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# South Africa's Nuclear Future

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**South African Institute of International Affairs**

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## **ABSTRACT**

The South African government has embarked on a programme to develop the country's nuclear energy capability in order to meet increasing national energy demand. In order to achieve its nuclear ambitions, government has appointed a cabinet-level committee to oversee the process, while key institutions are restructuring in line with government's ambitions. The nuclear plans have prompted questions within and outside South Africa due to their opacity and their reliance on institutions of dubious managerial competence and financial integrity. The questionable quality of this management also raises issues concerning the country's readiness to manage broader socio-economic issues arising from its nuclear planning. The nuclear programme should be seen against the backdrop of increased resource nationalism evident in South Africa's diplomacy, especially in respect of uranium. All these questions must be addressed by government if the integrity of the nuclear planning process is to be protected.

## **ABOUT THE AUTHOR**

Dr Jo-Ansie van Wyk is a lecturer in International Politics in the Department of Political Sciences at the University of South Africa (Unisa), Pretoria. She has completed a doctorate on South Africa's post-apartheid nuclear diplomacy. She is a Fulbright Alumna and a member of the South African Academy for Science and Art. She has completed consultancies for the World Bank, Unesco, the Institute for Security Studies, and Consultancy Africa Intelligence. In June 2010, she was appointed by the minister of trade and industry to serve on the South African Council for Space Affairs (SacsA).

## ABBREVIATIONS AND ACRONYMS

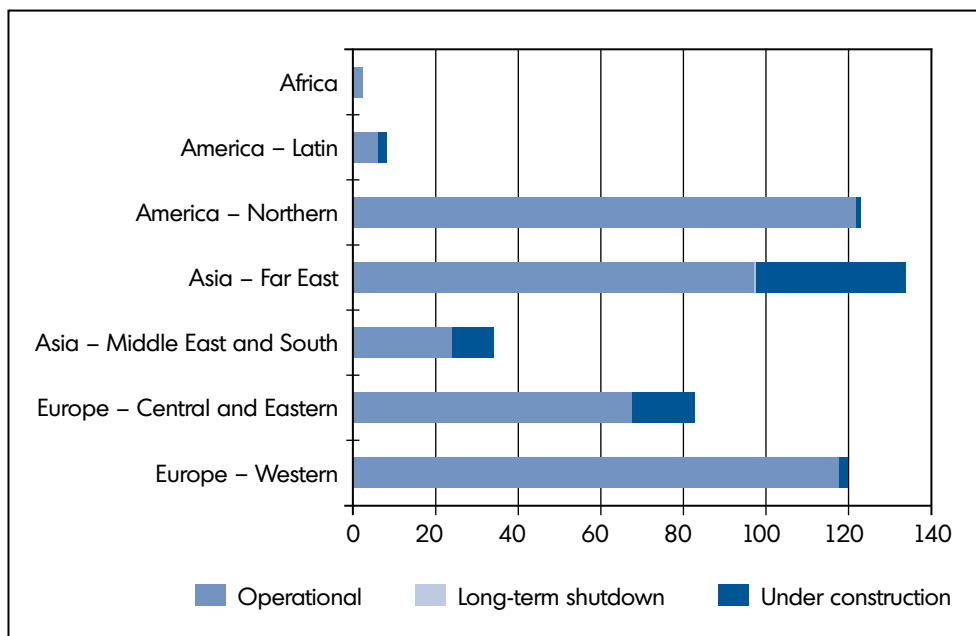
AEMFC	African Exploration Mining and Financing Company
Afcone	African Commission on Nuclear Energy
EIA	Environmental Impact Assessment
GHG	Greenhouse Gas
GWe	Gigawatt electrical
HEU	High Enriched Uranium
IAEA	International Atomic Energy Agency
INIR	Integrated Nuclear Infrastructure Review
IPP	Independent Power Producer
IRP	Integrated Resources Plan
IUEC	International Uranium Enrichment Centre
LEU	Low Enriched Uranium
MW	Megawatt
Necsa	Nuclear Energy Corporation of South Africa
NIP	National Infrastructure Plan
NNEECC	National Nuclear Energy Executive Coordination Committee
NNR	National Nuclear Regulator
NPC	South African Council for the Non-Proliferation of Weapons of Mass Destruction
NPT	Treaty for the Non-Proliferation of Nuclear Weapons
PBMR	Pebble Bed Modular Reactor
PWR	Pressurised Water Reactor
Safari-1	South African Fundamental Atomic Installation
tU	tonnes Uranium
TWh	TerraWatt Hours
ZAR	South African Rand

## INTRODUCTION

The nuclear power plant accident of 11 March 2011 at Fukushima in Japan caused questions to be raised around the world about the future of nuclear power. International support for nuclear power seems to have waned in the aftermath of that event, despite the 'nuclear renaissance' of renewed interest in nuclear power that had been evident for some time prior to it. A number of countries, including Germany, Switzerland and Belgium, have now expressed their intention to phase out nuclear power programmes in the short to medium term, in favour of forms of renewable energy such as wind and solar, which are regarded in some quarters as viable alternatives.<sup>1</sup>

Notwithstanding such responses, the development of nuclear energy capability and output continues as demand for power increases. In early 2013 there were 437 nuclear power reactors in operation worldwide, while 67 were under construction and only one was in long-term shutdown.<sup>2</sup> As Figure 1 shows, the majority of active reactors are in North America and Western Europe, understandably so in the light of those continents' historical leadership in scientific development. In coming decades, however, growth in nuclear installations is expected to take place mainly in China and India, according to the director general of the International Atomic Energy Authority (IAEA) Yukiya Amano.<sup>3</sup> China currently has the largest expansion plans; apart from 18 operational plants, it has a further 28 reactors under construction. By contrast the US, which has the largest number (103) of operational nuclear power stations, has only one under construction, while Russia has 33 operational and 11 under construction.<sup>4</sup>

**Figure 1: Regional distribution of nuclear power plants**



Source: International Atomic Energy Agency (IAEA), Power Reactor Information System (PRIS). The Database on Nuclear Power Reactors, 2013, <http://www.iaea.org/pris/>.

South Africa is not immune to these international trends. Severe electrical power outages experienced since early 2008 have led to an urgent need to focus on meeting energy demands if the country is to achieve its socio-economic developmental goals at the same time as meeting global greenhouse gas (GHG) emission targets. At present more than 90% of the country's electricity is produced by coal-fired power stations: South Africa is therefore a major emitter of GHG and has indicated its intention to opt for 'green' energy sources in the quest to reduce emissions.<sup>5</sup> South Africa presently generates 6% of its electricity from nuclear energy<sup>6</sup> and speaking at the Africa Energy Indaba held in Johannesburg in February 2013, Energy Minister Dipuo Peters reaffirmed that the country planned to reduce its carbon footprint through the use of new nuclear installations.<sup>7</sup>

Eskom, the state-owned power utility, can no longer fully meet growing national energy demands through its ageing nuclear and conventional infrastructure, hence the South African government's announcement of its intention to expand nuclear energy as part of the country's total energy mix.<sup>8</sup> It proposes to build a 'fleet' of six new nuclear power stations, together expected to add 9 600 MW to South Africa's power generation capacity, by 2020.<sup>9</sup>

Perhaps coloured by the past military connotations of its nuclear capacity, South Africa's current intentions in the field of energy generation might be expected to raise domestic and international political concerns. In addition, the development of nuclear energy is an expensive undertaking, which in a developing economy such as South Africa's might divert resources from cheaper energy sources, and from urgently needed social projects. Unquestionably also, some countries have used the pursuit of nuclear energy, and in particular its military overtones, as a political tool to enhance international status and prestige (as Iran has done, for example), which might also account for some misgivings as to the government's motivation.

This paper aims to address some of the main issues in respect of South Africa's nuclear future, including the country's growing energy demands, its nuclear agencies and structures, its nuclear diplomacy with Africa and the rest of the world, the role of public opinion, and some more general concerns about its nuclear future.

