Resources and Energy* (Cape Town: PMG, June 2, 2020), <https://pmg.org.za/taled-committee-report/4145/>.

69 Portfolio Committee on Mineral Resources and Energy, *Report on the Strategic Plan*.

# Nuclear energy expansion plans

By 2000, with the PBMR programme underway with international partners, there was an expectation that the programme would help to meet South Africa's future energy needs. However, by 2006 it was clear that it was unlikely to do so in the near future. Thus, in 2006 the Mbeki-led government decided to complement the PBMR programme with post-apartheid South Africa's first major nuclear expansion plan. It proposed the construction of a conventional nuclear power plant similar to Koeberg (ie, a pressurised water reactor). The announcement was followed by an environmental impact assessment (EIA) and the identification of three possible sites, ie, Bantamsklip, Thuyspunt and Duynefontein.

## Nuclear-1

In 2007 Eskom approved proposals to double the country's nuclear power generation to 80GWe by 2025. This would increase the contribution of nuclear energy to the country's power pool from 5% to 25%. Nuclear-1, as this expansion plan was referred to, envisaged a much larger programme than the 2006 plans, proposing a total of five nuclear sites and an intention to begin construction in 2016.

However, by the end of 2007 two significant events had occurred. First, the early stages of the country's largest-ever energy crisis and power cuts unfolded. South Africa is a major exporter of surplus power to its region and Eskom, the country's state-owned power utility, is a key actor in the Southern Africa Power Pool. The South African energy crisis had considerable implications for the country's notion of an African Renaissance and its African Agenda under the leadership of Mbeki.

The scale of the energy crisis necessitated urgency and clarity on the country's nuclear future and culminated in the release of its nuclear policy. This in turn spurred the promulgation of the Nuclear Energy Act that, among others, established nuclear governance institutions such as NECSA, SANEDI and the NRWDI (see Table 2).

These developments, however, were soon superseded by a second significant event. In December 2007 Mbeki lost the ANC leadership to Zuma. Mbeki's 'recall' as the country's president followed in September 2008. He was succeeded by deputy president Kgalema Motlanthe, with Zuma waiting in the wings as the ANC president.

In December 2008, during the early months of Motlanthe's presidential tenure, Eskom announced that it would not proceed with the bidding process for Nuclear-1 (with bids received from Areva (France) and Westinghouse [US]) owing to financial constraints. Instead Eskom stated that it would opt for a more affordable fleet approach that would include localisation and technology transfer.

Motlanthe's tenure ended with the 2009 South African elections that brought Zuma to power. His first term in office saw a number of significant nuclear-related decisions. First, the Inter-Departmental Task Team on Energy was established under the Inter-Ministerial Committee on Energy in 2009 to decide on the country's envisaged nuclear programme. Second, Eskom decided to terminate the PMBR programme, ostensibly owing to high costs and insufficient results. Third, Nuclear-1's draft Environmental Impact Report was published in March 2010, followed by the Zuma government's release of its IRP 2010-2030. The IRP outlined the country's energy demands, how it intended to mitigate these, and the cost thereof.

In 2011 Zuma's cabinet approved the IRP after a lengthy public consultation process that adapted the country's energy mix to include a share of 13.4% (compared to the current 5% and previously envisaged 25%) nuclear energy by 2030. This would effectively add 9MWe new nuclear energy generation capacity to the country's energy mix. Seemingly, at the time, South Africa's nuclear energy expansion plans were on track with the bidding process expected to open in 2014. In preparation for the process, Zuma established the National Nuclear Energy Coordination Committee (NNEECC) in November 2011 as the overall authority for the country's nuclear energy expansion programme in his office and acted as its chairperson. In addition, Eskom was designated as the 'owner-operator' of the new nuclear build plan. By the end of 2011, Zuma's energy minister announced that the South African government would spend \$50 billion on nuclear energy development until 2030.

In preparation for these expansion plans, the IAEA, upon the invitation of South Africa, conducted an Integrated Nuclear Infrastructure Review (INIR) in 2013. Typically, the INIR process entails the IAEA's assessing a country's nuclear energy expansion plans to secure its compliance with IAEA safeguards. During his SONAs of 2014, 2015 and 2016, Zuma explicitly referred to his government's nuclear expansion agenda. The South African government's intention to proceed with its nuclear expansion plans attracted significant international interest in the emerging lucrative contracts. Following SONA 2014, for example, South Africa's nuclear suitors lined up and signed a number of bilateral agreements with the country. Areva, a French multinational, promptly signed a cooperation agreement with NECSA. This was followed by a NECSA agreement with the Russian company NIAEP-Atomstroy export and its subsidiary, Nukem Technologies. The agreement included nuclear power plant and waste management, and financial assistance from the Russian government.

An agreement with Rosatom, which was expected to contribute \$10 billion to South Africa's expansion plans, was followed by an agreement with France in October 2014. There were also four agreements with China in November and December 2014, and another one in February 2015. During the course of 2015, agreements with the US, South Korea and Japan followed. Towards the end of 2014 the NNEECC became the Energy Security Cabinet Subcommittee with a mandate over the entire energy mix, intergovernmental agreements were signed and nuclear vendor parades held.

In May 2015 the energy minister announced that the bidding process would begin in September of that year, with the announcement of the successful bidder expected in 2016.

In June 2015 Eskom, by that time under severe financial strain, ceded its designated role in the nuclear expansion plan to the DoE, which had already committed to the country's nuclear future. In December 2015 the cabinet approved the RFP issuance by the DoE for the nuclear programme, endorsing NECSA as the implementing agent and the DoE as the procuring agency. Hereafter, the DoE issued its request for proposals for 9 000MWe nuclear energy.<sup>70</sup>

## Reports of widespread government corruption – and Zuma's involvement in this – culminated in a damning report by public protector Thuli Madonsela in October 2016

Reports of widespread government corruption – and Zuma's involvement in this – culminated in a damning report by public protector Thuli Madonsela in October 2016.<sup>71</sup> The report provided evidence of widespread state capture and corruption by the Zuma presidency. Undeterred, Zuma continued with impunity.

