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## GOVERNMENT NOTICE

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### DEPARTMENT OF MINERALS AND ENERGY

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### NUCLEAR ENERGY POLICY FOR THE REPUBLIC OF SOUTH AFRICA

JUNE 2008

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## **PURPOSE OF THE DOCUMENT**

This document presents a policy framework within which prospecting, mining, milling and use of nuclear materials as well as the development and utilisation of nuclear energy for peaceful purposes by South Africa shall take place.

## **VISION**

Industrial and technological leadership, to secure alternative energy resources for the future, through the development of a globally competitive infrastructure and skills for the peaceful utilisation of Nuclear Energy and Technology.

## **SCOPE**

The document covers the prospecting and mining of uranium ore and any other ores containing nuclear materials as well as the nuclear fuel cycle in its entirety focusing on all applications of nuclear technology for energy generation.

This policy does not cover non-energy related applications of nuclear technology.

### **Ministerial Foreword**

This policy document represents the South African government's vision for the development of an extensive nuclear energy programme by ensuring that Government's objective on the prospecting and mining of uranium ore and the use of uranium (or other relevant nuclear materials) as a primary resource of energy must be regulated and managed in a manner that will be for peaceful purposes. The long term goal is to be self-sufficient in all aspects of the nuclear fuel cycle where for each aspect, a feasibility study has been conducted. As a point of departure, South Africa has more than 20 years experience of safe nuclear power plant operation and experience in research, development and use of nuclear related technology.

South Africa's Koeberg Nuclear Power station has accorded our country the opportunity of acquiring a wide spectrum of skills in plant operation, radiological and environmental protection and radioactive waste management amongst others. These skills will be very important in ensuring safe and sustainable use of an extended nuclear energy programme for the benefit of the country. In this extended programme NECSA will play a vital role as the state's body responsible for research and development in the field of nuclear energy. It will also be important to retain and develop specialist scientists to ensure success of the programmes.

This document clarifies the main objectives and lays down the principles that will guide Government's vision for an extended nuclear energy programme. Above all, the principles of safety, the protection of the environment and peaceful uses must be highlighted. It will be necessary to implement new structures and mechanisms in order to ensure successful implementation of this Policy. The envisaged development of nuclear fuel cycle activities are major challenges but these are not insurmountable. This is a very ambitious undertaking but I am confident that with the contribution of the South African collective the vision is surely within reach.

The important role of nuclear energy in mitigating climate change by reducing greenhouse gas emissions deserves special mentioning. Today it is known that nuclear power is one of the least carbon intensive generating technologies and the significant annual savings of carbon dioxide emissions brought about by the world's nuclear power stations cannot be denied. When considering the emissions from the full life cycle, nuclear power produces only a tiny fraction of greenhouse gases when compared to fossil fuels. As we go into the future our nation and the world at large face energy and related environmental challenges. Our country needs an energy portfolio that can positively assist us in meeting these challenges.

**Ms B.P. Sonjica**

**Minister**

## **A. NUCLEAR ENERGY POLICY FRAMEWORK**

### ***1. Introduction***

This Policy serves as an embodiment of the South African Government's commitment to the further development and expansion of the existing nuclear energy sector in a coordinated manner. It presents the Government's vision for nuclear energy and proposes a framework within which this vision can be attained. The current involvement and activities in the nuclear energy sector both upstream and downstream are outlined. The long term vision of becoming globally competitive in the use of innovative technology for the design, manufacture and deployment of state of the art nuclear energy systems and power reactors and the nuclear fuel cycle is preserved.

This vision 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.

South Africa has a track record of safe and secure nuclear power plant operation and maintenance as well as world class research capabilities and development experience and use of nuclear power technology.

### ***2. Background***

South Africa has an energy intensive economy mainly as a consequence of the exploitation of the country's mineral resources. Coal accounts for over 90% of the total electricity generating capacity. This is mainly due to the abundant coal deposits in the north-eastern parts of the country. This resulted in South Africa building its first nuclear power station in the Western Cape during the 1980's in order to ameliorate the situation. Although at present nuclear power accounts for only approximately 6% of electricity generated in the country, it is very important in an area where there are no coal reserves.

Concerns over increases in the price of coal, reserve exhaustion and global warming, partly as a result of greenhouse gas emissions and other atmospheric pollutants, necessitate a departure from the over-reliance on electricity generated from coal.

The White Paper on Energy Policy calls for the achievement of energy security through the diversification of primary energy sources. Further, South Africa's electricity generation capacity has to be increased significantly in the next few decades to facilitate economic growth and social progress, while remaining sensitive to climate change. This presents an opportunity to promote diversity in primary energy sources, considering that the use of nuclear energy is increasingly being recognised worldwide as one of the strategies to mitigate greenhouse gas emissions and global warming, since it is an important low carbon emission source of electricity generation compared to fossil fuels.

South Africa also possesses sizeable uranium reserves and has an extensive uranium mining industry, making the country one of the important producers of uranium in the world. The presence of this primary energy source in South Africa is a key element of security of energy supply nationally.