## GROWING ENERGY NEEDS

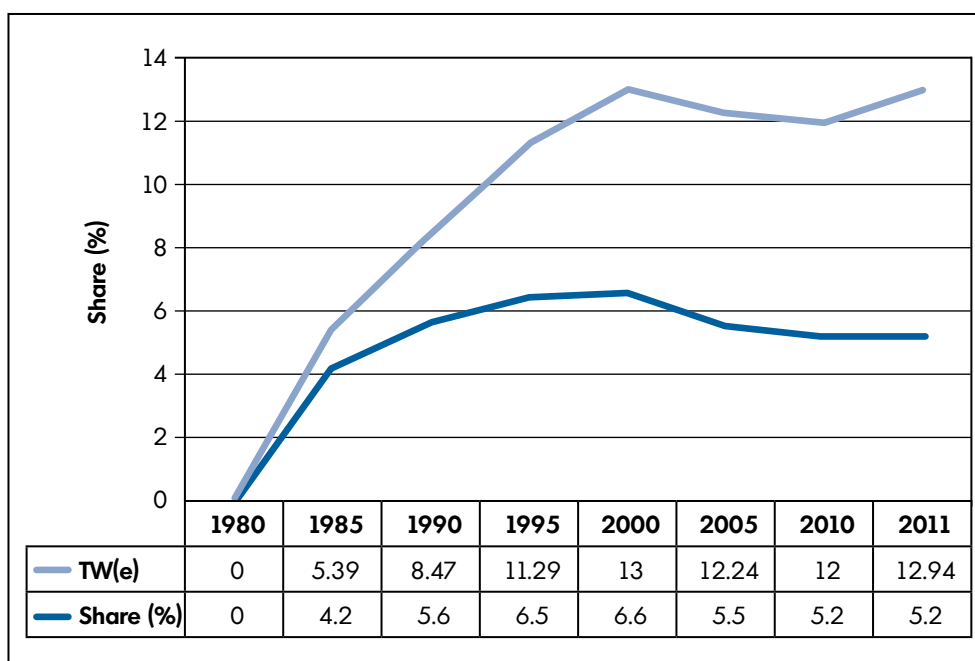
South Africa's growing energy needs are driven by four main issues: rapid population growth, an ageing energy infrastructure, and an energy-intensive socio-economic development agenda that demands major infrastructural development and industrialisation programmes. As regards the first of these, the population increased from 40.5 million in 1996 to 51.7 million in 2011<sup>10</sup> and at least 4.3 million households have no access to electricity.<sup>11</sup> On this measure alone, the present level of electrification in South Africa, at 73%, is too low but even so, a gap of about 90 TWh exists between supply and demand.<sup>12</sup>

The second problem is that of Eskom's ageing coal-fired and nuclear power stations, which are not closing that gap. Some conventional power plants were constructed in the 1950s,<sup>13</sup> and nuclear power has been generated for almost 30 years from the same facility – Eskom's single nuclear power station at Koeberg, approximately 30km northwest of Cape Town (see Table 1).

**Table 1: South Africa's nuclear power reactors**

<b>Reactor: code</b>	ZA-1	ZA-2
<b>Reactor: name</b>	Koeberg-1	Koeberg-2
<b>Type</b>	PWR	PWR
<b>Model</b>	CPI	CPI
<b>Capacity: Thermal</b>	2 775	2 775
<b>Gross</b>	970	940
<b>Nett</b>	930	900
<b>NSSS Supplier</b>	Framatome	Framatome
<b>Construction start</b>	July 1976	July 1976
<b>Grid connection</b>	April 1984	July 1985
<b>Commercial operation</b>	July 1984	November 1985

Source: IAEA, Nuclear Power Reactors in the World, Vienna, IAEA, 2012, p. 41.

**Figure 2: South Africa's nuclear electricity production and share, 1980–2011**

Source: IAEA, Nuclear Power Reactors in the World, Vienna: IAEA, 2012, p. 18.

Eskom is the owner-operator of Koeberg and as indicated in Figure 2 has increased both its production of nuclear electricity and nuclear's share of total power generation. The Koeberg I and 2 pressurised water reactors (PWRs) have a combined installed capacity of 1 840 MW but increasing demands have strained Koeberg's units, resulting in regular

shutdowns for inspection, maintenance or refuelling, and unforeseen tripping<sup>14</sup> due to rapidly ageing plant (its reactors have been operational since 1984 and 1985 respectively). The refuelling cycle of each unit takes approximately 18 months and has to be carried out mainly in summer when power demand is lower;<sup>15</sup> in 2012 Koeberg 1 was offline from 7 September to 25 November due to a fault in one of its generators.<sup>16</sup> As part of its attempt to curb outages, Eskom in 2011 adopted the Koeberg Business Plan, which contains a new outage strategy.<sup>17</sup> A project is now under way to extend Koeberg's original projected life span of 30 to 40 years,<sup>18</sup> for which Eskom has issued an expression of interest tender for the design, manufacture and installation of six new steam generators at Koeberg in 2016–2017.<sup>19</sup> Koeberg supplies most of Western Cape Province's power needs and contributes 6% of total capacity to the national power grid.<sup>20</sup>

In 2007 Eskom solicited bids for a fleet of up to 12 nuclear power reactors, but the process stalled in the wake of the 2008 global financial crisis and renewed appreciation of the value of South Africa's large deposits of coal as a source for carbon-intensive power production.<sup>21</sup> Widespread power outages and 'load-shedding' in 2008 galvanised the South African government into adopting its Nuclear Energy Policy, published in June of that year. This policy, however, became something of a side-issue in political turmoil that followed the September 2008 national conference of the African National Congress (ANC) at Polokwane, when incumbent President Thabo Mbeki was deposed. Mbeki's successor, Kgalema Motlanthe, did not remain president long enough to implement the policy.<sup>22</sup> Following the inauguration of President Jacob Zuma in 2009, however, nuclear energy received somewhat more attention; Zuma's accession to office happened at almost the same time as the African Nuclear Weapons Free Zone Treaty (the Pelindaba Treaty) came into force on 15 July 2009, which in turn raised awareness of the advantages of nuclear energy for the continent.

Climate change issues are a third determinant in South Africa's energy choices. South Africa is the world's sixth largest producer of coal and its fifth biggest exporter. As a major emitter of GHG, largely generated by its coal-fired power stations, South Africa has undertaken to reduce its carbon emissions by 34% in 2020 and 42% by 2025.<sup>23</sup> Despite its environmental impact and the national commitment to meeting emission targets, however, coal-based power generation<sup>24</sup> will remain the 'mainstay' of South Africa's power supply for the foreseeable future' according to Deputy President Kgalema Motlanthe.<sup>25</sup>

The fourth driver of South Africa's growing energy demands is the government's ambitious economic development plans. These are outlined for example in *Vision 2030*, the National Development Plan (NDP) of the National Planning Commission; according to which the government intends to spend about South African Rand (ZAR) 4 trillion during the next 15 years on infrastructure development.<sup>26</sup> Realising development goals of this order would further strain scarce energy resources, not least because Eskom's new 4 800 MW coal-fired power station, Kusile in Mpumalanga Province, will come on line only in 2018.<sup>27</sup>

In 2011 the government approved the Integrated Resources Plan (IRP) 2010–2030. This takes a 20-year projection of South Africa's electricity supply and demand which forecasts that in 20 years' time about 42% of electricity generated in South Africa will have to come from renewable resources; it therefore provides for the incorporation of 9.6 GW of nuclear power and 17.8 GW of other renewable energy by 2030. The plan opted for a nuclear fleet, instead of one or two nuclear units, with a total output of 9.6 GW.<sup>28</sup>



The adoption of the IRP coincided with the establishment of the Presidential Infrastructure Coordination Commission (PICC) in July 2011. In February 2012, the PICC adopted the National Infrastructure Plan (NIP) which prioritised 300 projects, consolidated into 18 Strategic Integrated Projects (SIPs). Three of the 18 SIPs concern energy: they are first, the development of a green economy (SIP 8), second electricity generation (SIP 9), and third electricity transmission and distribution (SIP 10).<sup>29</sup> These SIPs, among others, paved the way for the government to sign the first 28 renewable energy project agreements with independent power producers (IPPs) in November 2012. These will result in the procurement of about 7 800 MW of baseload capacity from IPPs by 2025, as well as a further 3 200 MW of renewables by 2020; and are in addition to the 3 725 MW currently procured from IPPs.<sup>30</sup> In terms of its Renewable Energy Independent Power Producer Programme the government is anticipating investments of ZAR 47 billion from IPPs in the renewable energy programme.<sup>31</sup> There is a further consideration that these developments will create a large number of jobs.<sup>32</sup>

## NUCLEAR DECISION MAKERS

The South African government's efforts to address growing energy demand date back some years. In 2008 it adopted the Nuclear Energy Policy,<sup>33</sup> at which time the cabinet also approved the reviewed National Energy Efficiency Strategy (NEES) and the gazetting of a draft NEES second review document for public comment. The review process analysed energy usage patterns of various economic sectors and examined the potential for adopting modern energy management practices and technologies, based on advice and opinion from international experts. It also set the scene for future energy reduction targets and the usage of energy resources.<sup>34</sup>

The strongest recent indication of the government's intention to pursue nuclear energy actively was the November 2011 cabinet approval of the establishment of the National Nuclear Energy Executive Coordination Committee (NNEECC) as the authority for decision-making, monitoring, and general oversight of the nuclear energy expansion programme.<sup>35</sup> An executive body led by Deputy President Motlanthe, it also includes at least eight cabinet ministers (see Table 2).