In November 2016 the Department of Energy issued its updated IRP, which now increased the nuclear contribution to the country's energy mix to 30% by 2050.<sup>72</sup> However, in December 2016 Treasury, realising the enormous cost of the expansion plans, withdrew its authorisation for the requests for information (RFIs) and significantly toned down its non-binding request for information from vendors.<sup>73</sup>

Besides Eskom's ceding of its role mentioned earlier and Treasury's reluctance to support Zuma's expansion plans, the Zuma administration's intentions suffered another setback in April 2017 prior to the deadline for the RFI. In a case brought to court by Earthlife Africa and the Southern African Faith Communities' Environment Institute (SAFCEI) against the nuclear build programme, the Western Cape High Court ruled that the government had not complied with constitutional provisions when it signed the nuclear agreements with Russia, the US and South Korea.<sup>74</sup> The ruling also set aside NERSA's approval of two ministerial determinations of November 2013 and December 2016 regarding the procurement of 9.6GWe nuclear energy, as well as Eskom's RFI issued in December

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70 Anthonie Cilliers, "Update: History of Nuclear in South Africa", *ESI Africa*, February 18, 2019, <https://www.esi-africa.com/features-analysis/update-history-of-nuclear-in-south-africa/>.

71 Public Protector of South Africa, "State of Capture: Report No. 6 of 2016/17", *Mail & Guardian*, November 2, 2016, <https://mg.co.za/article/2016-11-02-breaking-read-the-full-state-capture-report/>.

72 Cilliers, "Update: History of Nuclear".

73 Cilliers, "Update: History of Nuclear".

74 *Earthlife Africa (ELA) and the Southern African Faith Communities' Environment Institute (SAFCEI) v Minister of Energy and Others*, High Court of South Africa (Western Cape Division), Judgement, Case No 19529/2016, 26 April 2017, <https://www.groundup.org.za/media/uploads/documents/EarthlifeAfricaJhbnvMinisterOfEnergy.pdf>.

2016.<sup>75</sup> In the meantime, the country's energy crisis resulted in the government's signing agreements with several independent power producers (IPPs), but not shelving its nuclear expansion plans. Following the Final Environmental Impact Report for the siting of the nuclear power stations, the minister of environment, on 18 October 2017, granted environmental authorisation for the construction and operation of a new nuclear power plant at Duynefontein, close to Koeberg.

Opposition to Zuma's corruption in his party resulted in his resignation on 14 February 2018. Besides the devastating financial legacy of the corruption and state capture during his tenure, another outcome was the termination of South Africa's nuclear expansion plans, owing to financial considerations. Ramaphosa inherited a bankrupt Eskom and financially stressed fiscus.

## Ramaphosa's New Nuclear Build Programme

Ramaphosa's decision to shelve the Zuma presidency's nuclear expansion plan was the result of the high cost of the programme and his efforts to gain the trust of international investors. This was, however, repeatedly contradicted by government officials. In May 2018, for example, then energy minister Jeff Radebe confirmed that nuclear energy remained part of South Africa's future energy mix, with Loyiso Tyabashe, the senior manager of Nuclear New Build at Eskom, sharing the view.<sup>76</sup>

Zuma's nuclear decisions and agreements continued to cast a shadow over the country's energy future. Ramaphosa, then deputy president, had attended the cabinet meeting on 9 December 2015 where it was decided to issue a request for proposals for the South African nuclear expansion programme.<sup>77</sup> Rosatom submitted its bid in January 2017 and was widely regarded as the Zuma government's preferred bidder.<sup>78</sup> Following the said Western Cape High Court judgement, South Africa could not honour Zuma's agreements with Russia. Russia's President Vladimir Putin repeatedly brought up the nuclear issue in discussions with Ramaphosa.<sup>79</sup>

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75 *ELA and the SAFCEI v Minister of Energy and Others*.

76 Khulekani Magubane, "Nuclear Still in SA's Energy Mix, Says Jeff Radebe", *Fin24*, May 16, 2018, [https://www.news24.com/fin24/Economy/nuclear-still-in-sas-energy-mix-says-jeff-radebe-20180516?\\_sp=8c39daf0-b5ea-42cd-8711-d6c204d88a04.1591635957686](https://www.news24.com/fin24/Economy/nuclear-still-in-sas-energy-mix-says-jeff-radebe-20180516?_sp=8c39daf0-b5ea-42cd-8711-d6c204d88a04.1591635957686); Carin Smith, "Eskom Continues with Front-End Nuclear Preparation", *Fin24*, May 17, 2018, [https://www.news24.com/fin24/Economy/Eskom/eskom-continues-with-front-end-nuclear-preparation-20180517?\\_sp=8c39daf0-b5ea-42cd-8711-d6c204d88a04.1591635907362](https://www.news24.com/fin24/Economy/Eskom/eskom-continues-with-front-end-nuclear-preparation-20180517?_sp=8c39daf0-b5ea-42cd-8711-d6c204d88a04.1591635907362).

77 Lameez Omarjee, "I Was There When Cabinet Approved Nuclear Programme" – Ramaphosa", *Fin24*, October 30, 2018, <https://www.news24.com/fin24/Economy/i-was-there-when-cabinet-approved-flawed-nuclear-programme-ramaphosa-20181030>.

78 "Russia's Rosatom Bids for Nuclear in SA", *Fin24*, January 24, 2017, [https://www.news24.com/fin24/Economy/rosatom-bids-for-nuclear-in-sa-20170124?\\_sp=8c39daf0-b5ea-42cd-8711-d6c204d88a04.1591636387753](https://www.news24.com/fin24/Economy/rosatom-bids-for-nuclear-in-sa-20170124?_sp=8c39daf0-b5ea-42cd-8711-d6c204d88a04.1591636387753).

79 Sibongile Khumalo, "Ramaphosa Tells Putin the Time's Not Right for Nuclear", *News24*, July 27, 2018, <https://www.news24.com/fin24/Economy/ramaphosa-tells-putin-the-times-not-right-for-nuclear-20180727-2>; Peter Fabricius, "Ramaphosa Pleads Poverty as Putin – Again – Pitches that Big Nuke Deal", *Daily Maverick*, October 25, 2019, <https://www.dailymaverick.co.za/article/2019-10-25-ramaphosa-pleads-poverty-as-putin-again-pitches-that-big-nuke-deal/#gsc.tab=0>.