**Table 2: National Nuclear Energy Executive Co-ordinating Committee as of May 2013**

<b>Deputy President</b> Kgalema Motlanthe (Chair)		
<b>Minister in the Presidency</b> Trevor Manuel (also head of the National Planning Commission)	<b>Energy minister</b> Dipuo Peters (Deputy chair)	<b>Trade and industry minister</b> Rob Davies
<b>Finance minister</b> Pravin Gordhan	<b>Public enterprises minister</b> Malusi Gigaba	<b>Science and technology minister</b> Naledi Pandor

<b>High education and training minister</b> Blade Nzimande	<b>Economic development minister</b> Ebrahim Patel	<b>Water and environmental affairs minister</b> Edna Molewa
Eskom	NNR	Necsa
NNEECC supported by Nuclear Energy Technical Committee (Departmental Directors-general (of ministers represented in the NNEECC))		

Source: DOE, IAEA, [http://www.energy.gov.za/files/media/pr/2012/Media%20Statement%20-%20INIR%20IAEA%20Mission%201-%2017%20Oct%202012%20\(2\)\[1\].pdf](http://www.energy.gov.za/files/media/pr/2012/Media%20Statement%20-%20INIR%20IAEA%20Mission%201-%2017%20Oct%202012%20(2)[1].pdf).

Another indication of government interest is its initiation of an Integrated Nuclear Infrastructure Review (INIR). The INIR is a peer-reviewed assessment conducted by international experts on nuclear energy, coordinated by the IAEA, to support countries in developing their nuclear capacity by determining their infrastructure status and needs. The first step for countries undergoing an INIR is a self-assessment based on the approach outlined in the IAEA Milestones and Evaluation publications; this requires a detailed self-assessment of 19 nuclear infrastructure issues, specific to the conditions of the particular country.<sup>36</sup> The IAEA requires all 19 to be assessed when determining a country's readiness for nuclear energy expansion. The criteria address issues respectively of:

- national position on nuclear power (*sic*);
- nuclear safety;
- management;
- legislation;
- funding and financing;
- safeguards;
- regulatory framework;
- radiation protection;
- electrical grid;
- resource development;
- stakeholder involvement;
- siting and support facilities;
- environmental protection;
- emergency planning;
- security and physical protection;
- nuclear fuel cycle;
- radioactive waste;
- industrial involvement; and
- procurement structures.<sup>37</sup>

The South African government adopted the Milestone approach and by June 2012 the NNEECC had developed the self-evaluation report. An INIR mission visited the country from 30 January to 8 February 2013 following a pre-mission workshop with relevant South African stakeholders on 15–17 October 2012, designed to provide comment on the self-evaluation report, and to define the scope, work plan, and logistical arrangements

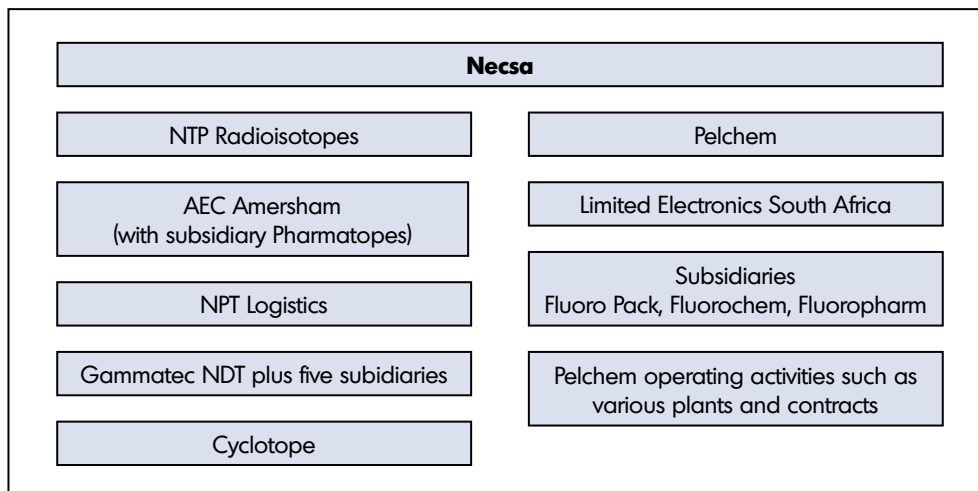
for the 2013 INIR Mission.<sup>38</sup> The director general of the IAEA visited the country during the mission; according to him the IAEA carried out a 'thorough review of all areas of South Africa's nuclear infrastructure'.<sup>39</sup> The mission also identified 'strengths in several areas supporting both the existing and new build programme, including regulatory self-assessment, environmental impact assessment, electricity power grid development, and stakeholder involvement'.<sup>40</sup> It also resulted in recommendations to further strengthen the country's nuclear infrastructure.

### STATE-OWNED NUCLEAR ENTERPRISES

Eskom and the Nuclear Energy Corporation of South Africa (Necsa) are the two major state-owned nuclear enterprises (SOEs). Necsa was established as a successor to the nuclear corporations of the National Party government, which left office in 1994. The SOEs control three major nuclear facilities: Koeberg, owned and operated by Eskom, and two Necsa facilities, respectively at Pelindaba, west of Pretoria, and Vaalputs, southeast of Springbok in the Northern Cape Province, which is the site of the National Radioactive Waste Disposal plant. Necsa manages and operates both the latter facilities on behalf of the National Radioactive Waste Disposal Institute.

In terms of the Nuclear Energy Act of 1999 Necsa undertakes and promotes research and development in the field of nuclear energy and radiation sciences and technology. It is also responsible for processing source material, including uranium enrichment. Necsa is also a commercial operation with several subsidiaries (see Figure 3). One of these, NTP Radioisotopes, is the Necsa group's main source of revenue with exports of ZAR 842 million to 60 countries in 2012; Pelindaba-based Pelchem, which handles Necsa's fluorochemical interests, achieved ZAR 186.1 million in sales for the same period, 4.9% higher than in 2011.<sup>41</sup> Necsa is also the owner-operator of the South African Fundamental Atomic Installation (Safari-1) reactor, commissioned in 1965.

**Figure 3: The Necsa group of companies**



Source: Necsa, *Annual Report 2012*.

Necsa is expected to play a leading role in the nuclear fuel cycle and in uranium enrichment. Concerns have been expressed in parliament, however, over a ZAR 31 million cut in the government's grant to Necsa for 2012–2013, to ZAR 455 from ZAR 486 million the previous year, a reduction that presumably increases the risk that Necsa will be unable to meet its legislative and policy mandates.<sup>42</sup>

## REGULATORY ENVIRONMENT

South Africa's nuclear activities for the most part fall under the Nuclear Energy and National Nuclear Regulator (NNR) acts of 1999, and the 2008 National Radioactive Waste Disposal Institute Act. Against this existing legislation and regulatory framework, South Africa is considering strengthening the legislative and regulatory structure by improving regulatory oversight and the functioning of the NNR.<sup>43</sup>

The NNR replaced the Council for Nuclear Safety (CNS). It oversees and enforces nuclear safety standards attending the operation of nuclear facilities, the prevention of nuclear accidents and the mitigation of the results of any such events. The NNR regulates the following areas and facilities:

- the complete nuclear fuel cycle;
- uranium exploration;
- uranium mining and milling;
- uranium enrichment;
- fuel fabrication;
- Koeberg nuclear power plant;
- waste management (Vaalputs);
- the Safari-1 research reactor;
- decommissioning of nuclear vessels; and
- mines and scrap metal dealers.<sup>44</sup>

Such activities embrace, among others, the licensing of visiting nuclear submarines and surface vessels, including some from the US (USS *George Washington*, USS *Enterprise*, USS *Theodore Roosevelt*), the UK (HMS *Turbulent*, HMS *Sceptre*, HMS *Talent*) and Russia (the battle cruiser *Petr Velikiy*); and the issuing of 42 nuclear installation authorisations and 147 certificates of registration.<sup>45</sup>

In anticipation of its extended role in overseeing the forthcoming fleet of nuclear installations, the NNR's budget allocation has risen from ZAR 30.9 million for 2012–2013 to ZAR 31.6 million for 2013–2014, and the regulator has restructured its organisation.<sup>46</sup> The NNR has also proposed amendments to its enabling NNR Act<sup>47</sup> and in addition is developing a comprehensive regulatory framework while reviewing capacity requirements in line with its strategy and structure.<sup>48</sup>

South Africa's dual-use capabilities are regulated and controlled by the South African Council for the Non-Proliferation of Weapons of Mass Destruction (NPC). Dual-use capabilities are those national capacities in technology, expertise, services, material, equipment and facilities that can contribute to the proliferation of weapons of mass destruction but could also be used for conventional military or commercial purposes.