The Ramaphosa administration released its energy blueprint, the IRP 2019, in October 2019. According to the document, South Africa would consider nuclear energy expansion in the long term but using smaller nuclear units rather than a fleet

The Ramaphosa administration released its energy blueprint, the IRP 2019, in October 2019. According to the document, South Africa would consider nuclear energy expansion in the long term but using smaller nuclear units rather than a fleet.<sup>80</sup> The IPR also proposed that the nuclear power plan should proceed ‘at a scale and pace that flexibly responds to the economy and associated electricity demand, in a manner that avoids tariff shocks in particular’.<sup>81</sup> More importantly, the IPR 2019 includes the decision to ‘[c]ommence preparations for a nuclear build programme to the extent of 2 500 MW at a pace and scale that the country can afford because it is a no-regret option in the long term’.<sup>82</sup>

The National Development Plan Update also acknowledges<sup>83</sup>

the role of nuclear in the energy mix calls for a thorough investigation of the implications of nuclear energy, including its costs; financing options; institutional arrangements; safety; environmental costs and benefits; localisation and employment opportunities; and uranium-enrichment and fuel-fabrication possibilities.

In presenting his portfolio’s Strategic Plan and the 2020–2021 Annual Performance Plan to Parliament in May 2020, Minister of Mineral Resources and Energy Gwede Mantashe informed Parliament of the New Nuclear Build Programme, which was until that point wrapped in denials and uncertainties. Mantashe made several important announcements about the implementation of the programme envisaged for the 2020/21 financial year, specifically the imminent commencement of ‘procurement processes to ensure the security of energy supply’, and that South Africa was considering small modular reactors.<sup>84</sup> Moreover, he confirmed the schedule for the programme, ie, that South Africa aimed to procure 2 500MW nuclear energy by 2024.<sup>85</sup>

Alongside these developments, and in preparation for the New Nuclear Build programme, Mantashe announced various nuclear energy-related legislative changes currently under consideration by cabinet. These include the National Nuclear Regulator Amendment

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80 DMRE, “Integrated Resource Plan (IRP 2019)”, 2019, 13, <http://www.energy.gov.za/IRP/2019/IRP-2019.pdf>.

81 DMRE, “Integrated Resource Plan”, 48.

82 DMRE, “Integrated Resource Plan”, 48.

83 DME, “Integrated Resource Plan”, 98.

84 PMG, “Department of Mineral Resources”.

85 PMG, “Department of Mineral Resources”.

The country's nuclear build programme was envisaged to add 2 500MW to its energy supply, in alignment with the IRP 2019

Bill and the Radioactive Waste Management Fund Bill. The National Energy Regulator Amendment Bill is currently being reviewed by the state law advisor and will be submitted to Parliament for review. The date for the submission to Parliament was not given.<sup>86</sup>

Significantly, on 14 June 2020 he issued a formal RFI: The South African Nuclear New Build Programme. The country's nuclear build programme was envisaged to add 2 500MW to its energy supply, in alignment with the IRP 2019. Although the RFI was an invitation to submit 'Information for the works/goods/services of the South African Nuclear New Build Programme', it also cautioned that it was 'a stand-alone information-gathering and market-testing exercise only, and NOT a competitive tender'.<sup>87</sup> According to the government, the purpose of the RFI is to 'make an assessment of Nuclear Power Plant (NPP) technologies which could be considered under the South African Nuclear Power Programme'.<sup>88</sup> In addition to this, the purpose of the RFI is to<sup>89</sup>

provide an improved understanding of the experience of different Nuclear Power Plant vendors and obtain information from NPP vendors relating [to] the financial and technical aspects. These will include costing and financing of respective NPP technologies; plant design features; license ability of plant design in South Africa; feasibility for construction at sites in South Africa; and a detailed project management plan; as well as indicative contracting models (such as Engineering Procurement Contract (EPC), Engineering Procurement Contract Management (EPCM), Build Own and Operate (BOO), Build Own and Transfer (BOT) and Build Own Operate and Transfer (BOOT).

Given the high cost of nuclear build programmes, the RFI indicates that<sup>90</sup>

[t]he financing options and related ownership models for such a high capital cost programme [are] of great importance. Consideration will be given to the complete range of such options in any future South African nuclear build programme.

Despite these lofty ideals and urgent imperatives, a number of challenges persist.

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86 PMG, "Department of Mineral Resources".

87 DMRE, "Request for Information (RFI): The South African Nuclear New Build Programme", June 14, 2020, <http://www.energy.gov.za/files/tenders/2020/nuclear-rfi/Nuclear-RFI-Advert.pdf>.

88 DMRE, "Request for Information (RFI)", 13.

89 DMRE, "Request for Information (RFI)", 13.

90 DMRE, "Request for Information (RFI)".

# Challenges

South Africa's electricity crisis is the result of widespread state capture, poor governance and corruption. Whereas the IRP 2019 envisages an energy mix that includes other power sources and agreements with IPPs, the country's long-term energy demands remain. The nuclear build option, considered but unrealised by Ramaphosa's predecessor, did not proceed owing to the high costs associated with nuclear energy expansion plans. For the government's plans to proceed, it will have to mitigate the cost of the nuclear build programme while dealing decisively with several other challenges.

South Africa's electricity crisis is the result of widespread state capture, poor governance and corruption

## Inefficient, ineffective and fragmented governance

The South African Constitution, Act 108 of 1996, mandates parliamentary portfolio committees to legislate, conduct oversight and facilitate public participation. Moreover, the Money Bills Amendment Procedure and Related Matters Act No. 9 of 2009 obliges portfolio committees to assess the 'effectiveness and efficiency of a department's use and forward allocation of available resources and may include recommendations on the use of resources in the medium term'.<sup>91</sup> Hence, the purpose of the Portfolio Committee on Mineral Resources and Energy is to<sup>92</sup>

[c]ontribute to the realisation of a developmental state and ensure effective service delivery through discharging its responsibility as a Portfolio Committee of Parliament. Its vision includes enhancing and developing the capacity of Committee Members in the exercise of effective oversight over the Executive Authority. One of the Committee's core objectives is to oversee, scrutinise and influence the action of the Executive and its agencies. This implies holding the Executive and related entities accountable through oversight of objectives of its programmes, scrutinising its budget and expenditure (annually), and recommending through Parliament actions it should take in order to attain its strategic goals and contribute to service delivery.

<sup>91</sup> PMG, *Budgetary Review and Recommendation Report of the Portfolio Committee on Mineral Resources and Energy (Vote 26)*, October 22, 2019, <https://pmg.org.za/taled-committee-report/3951/>.

<sup>92</sup> PMG, *Budgetary Review and Recommendation*.

In 2019 the Portfolio Committee on Mineral Resources and Energy concluded that<sup>93</sup>

[t]he Department [of Mineral Resources and Energy] is doing badly in executing its mandate or the purpose it was created for, which is to ‘... formulate energy policies, regulatory framework and legislation’, amongst others. The deadlines that the Department had set itself for the submission of legislation to Parliament in the Fifth Parliament have passed.

The Portfolio Committee further observed that, although the department had performed well on financial expenditure, its service delivery performance had been consistently below required standards. Table 8 outlines the department’s performance from 2014 to 2019. It has never achieved more than 60% on its performance (80% is required). In 2016/17 and 2017/18 the department reached only 42% of its performance targets and, in 2018/19, only 32%.<sup>94</sup>

TABLE 8 DEPARTMENT OF MINERAL RESOURCES AND ENERGY: SUMMARY OF FINANCIAL AND PERFORMANCE INFORMATION, 2014/15 – 2018/1				
Year	No. of targets set	No. of targets achieved	% targets achieved	% budget spent
2014/15	39	17	44	83.60
2015/16	76	39	51	98.0
2016/17	77	32	42	99.5
2017/18	67	28	42	97.54
2018/19	41	13	32	98.9

Source: PMG, *Budgetary Review and Recommendation Report of the Portfolio Committee on Mineral Resources and Energy* (Vote 26), 22 October 2019, <https://pmg.org.za/taled-committee-report/3951/>

In response, the DMRE blamed its poor performance on ‘delays in discharging outstanding obligations from the Department’s implementation of the New Nuclear Build Programme (NNBP)’.<sup>95</sup> Yet despite its admission of delays and poor governance, the DMRE issued an RFI on the country’s nuclear future in June 2020.

Governance issues have also emerged in terms of the auditing standards of the department’s entities. As Table 9 indicates, only two of the six entities under the department have received a clean audit.

NECSA’s poor governance has resulted in, among others, the corporation’s running at an operating loss of ZAR 95 billion (\$7.1 billion).<sup>96</sup> Moreover, it has failed to submit its annual report to Parliament on time for two consecutive years, thus avoiding accountability.

<sup>93</sup> PMG, *Budgetary Review and Recommendation*.

<sup>94</sup> PMG, *Budgetary Review and Recommendation*.

<sup>95</sup> PMG, *Budgetary Review and Recommendation*.

<sup>96</sup> NECSA, *2018 Integrated Annual Report*, 16.

TABLE 9      AUDIT OUTCOMES OF PUBLIC ENTITIES RELATED TO THE DEPARTMENT OF ENERGY, 2018/19	
Entity	Audit outcome
SANEDI	Unqualified
NERSA	Clean
NNR	Unqualified
CEF	Unqualified
NRWDI	Clean
NECSA	N/A – did not submit annual report

Source: PMG, *Budgetary Review and Recommendation Report of the Portfolio Committee on Mineral Resources and Energy* (Vote 26), 22 October 2019, <https://pmg.org.za/taled-committee-report/3951/>

Safety at the NECSA subsidiary NTP Radioisotopes also remains a grave concern.<sup>97</sup> The Portfolio Committee on Mineral Resources and Energy has received a briefing on NECSA's turnaround strategy, but it remains to be seen when it will achieve the intended results.<sup>98</sup>

Another aspect that challenges South Africa's nuclear governance for development is institutional fragmentation. As Table 10 shows, the country's main nuclear installations, facilities and non-proliferation mechanisms are spread over a number of cabinet portfolios, hindering coordination and effective nuclear governance.

TABLE 10      INSTITUTIONAL FRAGMENTATION VIS-À-VIS NUCLEAR GOVERNANCE IN SOUTH AFRICA	
Institution/facility	Ministry/department
Koeberg	Eskom and Public Enterprises
NECSA	Mineral Resources and Energy
Vaalputs	NECSA and Mineral Resources and Energy
iThemba LABS	Science and Technology
NPC	Trade and Industry

Source: compiled by author

Besides these issues relating to inefficient, ineffective and fragmented nuclear governance in South Africa, the state of Eskom is a major reason for the country's energy crisis. Eskom's woes include the following.

- Governance and leadership instability: Between 2007 and 2018, for example, Eskom had 10 chief executive officers, six chairpersons and multiple changes at senior management levels.

<sup>97</sup> PMG, *Budgetary Review and Recommendation*.

<sup>98</sup> NECSA, "NECSA Turnaround Strategy", April 18, 2018, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/191015necsa\\_strategy.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/191015necsa_strategy.pdf).

- Preference for maintaining Eskom's power monopoly and nuclear energy: Between 2015 and 2018 Eskom's senior management team was a vocal supporter of nuclear energy and refused to sign purchase agreements with IPPs.
- State capture and political interference: Eskom's management was implicated in state capture and found wanting of good corporate governance. By 2020 Eskom was technically bankrupt, owed almost ZAR 420 billion (\$2.6 billion) nearly 15% of South Africa's national debt), and relied on regular government bailouts. It had also been downgraded to junk status.
- Poor infrastructure maintenance: South Africa has experienced widespread power cuts (euphemistically called load shedding) since 2018, with nearly 4GW needing to be shed at certain points as aging and insufficient infrastructure cannot meet rising demands.<sup>99</sup>

Most of these issues have been identified in the IAEA's INIR conducted in South Africa in 2013 to assess the country's readiness to embark on a nuclear build programme. While the IAEA mission report mentioned the fragmented nature of South Africa's regulatory framework, it called on the NNR – as an important oversight body responsible for the country's compliance with international safety and security regulations – to mitigate the fragmented regulatory environment and oversee preparations for the new build programme.<sup>100</sup>

## Dwindling nuclear expertise

The IAEA's INIR mission report mentioned the country's insufficient nuclear expertise and workforce base, and recommended that<sup>101</sup>

South Africa should develop and implement a national human resources strategy and plan to address required improvements in: technical subjects at secondary school level; graduation rates for university engineering programmes; and training of artisans in areas relevant to nuclear industry.