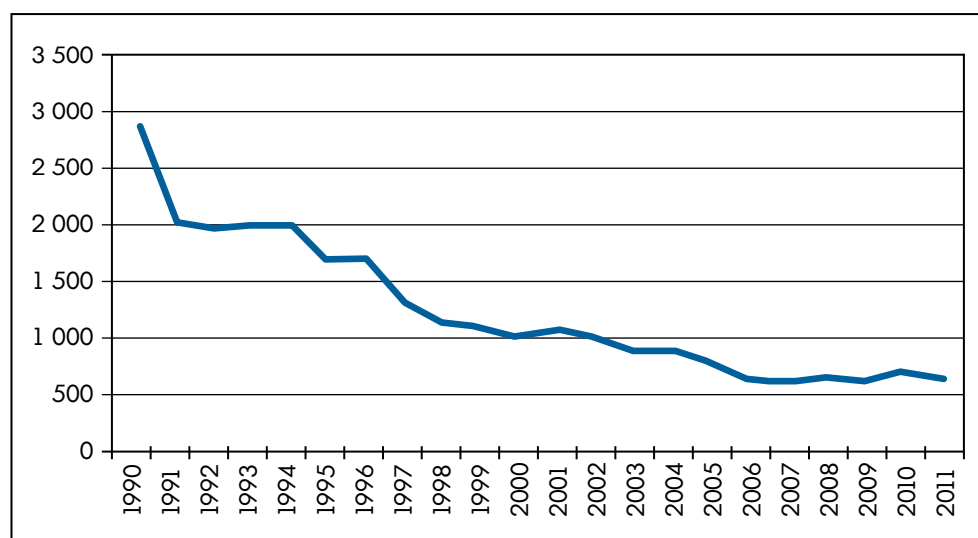
Dual-use items and technologies are subject to the Missile Technology Control Regime, an informal partnership of 34 countries aimed at controlling the proliferation of significant aerial military nuclear technology, and the Nuclear Supplier's Group (NSG) of nations, of which South Africa is a member.<sup>49</sup> In 2011 Minister of State Security Siyabonga Cwele indicated that progress had been made on a National Security Strategy and that dual-use technology has been identified as a 'strategic sector'. A departmental task team from South Africa's State Security Agency is conducting an assessment of resources and activities related to nuclear, biological, chemical, aerospace and missile technologies, and is expected to develop a national strategy for promoting research, technological development, innovation, co-ordination, integration and oversight in dual-use technologies.<sup>50</sup>

### RESOURCE NATIONALISM

One of the characteristics of global energy acquisition over the past few decades has been the growth of 'resource nationalism' – the tendency of nations, especially in the developing world, to assert aggressively their sovereignty over the natural resources within their boundaries. Since the early 1990s South Africa has shown increasing evidence of following the same path. According to industry sources government policies are aimed at securing South Africa's supply of uranium for 40–60 years.<sup>51</sup>

The value of South Africa's total mineral reserves is estimated at ZAR 18 trillion<sup>52</sup> and mining and related industries employ approximately one million people, contribute 18% to gross domestic product and pay nearly 20% of all corporate taxes.<sup>53</sup> South Africa accounts for 8% of world uranium reserves and is the tenth largest uranium producer,<sup>54</sup> although its output has fallen over the past few years (see Figure 4).

**Figure 4: South Africa's uranium production (1 000kg)**

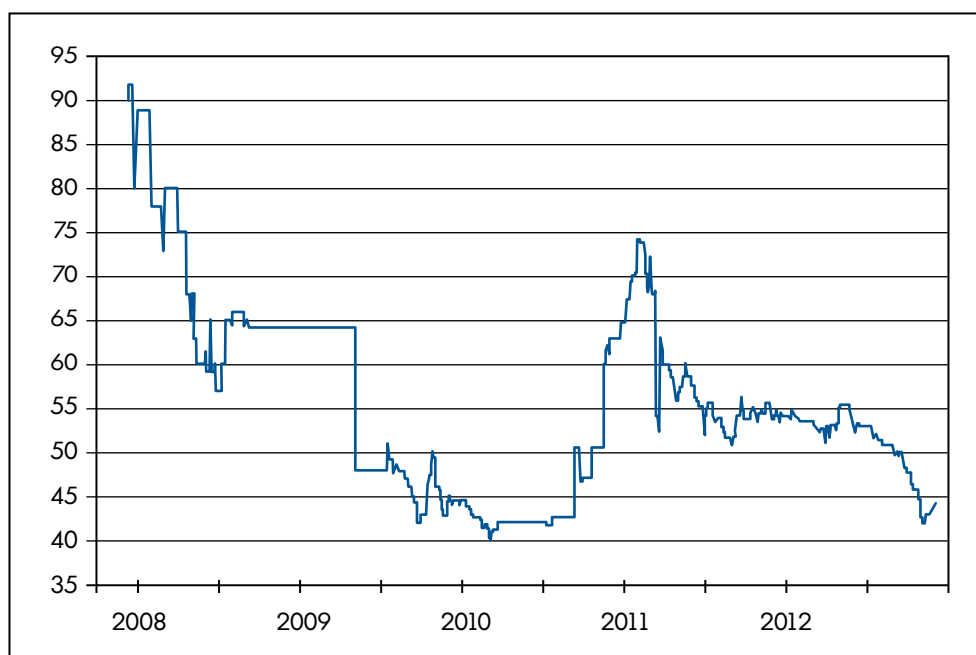


Source: Department of Mineral Resources, <http://www.dmr.gov.za>.

The sector in South Africa is privately owned and in 2011 domestic mining companies produced 656 tonnes of uranium (tU).<sup>55</sup> More than 30 domestic uranium mining companies are active in South Africa,<sup>56</sup> while foreign-owned and -registered enterprises operating in the sector include Areva (France), First Uranium Corporation (Canada), Leopard Resources (Australia), Shiva Uranium (Indian and South African investors) and UK-based UraMin Incorporated, now absorbed by Areva.

The decline in South Africa's uranium production among other reasons is associated with a fall in the uranium spot price (see Figure 5), continuing global economic difficulties, and a lack of investor confidence in South Africa's mining sector. Global demand for uranium, however, is increasing: China, for example, has ambitious nuclear power expansion plans which will require 10 000 tonnes of uranium oxide (U<sub>3</sub>O<sub>8</sub>) by 2020.<sup>57</sup> To help meet this demand, Chinese firms are prospecting for uranium in Namibia, Niger and Zimbabwe.<sup>58</sup>

**Figure 5: Uranium spot price, 2008–2012**



Source: Mining Investor.net, '5 year uranium spot chart', 5 December 2012, [http://www.mininginvestor.net/uranium-spot-price-chart/?qm\\_page=32590](http://www.mininginvestor.net/uranium-spot-price-chart/?qm_page=32590).

Annual demand from the world's nuclear reactors, which presently have a combined generating capacity of 375 gigawatt electrical (GWe), is 68 000 tU<sup>59</sup> and according to the annual joint IAEA-OECD (Organisation for Economic Cooperation and Development) publication, *Uranium: Resources, Production and Demand* (the so-called 'Red Book'), this is expected to rise. The Red Book estimates that global uranium demand will increase to between 97 645 tU and 136 385 tU by 2035, an amount required to feed nuclear reactors which by then will probably have a combined capacity of 540–746 GWe.<sup>60</sup>

South Africa does not itself enrich uranium for its power generation. Instead these services are provided by international corporations such as Areva (France), Westinghouse Electric Company (Japan/US), Tenex (Russia) and Urenco (Germany, The Netherlands and UK).<sup>61</sup> The German firm Nukem played a part in the development of the innovative Pebble Bed Modular Reactor (PBMR) and the Russian Nuclear Energy State Corporation (Rosatom) was involved in the isotope sector in South Africa. Areva and Toshiba's Westinghouse at present supply Koeberg's two reactors with 30 tonnes of enriched uranium annually.<sup>62</sup>