The South African nuclear sector employs approximately 2 700 people.<sup>102</sup> Of these 1 962 are employed at NECSA, 1 200 at Koeberg and the remainder at, for example, iThembaLABS' facilities.<sup>103</sup>

The current workforce and small pool of experts will not be sufficient should the country proceed with its nuclear energy expansion plans. Nuclear science and physics are taught

99 Alina Averchenkova, Kate Elizabeth Gannon and Patrick Curran, *Governance of Climate Change Policy: A Case Study of South Africa* (London: Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science, 2019), 15, [http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/06/GRI\\_Governance-of-climate-change-policy\\_SA-case-study\\_policy-report\\_40pp.pdf](http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/06/GRI_Governance-of-climate-change-policy_SA-case-study_policy-report_40pp.pdf).

100 IAEA, *Mission Report on the Integrated Nuclear Infrastructure Review (INIR)*, 30 January – 8 February 2013, 2013, 3–4, <https://www.iaea.org/sites/default/files/documents/review-missions/inir-report-south-africa-080213.pdf>.

101 IAEA, *Mission Report on the Integrated*, 10.

102 DoE, "Nuclear Energy: Background", [http://www.energy.gov.za/files/esources/nuclear/nuclear\\_back.html](http://www.energy.gov.za/files/esources/nuclear/nuclear_back.html).

103 NECSA, *2018 Integrated Annual Report*, 76; "Koeberg Manager: More Than Just a 9 to 5 Job", *Netwerk24*, April 25, 2018, <https://www.netwerk24.com/ZA/Tygerburger/Nuus/koeberg-manager-not-just-a-9-to-5-job-20180424-2>.

at South African universities such as Cape Town, Witwatersrand, and North-West University (NWU). However, the country also lacks technical skills. Efforts to mitigate these shortages have resulted in the establishment of the NECSA Learning Academy and the Eskom Nuclear Operator Pipeline Project (2016). A number of South Africans have also been trained outside the country, for example at power plant operations in China (2015), and participated in the South African-IAEA Nuclear Energy Management School in 2018.<sup>104</sup> Besides these initiatives, Rosatom signed a training agreement with NWU in 2013, and South Africa and Russia signed the Memorandum on Cooperation in Training Personnel for the South African Nuclear Power Industry in 2015.<sup>105</sup> Inter-governmental training agreements have also been signed with France and South Korea.<sup>106</sup>

Yet these training initiatives and international agreements to improve South Africa's nuclear skills base are not sufficient to meet the demands of the envisaged Nuclear New Build Programme or the country's future energy demands.

## Budget constraints

Table 11 outlines the appropriation and expenditure of the department during the 2018/19 financial year. Programme 5 (Nuclear Energy) has been allocated less than ZAR 1 billion (\$75.5 million), which makes it almost impossible to realise the objectives of the IRP 2019 and contribute to the country's nuclear development.

<b>Programme</b>	<b>Final appropriation (ZAR million)</b>	<b>Actual expenditure (ZAR million)</b>	<b>Variance as % final budget</b>
1 Administration	305,329	304,017	0.43
2 Energy policy & planning	46,073	40,066	13.04
3 Petroleum & petroleum products regulation	79,242	77,044	2.77
4 Electrification & energy programme & project management	5,380,591	5,364,511	0.30
5 Nuclear energy	875,486	875,285	0.02
6 Clean energy	496,811	429,317	9.96
<b>Total</b>	<b>7,163,532</b>	<b>7,090,239</b>	<b>1.02</b>

Note: At the time, the \$ and ZAR exchange rate was US\$1=ZAR13.21

Source: PMG, *Budgetary Review and Recommendation Report of the Portfolio Committee on Mineral Resources and Energy* (Vote 26), 22 October 2019, <https://pmg.org.za/tables-committee-report/3951/>

104 "China Helps South Africa Develop Its Nuclear Workforce", *World Nuclear News*, April 25, 2015, <https://world-nuclear-news.org/Articles/China-helps-South-Africa-develop-its-nuclear-workf>.

105 "Russia to Give SA Nuclear Training Input", *Brand South Africa*, August 12, 2013, <https://www.brandsouthafrica.com/investments-immigration/science-technology/nuclear-120813>; DoE, "Rosatom and South Africa Develop Cooperation in the Nuclear Power Industry", Press Statement, July 9, 2015, <http://www.energy.gov.za/files/media/pr/2015/Media-Statement-Rosatom-and-SA-develop-cooperation-in-the-nuclear-power-industry-09July2015.pdf>.

106 South African Government, "Energy on Nuclear Procurement Process Update", July 14, 2015, <https://www.gov.za/speeches/nuclear-procurement-process-update-14-jul-2015-0000>.



The 2020/21 budget allocation for the combined portfolios (Mineral Resources and Energy) amounts to ZAR 9.3 billion (\$584 million), representing a budgetary decrease of 2.6%. The DMRE's budget allocation for its Nuclear Energy Regulation and Management Programme is outlined in Table 12. It shows that a budget adjustment had been made for the 2019/2020 financial year. Moreover, its allocations in terms of the Medium-Term Expenditure Framework for the 2020–2023 financial years seem to be insufficient to, for example, meet the demands of both the RFI and its existing mandate.

TABLE 12 NUCLEAR ENERGY REGULATION AND MANAGEMENT PROGRAMME BUDGET ALLOCATION								
Programmes	Baseline					Medium-Term Expenditure Framework		
	2016/17	2017/18	2018/19	2019/20		2020/21	2021/22	2022/23
	Audited outcome	Audited outcome	Audited outcome	Voted (main appropriation)	Adjusted appropriation	Revised indicative baseline	Revised indicative baseline	Revised indicative baseline
ZAR (thousand)	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Nuclear energy regulation and management	871,710	793,917	870,006	1,039,305	1,038,536	1,096,059	1,155,815	1,199,493
Total for programmes	9,173,943	9,721,332	8,970,362	9,445,241	9,185,777	9,337,028	9,569,985	10,583,371

Source: PMG, "Department of Mineral Resources and Energy Strategic Plan and the 2020-2021 Annual Performance Plan" (Presentation to the Portfolio Committee on Mineral Resources and Energy, Cape Town, May 7, 2020), <https://pmg.org.za/committee-meeting/30156/>

## Rising expectations

NECSA presented its Strategic Plan 2020/21 to the Portfolio Committee on Mineral Resources and Energy on 20 May 2020. According to NECSA, its sustainability depends on South Africa's nuclear build programme, the construction of a multi-purpose reactor for nuclear research and isotope production, and the establishment of a state-owned pharmaceutical company.<sup>107</sup>

The peaceful use of nuclear energy in South Africa also includes nuclear medicine. In 2019 the country announced the launch of its Nuclear Medicine Research Infrastructure project

<sup>107</sup> AB Myoli, "NECSA Group Strategy: Presentation to the Portfolio Committee on Mineral Resources and Energy", PMG, May 20, 2020, [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/200519Necsa\\_Group\\_Strategy\\_Outline\\_20\\_May\\_2020.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/200519Necsa_Group_Strategy_Outline_20_May_2020.pdf).

to establish a distribution network of medical imaging facilities dedicated to drug development and clinical research, expected to be fully operational by 2021.<sup>108</sup>

## The peaceful use of nuclear energy also applies to other areas of health, agriculture and veterinary science in the country

The peaceful use of nuclear energy also applies to other areas of health, agriculture and veterinary science in the country. South Africa's National Institute of Communicable Diseases has built Africa's first mosquito vector mass rearing facility, while its Malaria Sterile Insect Technique project has completed a pilot mass rearing facility with a small-scale pilot release programme scheduled for 2020. South Africa also participates in regional veterinary projects to detect zoonotic diseases in wildlife and livestock. In addition, the country takes part in the Food and Agriculture Organization and the IAEA's Veterinary Diagnostic Laboratory Network project in African and Asian countries, collaborating to improve diagnostics, treatment, animal health and, ultimately, food and human security.<sup>109</sup>

## Ageing infrastructure

As mentioned earlier, South Africa's nuclear infrastructure is ageing and it is becoming increasingly costly to maintain and/or to extend its life span. SAFARI-1, inaugurated in 1965, is set to operate until 'at least 2030 or longer pending an engineering assessment'.<sup>110</sup> Similarly, the IRP 2019 plan is based on the assumption that Koeberg's plant life will be extended to 2044. However, the following section from the IRP 2019 contains more anxiety-inducing statements than solutions, as it suggests that Koeberg will be extended far beyond 2024 and 2025 (see Table 5).<sup>111</sup>

The extension of design life of the Koeberg Power Station is critical for continued energy security in the period beyond 2024, when it reaches the end of its 40-year life. This extension, once all the necessary regulatory approvals have been received, will increase the capacity to its original design capacity of 1926MW. Eskom is at an advanced stage with technical work required for the extension of the life of Koeberg plant. Eskom is also in the process of applying for the necessary approvals

108 DoE, "Statement Delivered by Ambassador Rapulane Molekane, Permanent Representative, on Behalf of the Republic of South Africa to the 63<sup>rd</sup> Session of the International Atomic Energy Agency (IAEA) General Conference" (IAEA General Conference, Vienna, September 18, 2019), <http://www.energy.gov.za/files/media/speeches/2019/RSA-National-Statement-63rd-IAEA-General-Conference-18092019.pdf>.

109 DoE, "Statement Delivered by Ambassador".

110 NECSA, "SAFARI-1: Future Operational Expectations", <http://www.NECSA.co.za/services/safari1/>.

111 DoE, "Integrated Resource Plan", 17, 21, 40, 52, 57.

from the National Nuclear Regulator. The Department is monitoring progress with Eskom on a regular basis. In order to avoid the demise of the nuclear power in the energy mix, South Africa has made a decision regarding its design life extension and the expansion of the nuclear power programme into the future.

South Africa's nuclear infrastructure is ageing and it is becoming increasingly costly to maintain and/or to extend its life span

## Nuclear safety and security

Safety and security concerns regarding South Africa's nuclear facilities and materials are perennial. On 7 November 2007 Pelindaba's emergency control centre was attacked by four armed assailants, while a second group of four armed intruders attempted to break in at another area of the facility. On 28 April 2012 another break-in, the third in seven years, occurred.<sup>112</sup> South Africa's response to the events as mere criminal acts has been questioned, and a 98-page report commissioned on the 2007 attack was never made public.<sup>113</sup>

To address the issues of nuclear safety and security, the South African government envisages the development of regulations on physical protective measures for nuclear material, and the submission of draft regulations in this respect to the minister for public consultation.<sup>114</sup> However, it remains to be seen whether these will be implemented.

## Public opinion

Historically, South Africa conducted its nuclear affairs in secret. In contrast to the apartheid-era nuclear programme, democratic South Africa's nuclear programme is not military driven. Instead, public oversight of all government decisions is, for example, enshrined in Chapter 9 of the Constitution.<sup>115</sup>

Relatively few public opinion surveys on nuclear energy have been conducted in the country. However, civil society engagement on nuclear energy remains robust. In 2007, for instance, 31 organisations and individuals made presentations to Parliament's public

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112 "Break-in at Nuke Facility".

113 Douglas Birch and J Jeffrey Smith, "How Armed Intruders Stormed Their Way Into a South African Nuclear Plant", *Washington Post*, March 14, 2015, [https://www.washingtonpost.com/world/how-armed-intruders-stormed-their-way-into-a-south-african-nuclear-plant/2015/03/13/470fc8ba-579d-4dba-a0c0-f0a1ed332503\\_story.html](https://www.washingtonpost.com/world/how-armed-intruders-stormed-their-way-into-a-south-african-nuclear-plant/2015/03/13/470fc8ba-579d-4dba-a0c0-f0a1ed332503_story.html).

114 PMG, "Department of Mineral Resources".

115 South Africa, "The Constitution of the Republic of South Africa, Act 108 of 1996" (Pretoria: Government Printer, 1996).

hearings on nuclear energy.<sup>116</sup> In 2018 the Portfolio Committee on Energy received 41 written submissions and 38 requests to make oral submissions on the Draft Integrated Resources Plan 2018.<sup>117</sup> Fourteen organisations made presentations on the Draft Integrated Resources Plan 2018 to the committee in October 2018.<sup>118</sup>

Relatively few public opinion surveys on nuclear energy have been conducted in the country. However, civil society engagement on nuclear energy remains robust

Besides submissions to public hearings, contestation over South Africa's nuclear future and decisions has taken place at community level and in South African courts. Civil society organisations such as Save Bantamsklip and the Thuyspunt Alliance are focusing on the communities affected by the designation of Bantamsklip and Thuyspunt as sites for new nuclear power stations.