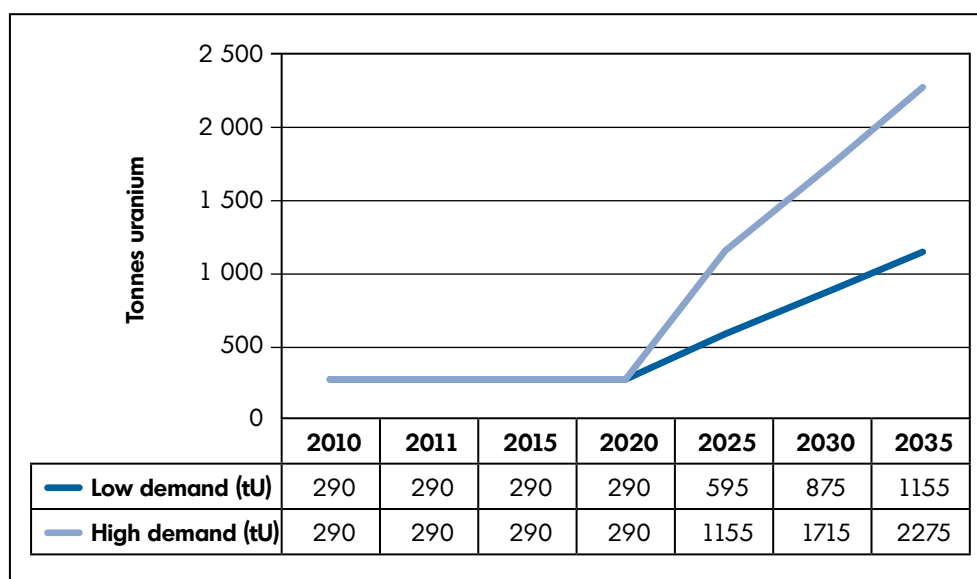
In 2007 Public Enterprises Minister Alex Erwin announced that the South African government has declared uranium a 'strategic mineral'.<sup>63</sup> At the same time the minister of minerals and energy announced that declaring uranium a strategic mineral 'would lead to more controls over its production and exportation to ensure that South Africa has adequate reserves of the mineral in years to come'.<sup>64</sup> Against this background, in June 2011 the government released a 'beneficiation strategy' for the minerals industry which defined beneficiation as the 'transformation of a mineral (or a combination of minerals) to a higher value product, which can either be consumed locally or exported' and is a term used interchangeably with 'value addition'.<sup>65</sup> The strategy identifies ten 'strategic mineral commodities' including uranium and thorium, which are used as fuel in the nuclear industry.<sup>66</sup> South Africa's uranium enrichment (that is, beneficiation) facilities (the so-called Y- and Z-Plants) were closed down after South Africa joined the Treaty for the Non-Proliferation of Nuclear Weapons (NPT) in 1991; hence the country now exports only U<sub>3</sub>O<sub>8</sub> material from the first phase of beneficiation, and imports all its enriched uranium.<sup>67</sup> In order to accomplish the beneficiation of uranium the 2011 strategy proposes interventions such as quantification of South Africa's uranium and/or thorium reserves and resources; investigations into the economic feasibility of re-establishing uranium enrichment; planning for nuclear waste treatment and mine rehabilitation; and the finalisation of the national uranium policy with relevant stakeholders.<sup>68</sup>

South Africa's growing resource nationalism was further illustrated when President Zuma, while attending the March 2012 Nuclear Security Summit (NSS) in Seoul, South Korea, insisted that South Africa reserved the right to enrich uranium to 'any level' despite global attempts to curb the use of highly-enriched uranium (HEU), now considered to be a national strategic asset.<sup>69</sup> Zuma also stated that despite pressure from the US, South Africa would retain control of the HEU derived from the nuclear weapons programme it abandoned in the 1990s, seemingly resentful of the 2011 repatriation to the US of 6.3kg of the several hundred kg of HEU it holds in store.<sup>70</sup> Another illustration of increasing resource nationalism is a statement by the minister of energy that South Africa's nuclear programme is also concerned with the beneficiation of mineral resources, in particular of uranium; together with presumptions of the intent to which the nuclear power industry would create additional employment through the uranium mining and fuel manufacturing sector.<sup>71</sup>

Feasibility studies relating to the re-establishment of nuclear fuel cycle programmes in South Africa were completed in 2011.<sup>72</sup> Necsa's pre-feasibility studies, in collaboration with potential partners in the establishment of a uranium enrichment facility, are going ahead and it has been agreed that the study would be reviewed every two years.<sup>73</sup> South Africa's proposed nuclear installations are expected to consume about 465 tonnes of enriched uranium annually by 2030 (see Figure 6). Necsa's studies have concluded that it

is therefore commercially viable to revive the nuclear value chain, including enrichment, conversion and nuclear fuel manufacturing, to reduce South Africa's dependence on foreign sources,<sup>74</sup> and the company has expressed its intent to establish a capacity to produce nuclear fuels and fuel fabrication facilities for PWRs 'to ensure eventual security of fuel supply for South Africa'.<sup>75</sup>

**Figure 6: South Africa's annual reactor-related uranium requirements, 2010–2035**



Source: OECD Nuclear Energy Agency (NEA) and IAEA [http://www.iaea.org/~/media/~/media/News\\_Centres/Press\\_Kit/2011/20110120\\_uranium\\_requirements.pdf](http://www.iaea.org/~/media/~/media/News_Centres/Press_Kit/2011/20110120_uranium_requirements.pdf).

In 2011 President Zuma reactivated the African Exploration Mining and Financing Company (AEMFC), a previously dormant state-owned mining corporation established in 1944 and currently a subsidiary of the state-owned Central Energy Fund (CEF). The AEMFC will consolidate government's mining assets and interests and concentrate on declared strategic minerals such as uranium and coal.<sup>76</sup> Its principal activities are to acquire and hold prospecting and mining rights for the state, to perform geological exploration and feasibility studies, to develop mines, and to engage in mining operations.<sup>77</sup> In the 2011–2012 financial year, however, the company incurred a net loss of ZAR 48.8 million; almost double its 2011 losses, indicating that like other SOEs the AEMFC is not a viable operation.<sup>78</sup> This perception notwithstanding, in October 2012 the minister of mineral resources, called for greater involvement of the AEMFC in the South African mining industry,<sup>79</sup> echoing an earlier statement by President Zuma that the state 'must actively participate in the mining industry to ensure that our national interest is protected and advanced'.<sup>80</sup>

In December 2012, the cabinet approved the Draft Mineral and Petroleum Resources Development Amendment Bill. Among other things this aims to regulate the exploitation of associated minerals, and provides for the implementation of an approved beneficiation strategy through which strategic minerals can be processed domestically.<sup>81</sup> The government



is also developing a nuclear fuel cycle strategy for the beneficiation of uranium resources and to establish a uranium conversion plant, a uranium enrichment plant, and a fuel fabrication plant.<sup>82</sup> South Africa's intentions in this respect are also evident in the 2012 Defence Review, which states that it is in the South African national interest to secure 'fundamental resources, minerals (and) energy'.<sup>83</sup>

Resource nationalism is also evident in South Africa's opposition to international nuclear fuel banks and enrichment facilities (see Table 3).<sup>84</sup> In 2007 Russia established the International Uranium Enrichment Centre (IUEC) the first international enrichment facility, with a view to allowing all countries pursuing peaceful nuclear energy unimpeded access to the nuclear fuel cycle. Its current members are Russia, Kazakhstan, Armenia and Ukraine. Rosatom holds 70% of its shares. In terms of an agreement with the IAEA the IUEC has to make material available to any country designated by the director-general of the IAEA.<sup>85</sup> The US, Germany and the UK are also considering establishing nuclear fuel facilities.<sup>86</sup>

**Table 3: International uranium enrichment and nuclear fuel centres**

	<b>International Uranium Enrichment Centre</b>	<b>IAEA LEU bank</b>	<b>American Assured Fuel Supply (AFS)</b>
<b>Location</b>	Russia	To be determined; Kazakhstan has offered to host	US
<b>Date of operation, authorisation or announcement</b>	Operational since 17 December 2010	IAEA Board authorised, established 3 December 2010	Announced in August 2011
<b>Owner</b>	Russian government through majority share in Rosatom	IAEA	US government
<b>Uranium enrichment levels</b>	2–4.95%	2–4.95%	2–4.95%
<b>LEU reserve (tonnes)</b>	120	To be determined	230
<b>Cost</b>	Valued at \$300 million	Donors pledged \$125 million and EUR 25 million to cover establishment and initial operational expenses	Not available

Source: OECD Nuclear Energy Agency (NEA) and IAEA, Uranium 2011: resources, production and demand, Paris, OECD NEA & IAEA, 2012, pp. 120–121; <http://www.iaea.org/infocentre/press/2011/012011.pdf>.

## SOUTH AFRICA'S NUCLEAR DIPLOMACY

South Africa is one of very few countries – others being Brazil and Libya – to have voluntarily terminated its nuclear weapons programme; the process began in 1989 and

ended in 1993.<sup>87</sup> Following verification of the termination of the programme by the IAEA in the latter year, South Africa's nuclear diplomacy changed from a defence orientation to one of focus on the peaceful uses of nuclear energy, nuclear non-proliferation and nuclear disarmament. It has been lauded especially for its bridge-building role at various conferences of the NPT.

Leaving aside the dismantling of its nuclear weapons programme, the post-1990 period has been a dynamic time in terms of South Africa's international relations and diplomacy. Between 1990 and 2010 it established numerous bilateral relations, acceded to the NPT (in 1991) and joined or re-joined several nuclear-related organisations, including the IAEA, the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies, the Nuclear Suppliers Group, the Zangger Committee of nuclear exporters, the Network of Regulators of Countries with Small Nuclear Programmes, the African Nuclear Regulators' Group and the Generation IV International Forum.