Other challenges to the government's nuclear decisions include the application made by Business Day, The Sunday Times and the Council for the Advancement of the South African Constitution in October 2014, under the Promotion of Access to Information Act (PAIA), to request evidence of a record of the Zuma government's decision to continue with its nuclear power plans. In parallel to this application, The Sunday Times submitted a PAIA application to the Presidency, Parliament and the DoE to access the framework agreement South Africa signed with Russia. The request was refused by the DoE because it would 'compromise the delicate negotiations' between South Africa and other vendor countries. The main opposition party in Parliament, the Democratic Alliance, asked the Minister of Energy to appear before Parliament to explain the South Africa-Russia and South Africa-France framework agreements. Minister Tina Joemat-Pettersson failed to do so. Also in November 2014, the SAFCEI made a PAIA application to National Treasury for information regarding the nuclear agreements.<sup>119</sup> In addition, Earthlife Africa Johannesburg and SAFCEI lodged a successful court challenge to the legality of the nuclear procurement

116 Portfolio Committee on Environmental Affairs and Tourism, "Nuclear Energy Impact in South Africa: Public Hearings", PMG, June 20, 2007, <https://pmg.org.za/committee-meeting/9013/>.

117 Portfolio Committee on Energy, *Report of the Portfolio Committee on Energy on the Draft Integrated Resource Plan 2018 (IRP2018) Public Hearings*, PMG, November 27, 2018, <https://pmg.org.za/taled-committee-report/3488/>.

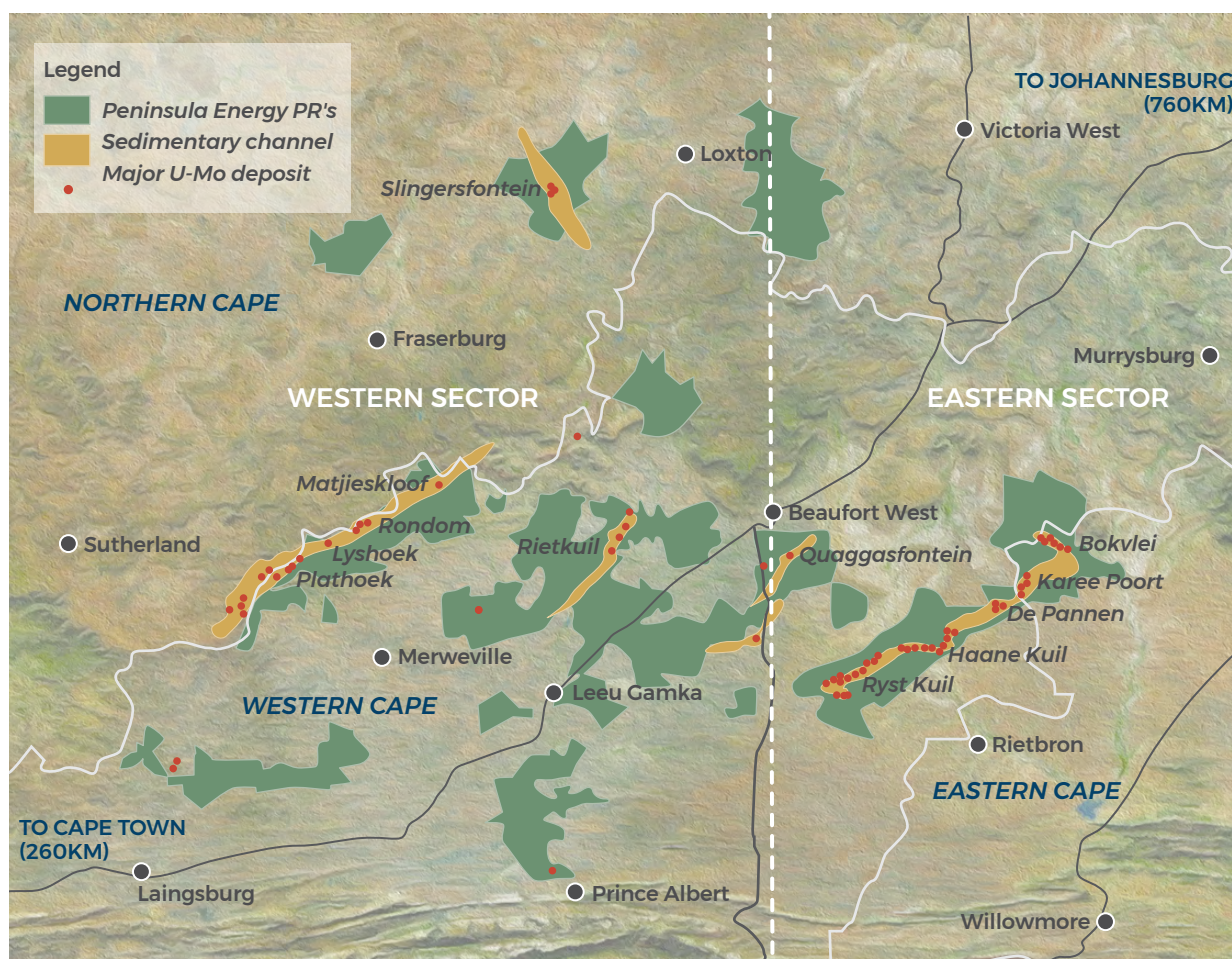
118 Portfolio Committee on Energy, "Draft Integrated Resources Plan 2018: Public Hearings", PMG, October 17, 2018, <https://pmg.org.za/committee-meeting/27278/>.

119 Brenda Martin and David Fig, *Final Report: Findings of the African Nuclear Study* (Johannesburg: Heinrich Böll Stiftung Southern Africa, 2015), 20, [https://www.sortirdunucleaire.org/IMG/pdf/heinrichbo\\_IIstiftung-2015-findings\\_of\\_the\\_african\\_nuclear\\_study-final\\_report.pdf](https://www.sortirdunucleaire.org/IMG/pdf/heinrichbo_IIstiftung-2015-findings_of_the_african_nuclear_study-final_report.pdf).

deal. In 2017 the court declared the agreement with Russia and other vendor countries unconstitutional.<sup>120</sup>

There is also significant public concern about the adverse environmental impact of uranium mining on surrounding areas. Australian firm Peninsula Energy Limited (Peninsula) has obtained prospecting rights across 7 550km<sup>2</sup> in the Karoo (see Figure 6).

**Figure 6 Peninsula Energy's Karoo projects**



Source: Karoo Space, "Uranium Mining Threatens the Karoo", January 18, 2016, <http://karoospace.co.za/uranium-mining-threatens-the-karoo/>

In 2014 the extent of Peninsula's uranium mining ambitions in the Karoo became evident owing to its mining licence applications. Several non-governmental organisations such as Earthlife Africa, SAFCEI and the Southern Cape Land Committee have joined farmers, activists and government departments opposing Peninsula's plans. These organisations

120 Liesl Peyper, "Court Sets Aside Nuclear Deals With Russia, Other Countries", *Fin24*, April 26, 2017, [https://www.news24.com/fin24/Economy/breaking-court-sets-aside-nuclear-deals-with-russia-other-countries-20170426?\\_sp=8c39daf0-b5ea-42cd-8711-d6c204d88a04.1591637025930](https://www.news24.com/fin24/Economy/breaking-court-sets-aside-nuclear-deals-with-russia-other-countries-20170426?_sp=8c39daf0-b5ea-42cd-8711-d6c204d88a04.1591637025930).

were able to prove irregularities in Peninsula's EIA and other related documents submitted in support of its licence application. Having spent approximately \$10 million in legal and consultancy fees, Peninsula decided to sell its rights in the Karoo Uranium Project at the end of March 2018.<sup>121</sup>

These events and developments show that, despite perceptions that South Africans are not knowledgeable about nuclear science and technology, the country has an active civil society that continuously attempts to hold the government accountable, using all available means to do so.

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<sup>121</sup> Stefan Cramer, "Victory for Campaign Against Uranium Mining Project in South Africa's Karoo Region", *The Ecologist*, April 24, 2018, <https://theecologist.org/2018/apr/24/victory-campaign-against-uranium-mining-project-south-africas-karoo-region>.



# Conclusion

South Africa is regarded as the poster child for nuclear disarmament, nuclear non-proliferation and the peaceful uses of nuclear energy. This report set out to sketch South Africa's nuclear context, focusing on the origins and development of the country's nuclear energy sector during the apartheid era when nuclear-related developments took place in secret. The international community only became aware of the full extent of the programme after the IAEA had verified the complete dismantlement of the country's nuclear weapons. South Africa set out to build on the country's non-proliferation and disarmament credentials it accumulated once it ratified the NPT in 1991, signed a Safeguards Agreement with the IAEA, and dismantled its nuclear weapons programme. Illustrating its commitment to nuclear disarmament, the peaceful uses of nuclear energy and nuclear non-proliferation, South Africa joined a number of multilateral nuclear regimes and organisations, and signed various international agreements. These normative commitments at the international level were, especially during the Mandela and Mbeki presidencies, domesticated into South African law and policies. Besides the formulation and adoption of new policies and new legislation, South Africa also established a number of new nuclear governance entities. The intention was to focus on and develop peaceful uses of nuclear energy in the country to achieve post-apartheid South Africa's development needs.

South Africa is regarded as the poster child for nuclear disarmament, nuclear non-proliferation and the peaceful uses of nuclear energy

However, these noble intentions never fully materialised. Almost a decade of rampant and unhindered state capture during the Zuma presidency (2009–2018) resulted in financial difficulties for the state. More pertinent to this report, the Zuma presidency failed to resolve the country's energy crisis, and to fully implemented the recommendations of the IAEA *Mission Report on the Integrated Nuclear Infrastructure Review (INIR)*.<sup>122</sup> Using 19 milestones for its assessment, the IAEA evaluated South Africa's preparedness for embarking on a nuclear build plan. Some of the most pertinent recommendations are referred to below.

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<sup>122</sup> IAEA, *Mission Report on the Integrated*, 4, 10.



Ramaphosa's administration has resuscitated the country's energy expansion plans, issuing an RFI in mid-June 2020. Seemingly, a more cautious approach has emerged. However, the country's continued peaceful use of nuclear energy and its plans to meet its future energy demands by expanding the nuclear component of the country's energy mix face significant challenges.

The following recommendations could mitigate some of these challenges. Recommendations are listed under the respective challenges.

## Inefficient, ineffective and fragmented governance

- Follow up on the IAEA INIR mission to assess the state of the implementation of its recommendations, and its recommendations to further improve nuclear governance.
- Finalise the restructuring of Eskom.
- Revise or update the country's 2008 Nuclear Energy Policy, as many domestic and international changes have occurred since its adoption by cabinet. The policy should also be reconsidered and/or reviewed. Formulated during the last part of Mbeki's administration and coinciding with a global nuclear renaissance, the policy, albeit ambitious, requires reconsideration to take account of new realities such as COVID-19's financial impact and the cost of nuclear energy.
- Revise and update existing nuclear legislation to account for the said changes and the shortcomings identified by the IAEA in 2013.
- Although safety principles are addressed in promulgated regulations, the acts of Parliament do not adequately address a number of issues, such as the Fundamental Safety Principles and, in particular, the prime responsibility for safety of the licence holder; decommissioning; nuclear security and some aspects of civil liability for nuclear damage.<sup>123</sup> This needs to be looked at.

## Dwindling nuclear expertise

- Conduct a skills audit to determine the state of nuclear energy training and education in the country. This audit should include an assessment of existing national and inter-governmental training programmes.
- Establish a dedicated nuclear university or campus within one of the existing universities. A second option would be to prevent the duplication of educational and other training programmes.

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<sup>123</sup> IAEA, *Mission Report on the Integrated*, 4, 10.

## Budget constraints

- Stop wasteful expenditure. Herein parliamentary oversight should play a role. In addition, criminal proceedings should be instituted against those involved in corruption in the sector and those who failed to achieve their fiduciary duties.
- Ensure state-owned entities such as the NECSA group of companies are not reliant on government funding. This will improve their performance and financial viability.
- Ensure that the funding model of the future nuclear build is advantageous to South Africa.

## Rising expectations and public opinion

- Continuously conduct public education on nuclear energy. Education campaigns in the past were short-lived with no real assessment of their impact.
- Ensure constant public consultation on the country's nuclear future.



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