South Africa has reiterated that a 'primary goal' of its foreign policy is to 'reinforce and promote [itself] as a responsible producer, possessor and trader of defence-related products and advanced technologies in the nuclear, biological, chemical and missile fields'.<sup>88</sup> The government argues that South Africa in this way '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>89</sup>

South Africa was a founder-member of the IAEA in 1957. Today, it serves on the IAEA board of governors and has signed several multilateral nuclear-related agreements; respectively the:

- Agreement on the Privileges and Immunities of the IAEA;
- Convention on the Physical Protection of Nuclear Material;
- Convention on Early Notification of a Nuclear Accident;
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency;
- Convention on Nuclear Safety;
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
- Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (RSA); and
- African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA).

It has also signed a safeguards agreement and an additional protocol with the IAEA.<sup>90</sup> Ratification of these agreements is indicative of a shift from a secretive approach to nuclear issues to a policy somewhat less opaque and more compliant with internationally-accepted norms. Several issues relating to the country's nuclear diplomacy are pertinent in this respect. Among others they include South Africa's nuclear diplomacy with other African countries and with Iran, and its responses to countries cultivating South Africa as potential contractors for the new nuclear fleet.

## Africa

In December 2012 the cabinet approved an amended white paper on South Africa's foreign policy for submission to parliament. The draft white paper uses the framework of the 'Diplomacy of "Ubuntu"' to explain South Africa's foreign policy, and cites Africa as one of the pillars upon which special stress is placed.<sup>91</sup> In the light of South Africa's nuclear diplomacy with the rest of the continent it is especially important that 13 other African countries (Algeria, Egypt, Ghana, Kenya, Libya, Morocco, Namibia, Nigeria, Senegal, Sudan, Tanzania, Tunisia and Uganda), are considering the development of nuclear energy.<sup>92</sup> Apart from its bilateral and multilateral co-operation on nuclear issues on the continent, South Africa hosts and leads the African Commission on Nuclear Energy (Afcone), the compliance mechanism of the Pelindaba Treaty, which came into force 15 July 2009. South Africa is in the process of finalising a host agreement with Afcone; Atnatiwos Zeleke Meshesha, an Afcone commissioner, summarised the main elements of the Pelindaba Treaty as the renunciation of nuclear explosive devices; the prevention of stationing nuclear explosive devices; prohibition on testing nuclear explosive devices; declaration, dismantling, destruction or conversion of nuclear explosive devices and the facilities for their manufacture; the conduct of peaceful nuclear activities; physical protection of nuclear materials and facilities; prohibition of armed attacks on nuclear installations; and exchange of information.<sup>93</sup>

South Africa has signed a ZAR 15 million agreement with the IAEA to promote human capital development and knowledge-sharing in technology in Africa. In terms of the agreement South Africa and the IAEA will focus on agriculture and livestock production, human health, water resource development, environmental management and integrated pollution control, energy, human capital for nuclear science and technology, and on capacity building in Africa.<sup>94</sup>

## Iran

South Africa has consistently expressed its support for the 'inalienable right' of all states, especially developing countries, to develop nuclear energy for peaceful purposes within the framework of the NPT.<sup>95</sup> This has resulted in strong support for Iran, although it is suspected of developing a nuclear weapons programme.<sup>96</sup> In this regard, in July 2012 South Africa suspended its ambassador to Iran, Yusuf Saloojee, following accusations by the South African mobile telephone operator MTN that the envoy had taken bribes to influence South Africa's voting behaviour in the IAEA and UN toward support for Iran.<sup>97</sup> During October 2012, however, when South Africa was serving as a non-permanent member of the UN Security Council, the country suspended all imports of crude oil from Iran for a fifth consecutive month in compliance with Security Council sanctions against Iran. Whereas South Africa previously imported 25% of its crude oil from Iran, it has now diversified its suppliers in compliance with the UN sanctions to alternative sources including Angola, Equatorial Guinea, Nigeria, Saudi Arabia, and the United Arab Emirates. The US granted exemptions to South Africa to import Iranian oil, but such imports are still subject to EU sanctions that prevent insurance companies underwriting oil shipments from Iran. South African lobbying for the EU to grant waivers has been unsuccessful. This places additional strain on South Africa's growing energy demands as some of the country's

refineries are designed to treat only Iranian-type crude. Replacing Iran as a source would be costly and might result in a repeat of disruptions in fuel supplies experienced in 2011, when the Iranian problem first surfaced.<sup>98</sup>

### **Foreign 'courtiers'**

Since the South African government's announcement of its proposed nuclear power programme it has been courted by major global nuclear corporations such as the French and Russian state-owned nuclear utilities Areva and Rosatom. In October 2012 a delegation representing some 40 French business enterprises, including nuclear contractors, visited South Africa for a conference on business ties between the two countries.<sup>99</sup> In the reverse direction, a government-led delegation including South African nuclear companies and representatives of the Nuclear Industry Association of South Africa visited Russia in November 2012. Meetings were held with Rosatom subsidiaries Nizhny Novgorod Engineering Company Atomenergoproekt, which offers engineering services in nuclear power plant projects (NPPs), and Atomstroyexport, which specialises in the construction of NPPs outside Russia. The visit took place in the context of a memorandum of understanding signed between Necsa and the Rosatom affiliate Rosatom Overseas. South Africa's National Nuclear Regulator (NNR) has also signed a co-operation agreement with the Russian nuclear regulator, Rostekhnadzor, covering radiation and nuclear safety and security.<sup>100</sup> Nuclear issues also came under consideration in November 2012 at the 11<sup>th</sup> session of the South Africa–Russia Inter-governmental Committee on Trade and Economic Cooperation, a group that meets annually to discuss and strengthen social, economic, and commercial relations as well as technical co-operation between the two countries.<sup>101</sup>

One of the main preoccupations concerning South Africa's nuclear future is the development of a skills pool unique to the nuclear sector. In this connection, Necsa and Alstom South Africa, a subsidiary of the French power generation and transmission and rail infrastructure group Alstom, signed an agreement in November 2012 in terms of which Alstom South Africa undertook to invest ZAR 8 million in equipment for a new coded welding centre launched at Necsa's Nuclear Skills Development Centre (NSD) in February 2013.<sup>102</sup>

## **PUBLIC OPINION ON THE NUCLEAR FUTURE**

South African public opinion on the nuclear future is influenced by factors mainly related to concerns about the cost and safety of nuclear energy, and government's unilateral decision-making and secrecy in respect of nuclear decisions. Parallels have also been drawn between alleged serious malpractices attending the strategic arms procurement package (the 'arms deal') and dubious levels of transparency surrounding the proposed nuclear programme and the termination of operations at the PBMR project.

### **What South Africans know**

In 2011 Necsa commissioned one of the few public opinion surveys to have been conducted on the South African public's attitudes to nuclear energy. The survey, undertaken by the

Human Sciences Research Council, concluded that South Africans know little about nuclear energy and its associated technology; 40% of respondents could not indicate whether or not they were in favour of nuclear energy and only 23% approved of it. Respondents were asked to identify the benefits and disadvantages of nuclear energy as a source of electricity. The survey showed that most South Africans were inclined to perceive nuclear energy as a means of ensuring a reliable supply of electricity, and as an energy source that would help combat climate change (cited by 23% and 16% respectively). A smaller proportion (14%) considered nuclear generation as competitive in cost and as offering an unlimited supply of power. Safety risks, nuclear waste disposal and risk of radiation were regarded as its main disadvantages. One-third (34%) believed nuclear accidents to be a risk, while the long-term disposal of nuclear waste and the risk of radiation or contamination were issues cited by 20% of respondents. Despite some safety concerns, 40% 'agreed' or 'strongly agreed' that the nuclear reactors at Koeberg should continue to operate (44% did not know); 38% thought that South Africa should construct new nuclear reactors to generate electricity (42% did not know).<sup>103</sup>

The anti-nuclear lobby in South Africa is small, but vocal: organisations such as Save Bantamsklip, Greenpeace South Africa, the Coalition against Nuclear Energy, and Earthlife Africa are notable in this respect. Their wide-ranging activities include public protest actions and participation in public hearings on nuclear issues.

### **Government's efforts to influence public opinion**

In the wake of the Fukushima incident the South African government is wary of the effect of public opinion on nuclear policy. According to the minister of energy '[T]he success and deployment of nuclear power requires public acceptance, and public education and radioactive waste management issues are the most important topic surrounding nuclear energy. We will be investing resources and greater effort in this regard.'<sup>104</sup> In October 2012 the government participated in an IAEA technical meeting on nuclear communication and stakeholders,<sup>105</sup> similar initiatives were mounted by the NNR, which is currently implementing a new communication strategy.<sup>106</sup> The NNR's public hearings on Necsa's application for a nuclear installation licence to construct a smelter, however, resulted in widespread criticism from civil society and business entities in the vicinity of Pelindaba, where the smelter is to be situated. The proposed smelter is expected to process 14 000 tonnes of uranium-contaminated scrap metal, presently stored on Necsa's Pelindaba site.<sup>107</sup>

Government has introduced several public information initiatives. These include opening a Necsa Visitor Centre at Pelindaba and launching Necsa's nuclear awareness advertising campaign in 2011. The 12-month campaign was promoted through radio, print, theatre, websites, social media and other appropriate communications channels and was said to have reached four million people (Necsa continues to employ the leading advertising agency Saatchi & Saatchi to promote the benefits of nuclear energy).<sup>108</sup> In 2008 the government spent ZAR 4 million in a bid to rework the image of nuclear power in South Africa; Johannesburg-based brand consultancy Freedthinkers was appointed to survey public opinion on nuclear energy, in parallel with the development of a nuclear vocabulary in all South Africa's 11 official languages.<sup>109</sup>

### **Environmental Impact Assessments (EIAs)**

Government has identified three possible sites for the construction of new nuclear power stations. They are Bantamsklip (near Hermanus in the Western Cape), Duinefontein (next to Koeberg) and Thyspunt (between Oyster Bay and St Francis Bay in Eastern Cape Province), all of them areas of important biodiversity that may be disrupted if construction goes ahead. Eskom has conducted EIAs on all the sites.<sup>110</sup> According to the minister of energy 28 studies have been completed in the EIA, which assess the impact on biodiversity issues around vulnerable fauna and flora; wetlands and dune morphology; transport; heritage and conflict with other socio-economic activity (including in particular fishing for chokka, a species of small squid, and other fishing, tourism and agricultural interests).

A revised draft environmental impact report was released for public comment in 2011; the comments will be included in the final EIA report. In addition, a number of revised specialists' reports had been anticipated for release to the public in mid-2012 but never appeared.<sup>111</sup> According to the pressure group Thyspunt Alliance, Eskom and its consultants have not published the third draft of the environmental impact report in respect of Thyspunt and in fact have delayed its publication for a year.<sup>112</sup> Hence the process outlined by the minister in parliament in April 2012 has been so compromised that the final environmental impact report could not be completed and submitted to the department of environmental affairs towards the end of 2012, in time for a decision on environmental authorisation, a decision now expected in 2013.<sup>113</sup> In response, anti-nuclear interest groups Earthlife Africa, Greenpeace Africa, Justice and Peace, and Ceasefire formed an alliance aimed at raising concerns about the cost of the new build project, the safety of nuclear power and the lack of transparency and accountability in the nuclear sector.

### **CONCERNS ABOUT SOUTH AFRICA'S NUCLEAR PROGRAMME**

The government's 2011 assessment of South Africa's readiness to procure a nuclear fleet identified a number of critical areas, such as finance, safety, radioactive waste management, human resources and the lack of nuclear skills.<sup>114</sup> These issues, however, are far from the only ones: several other concerns affecting the viability of the programme need to be addressed urgently. They include, in particular, doubts about the integrity of political processes and controls, and reservations as to the adequacy of Eskom's financial resources and management.

#### **Turf wars**

The first of these issues concerns government's departmental responsibilities and potential conflicts. The cabinet's decision to go ahead with its nuclear plans is in clear contradiction to the National Planning Commission's NDP which, located as it is in the presidency, laid down a requirement for further feasibility studies and warned that an 'in-depth investigation into the financial viability of nuclear energy was vital'; it recommended that government reassess the desirability of such a programme.<sup>115</sup> This is in stark contrast to the position of among others the Department of Energy, which through its minister is a

vocal advocate of the nuclear plans. Such inter-departmental differences may be due to varying perceptions within government circles of nuclear energy as a whole and in that way may have an impact on the country's future nuclear planning, especially its funding, tender procedures and power delivery processes.

### **Cost**

One of the causes of the turf wars is different views on the cost of the nuclear energy expansion plans and the financial burden this may place on the government. Concerns expressed by the National Planning Commission and civil society about the large (ZAR 300 billion) capital cost of nuclear power have been dismissed by the minister of energy, a strong supporter of nuclear energy and the government's nuclear plans, as 'typical scare tactics used by people who do not have the best interest of our people at heart'.<sup>116</sup> Similar views have been expressed by ANC leaders in the past when criticised or opposed.<sup>117</sup> Such statements overlook the stark fact the government's cost estimates for generating nuclear energy, at \$3,000–4,000/kW, differ markedly from generally accepted informed estimates of \$7,000/kW.<sup>118</sup> Government estimates that total power capacity extension under the IRP will cost approximately ZAR 4 trillion by 2030, including new power plants and transmission and distribution infrastructure.<sup>119</sup> This level of expenditure will clearly have an impact on the future cost of electrical power, which in South Africa is already high – even after Necsa rejected Eskom's application of November 2012 for a 16% increase in its utility tariff in favour of an 8% annual increase over the next five years.<sup>120</sup>

### **Tender process**

The South African government already stands accused of permitting irregularities in respect of the award of tenders to individuals and companies close to, or within, government structures. Expanding the country's nuclear power generation and distribution will require the award of very large government tenders, and concerns have been raised about the transparency of any future nuclear tender process. Even at this early stage energy-related tenders have been awarded to, for example, the ANC's investment arm, Chancellor House Holdings, which is in turn a 25% shareholder in Hitachi Power Africa, one of the contractors to Eskom's Medupi and Kusile power stations. At ZAR 38.5 billion this is the largest contract in Eskom's history.<sup>121</sup> The project is already 20 months behind schedule and costs have increased to ZAR 60 billion – a situation which clearly raises questions about the integrity of the costing and tendering process – but no penalties have been levied on the politically connected Hitachi despite such an apparent performance shortfall.<sup>122</sup> Such a situation raises obvious questions about the likely conduct of the much larger tender and costing process for the procurement of the country's nuclear fleet.

Concerns have also been expressed about the number of high-profile nuclear decision-makers who have taken up posts in other areas of the nuclear sector, giving rise to speculation about conflicts of interest, 'revolving doors' and possible consequential tender irregularities.<sup>123</sup> Moves have included the resignation of Necsa's CEO, Rob Adam, to join the Aveng Group, a construction firm in the nuclear industry run by a former colleague, Roger Jardine, when Adam was director-general of the department of science and technology.<sup>124</sup> Adam's successor at Necsa is Phumzile Tshelane, acting general manager

in Eskom's nuclear new build division.<sup>125</sup> In addition to these changes Deputy President Motlanthe was appointed to lead the NNEECC and the NNR CEO Boyce Mkhize has resigned to 'pursue business interests'.<sup>126</sup>

### **Eskom's finances, management and resources**

Eskom is a critical institution for the realisation of the South African government's nuclear ambitions. It is generally accepted, however, that like most South African SOEs, it is poorly managed.<sup>127</sup> In an effort to assess the performance of such organisations President Zuma in 2010 established the Presidential State-owned Enterprises Review Committee. The committee's report on 700 national SOEs and public entities was presented to cabinet in September 2012 but has not yet been released to the public.<sup>128</sup> By mid-March 2013, the status of the report was still unclear and is 'still being discussed by Cabinet'.<sup>129</sup>

Cabinet's endorsement in 2012 of Eskom as the owner-operator of the future nuclear power stations reaffirms that utility's position in terms of the 2008 national nuclear policy. Like those of many South African SOEs, however, Eskom's finances and management are in a poor state, to the extent that in October 2012 credit rating agency Moody's downgraded Eskom's unsecured bond rating.<sup>130</sup> One implication of this action is that Eskom will experience difficulties in securing international finance to support its expansion plans. Its Transmission Ten-Year Development Plan: 2013–2022 sets out planned investment on power transmission infrastructure projects of almost ZAR 150 billion over the next decade.<sup>131</sup> Eskom's 2012 application for a 16% tariff increase, had it been successful, would have raised ZAR 1 trillion, but still would not have generated sufficient capital to finance the nuclear fleet.<sup>132</sup>

Eskom is the state-owned entity responsible for power generation and distribution and as such is a key player in realising government's socio-development objectives. The fact that it falls under the Department of Public Enterprises and not the minister of energy, exacerbates government turf wars. Furthermore, despite the fact that it is poorly managed and financially struggling, its close ties to political and business elites may hugely inflate the tender price of nuclear expansion projects, which in turn will add to the cost of expansion plans, power generation and distribution.

### **Lessons from the PMBR debacle**

Misgivings about the competence of Eskom have been reinforced by financial failures in respect of the PMBR, which still loom large and will further constrain the utility's future financing. Pebble Bed Modular Reactor (Pty) Ltd was established in 1999 to develop and market small-scale, high-temperature reactors in South Africa and abroad, with an 800-member project team based in Pretoria. In 2010, however, Public Enterprises Minister Barbara Hogan announced that the government would no longer invest in the PMBR, which had already accounted for ZAR 10 billion and for which another ZAR 30 billion was required from government, given that the company had been unable to attract further private investors. Government's financial contribution had amounted to 80.3%, while Eskom had contributed 8.8% and Westinghouse and the Industrial Development Corporation 4.9% each.<sup>133</sup>



Against this background the government commissioned an independent high-level review of the project and established an inter-departmental task team to consider the fate of the PBMR. The company was significantly down-sized in a process that involved staff retrenchment, decommissioning of its Fuel Development Laboratory (FDL) and mothballing of the Helium Test Facility. Cabinet decided to put the PBMR on to a care and maintenance basis to protect its intellectual property and other assets.<sup>134</sup>

Eskom has managed the PBMR since 1 April 2012 and will continue to do so until the end of the care and maintenance phase in 2013, when the government will make a final decision on the company. The government has, however, promised to 'protect and preserve' PBMR's intellectual property and assets, a process that includes 'packaging' more than 86% of the intellectual property for preservation. Government is also pursuing an intellectual property audit of the PBMR 'to protect its future value' and has conducted a skills audit to determine how the stock of acquired expertise could be utilised.<sup>135</sup> Calls by opposition political parties and non-governmental organisations for a financial audit of the PBMR to determine how taxpayers' money had been spent, fell on deaf ears.<sup>136</sup>

### **Post-Fukushima nuclear safety and security**

Nuclear safety and security in South Africa remain a concern, as recent events have illustrated. On 28 April 2012 a security breach occurred at Necsa's Pelindaba facility. The occurrence was not reported to the NNR in a timely manner; in fact, Necsa only submitted its report on the incident on 7 July 2012. Earlier, in April 2012, the NNR had suspended Necsa's acceptance of nuclear waste from Koeberg following non-compliance by the corporation at its Vaalputs nuclear waste storage facility.<sup>137</sup> In November the same year police discovered radioactive material on the site of the scrap metal recycling company SA Metal in the Cape Town suburb of Epping; the origin of the material is still unclear<sup>138</sup> although according to Necsa, in 2011 the IAEA had found no indication of diversion of declared nuclear material from peaceful purposes and no indication of undeclared nuclear material or activities in South Africa. Although the IAEA also concluded that all South Africa's nuclear material is directed to non-military activities, such breaches in nuclear security undermine the country's international standing and pose a risk of nuclear proliferation.<sup>139</sup>

In June 2011, following on these incidents and in the wake of the Fukushima leakage, the government concluded an agreement with the IAEA to assist with a stress test of the Koeberg power station in the event of flood or earthquake.<sup>140</sup> The safety assessment was designed to evaluate the behaviour of the Koeberg plant in a hypothetical set of extreme conditions that could cause a loss of power or cooling; the exercise supports the implementation of the IAEA's international safety standards that protect health and minimise danger to life and property. Koeberg is currently undergoing its second 10-year safety review.<sup>141</sup>

The NNR also directed Eskom and Necsa to conduct reassessments of their reactors to determine whether the plants can withstand major external events. Its review of the reassessments concluded that the installations were adequately designed and are maintained and operated to withstand all the external events considered in the original design protocols. The NNR has, however, identified five areas for improvement in

regulatory standards and practices, which will be addressed as part of a current review of the regulatory framework.<sup>142</sup>

According to a Koeberg executive the plant can withstand an earthquake of seven on the Richter scale.<sup>143</sup> The Koeberg emergency plan, conducted by the NNR, is reviewed every two years; the latest of these exercises took place on 5 September 2012, when the station's emergency preparedness was tested successfully.<sup>144</sup> In addition the NNR conducted an inspection of Safari-1 which confirmed its safety and operational integrity.<sup>145</sup>

Despite considerable goodwill towards South Africa as a state that dismantled its nuclear weapons programme, some international concerns remain in respect of its nuclear affairs. The Nuclear Material Security Index issued in 2012 by the Washington-based Nuclear Threat Initiative indicated that although South Africa scores high in terms of five measures – an independent nuclear regulatory agency, safeguards adoption and compliance, domestic nuclear-related security legislation, control and accounting procedures, and international compliance – it rates lower in political stability, corruption, failure to specify quantities of nuclear materials, and poor physical security during transport.<sup>146</sup>

### **Transparency**

Although the South African constitution guarantees the right of South African citizens to access any information held by the state, there are significant concerns about government's transparency in respect of its nuclear ambitions.<sup>147</sup> The South Africa government has been criticised for the secrecy attending the new nuclear building plans. Two pieces of legislation, the National Key Points Act (NKPA) of 1980, and the Promotion of Access to Information Act (PAIA), Act of 2000, pose particular concerns. Drafted in 1980, the NKPA is a hangover from the PW Botha regime of the 1980s and gives arbitrary powers to the minister of police to declare any building or installation a key point vital to state security; under its provisions the state is under no obligation to be in any way accountable in respect of such a key point.<sup>148</sup>

In consequence the current South African government's secrecy about its energy infrastructure programme and policy is a cause for disquiet. In August 2012, the official opposition in parliament, the Democratic Alliance (DA) accused the minister of energy of being either ignorant or 'purposefully secretive' about these matters. The minister refused to answer questions pertaining to the volume of South Africa's uranium stockpile at Pelindaba, and payments made by Necsa to Klydon Ltd, a uranium enrichment company, due to their 'classified' and 'commercially sensitive' nature.<sup>149</sup> Similarly, NGOs such as Greenpeace Africa and the South Africa History Archives have lodged a formal complaint with the public protector and the South African Human Rights Commission in response to the energy minister's second refusal to publicise the INIR<sup>150</sup> compiled by her department to determine the country's preparedness to build nuclear power stations, and discussed in a closed meeting with the IAEA in October 2012.<sup>151</sup>

### **The Mangaung legacy**

The ANC's 53<sup>rd</sup> national conference held in Mangaung (Bloemfontein municipality) in December 2012 resulted in the re-election of President Zuma as ANC president, despite

challenges from Deputy President Motlanthe, among others. Several ANC officials opposing Zuma's candidature failed in their bid for re-election to senior party positions: they included NNEECC members Motlanthe, the former minister of finance Trevor Manuel, Dipuo Peters and Ebrahim Patel.<sup>152</sup> Although these individuals retain their cabinet membership they are no longer members of the ruling party's inner circle of influence and decision-making, a situation that might bring with it marked differences on nuclear issues and agendas.

The ANC regards energy security as an important aspect of the country's economic 'transformation'. A further outcome of the Mangaung conference was the adoption of policy documents (such as the NDP) and resolutions in respect of, for example, energy security and strategic mineral resources. Such ANC conference resolutions are often a precursor to an appearance on the government's own agenda. The ANC also adopted a resolution on the country's mineral sector, the development of which it believes will contribute to economic transformation. The resolution distinguishes between several types of minerals that require development, namely those for manufacturing (iron ore, base metals and the platinum group), energy (coal, gas, shale and uranium), agriculture (phosphates, sulphur and limestone), and infrastructure (steel, cement and copper). The resolution states that 'those strategic minerals that require special public policy measures will be indentified' and calls for the 'strengthening of the state mining company [African Exploration Mining and Finance Corporation]'.<sup>153</sup>

## SUMMARY AND CONCLUSION

South Africa's progress towards its largest nuclear procurement programme is taking place in the context of changes within the ANC ruling party, an increase in global demand for uranium, and growing energy needs within South Africa. There is a national shortage of electricity supply, arising from an aging energy infrastructure, a rising population and an ambitious socio-economic development programme. To help achieve its energy objectives the government has established a committee to drive its nuclear expansion plans, an action that on the face of it contradicts the recommendations of the NPC that further feasibility studies on nuclear energy should be conducted before a decision on a new nuclear fleet is taken; nonetheless various government and regulatory institutions, such as the NPC, the NNR and Necsca are being restructured in preparation for nuclear power expansion.

A failure to complete EIAs for the proposed sites for the new power stations, taken with the poor financial position of Eskom, and government's secrecy about various issues in respect of its nuclear plans, constitutes a major concern and has resulted in some public protest. In addition to these factors, resource nationalism is on the rise in South Africa, which is aiming to secure its future uranium supplies. Finally, persistent concerns about South Africa's nuclear future include the high cost of the programme, its preference over alternative energy sources, an opaque tender process, safety and security issues, a general lack of transparency, and the quality of leadership in the ruling party.

Like many developing countries, South Africa seems to regard nuclear energy as a panacea for its development challenges and energy requirements. In addition, nuclear power generation capability carries with it some international status and prestige. In the wake of the IAEA INIR mission to South African of February 2013, the South African

government indicated that it will make an announcement in respect of the country's future nuclear expansion plans in July 2013. It remains unclear, however, whether government's nuclear agenda is aligned with the South African citizenry's ideals. The costly and secretive nature of government's nuclear plans raises serious questions of probity, especially when viewed against the backdrop of wider unease over failures in governance and transparency standards. Public-private sector collusion on some mega-construction projects, conflicts of interest arising from the ANC's business interests in the energy sector through its effective shareholding in Hitachi, and the high-profile corruption revealed in the arms procurement saga, all fall into this category.

Unless South Africa's nuclear planners meet such concerns head-on, their programmes will fail to inspire confidence, at home or abroad.

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