The geographical positioning of South Africa and limited resources in certain areas makes nuclear energy a viable alternative to coal for electricity generation on a large scale. Nuclear energy is attractive for a number of reasons amongst which are the following:

- South Africa has sizeable uranium (and other potential nuclear material) reserves and a vibrant mining industry
- The extraction of uranium ore does not present any major challenges
- Value addition in the form of beneficiation of uranium ore and the implementation of a strong nuclear energy programme would lead to job creation and the further development of a skilled workforce.

- A solid regulatory framework, which would facilitate a structured development of the nuclear sector, already exists in South Africa.
- South Africa's non-proliferation credentials, policy and legislative framework allows for the pursuit of a peaceful nuclear energy programme consistent with national and international nuclear non-proliferation obligations.
- Low carbon emissions based on full life cycle and significant role in achieving clean air by avoiding polluting emissions as compared to fossil fuels.
- The availability of safer more efficient new generation nuclear power technologies.
- Available energy resources for bulk electricity generation.

The White Paper on Energy Policy (1998) also states that *“Government will ensure that decisions to construct new nuclear power stations are taken within the context of an integrated energy policy planning process with due consideration given to all relevant legislation and the process subject to structured participation and consultation with all stakeholders”*. This policy provision has in the meantime been taken over by pressing energy security challenges and although the Department of Minerals and Energy published the “Integrated Energy Plan for the Republic of South Africa” (9 March 2003) it only indicated that investigations into nuclear options as a future energy source should continue. Based on Government's fundamental position on diversification of energy resources to ensure security of supply, Nuclear is a viable energy resource for base load electricity production in the areas of South Africa that have no alternative energy resources that can be used for base load power. With regard to public consultation on the construction of new nuclear power stations new legislation promulgated since the 1998 White Paper on Energy Policy makes provision for such consultation during the Environmental Impact Assessment process and the Nuclear Installation Licensing process.

### **3. International Situation**

It is universally accepted that energy, and access to it, is essential for human development. Equally the continued health of the planet's environment is of concern to many Governments including the South African Government. There is consensus on the need to save energy, to diversify energy sources and to improve energy efficiency, while reducing greenhouse gas emissions. As a result there is a resurgence of electricity generation through the use of nuclear energy. Climate change and pressures on greenhouse gas emissions have resulted in many countries having adopted and launched nuclear energy programmes for electricity generation. This is because the contribution from nuclear power generation to greenhouse gases is negligible compared to fossil fuels. It is therefore anticipated that suppliers, manufacturers and operators will increasingly pay attention to nuclear technology as an important source of electricity generation. South Africa as a global player experiences similar energy policy driving forces and needs to respond appropriately.

### **4. Nuclear Energy Policy Objectives**

Through this Policy Government aims to achieve the following objectives:

- Promotion of 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;
- Establishment of the necessary governance structures for an extended nuclear energy programme;
- Creation of a framework for safe and secure utilisation of nuclear energy with minimal environmental impact;
- Contribution to the country's national programme of social and economic transformation, growth and development;
- To guide in the actions to develop, promote, support, enhance, sustain and monitor the nuclear energy sector in South Africa.

- Attainment of global leadership and self-sufficiency in the nuclear energy sector in the long term;
- Exercise control over un-processed uranium ore for export purposes for the benefit of the South African economy;
- Establishing of mechanisms to ensure the availability of land (nuclear sites) for future nuclear power generation;
- Allow for the participation of public entities in the uranium value chain;
- Promoting energy security for South Africa;
- Improvement of the quality of human life and to support the advancement of science and technology;
- Reduction of greenhouse gas emissions; and
- Skills development related to nuclear energy.

## ***5. Existing Nuclear Energy Governance Framework***

The Minister of Minerals and Energy is the responsible the Minister for the governance of the nuclear industry and related matters. Apart from the Minister's authority over radioactive waste and irradiated nuclear fuel, the Minister also regulates matters regarding nuclear non-proliferation as set out in the Nuclear Energy Act.

### **5.1 White Paper on Energy Policy (1998)**

Nuclear energy policy is guided by the White Paper on Energy Policy as approved by Government at the end of 1998, where it was retained as one of the policy options for electricity generation. As part of national policy government also encouraged a diversity of both supply sources and primary energy carriers. In terms of the White Paper Government will investigate the long-term contribution nuclear power can make to the country's energy economy and, secondly, how the existing nuclear industrial infrastructure can be optimised. This Nuclear Energy Policy outlines the vision envisaged in the White Paper. Some of the main policy objectives relate to decisions regarding

possible new nuclear power stations, the management of radioactive waste, safety monitoring of the nuclear industry, effectiveness and adequacy of regulatory oversight and a review of bodies associated with the nuclear industry.

### **5.2 Nuclear Energy Act, 1999 (Act No. 46 of 1999)**

The Nuclear Energy Act provides for the following:

- Establishment of the South African Nuclear Energy Corporation wholly owned by the State with its main function being to undertake and promote research and development in the field of nuclear energy and radiation science and technology
- Ministerial responsibility for the implementation and application of the Safeguards Agreement entered into by the Republic and the International Atomic Energy Agency (IAEA) in fulfilment of South Africa's obligations under the Nuclear Non-Proliferation Treaty and any additional protocols.
- Ministerial authority to regulate the acquisition and possession of nuclear material and related equipment in consultation with the South African Council for the Non-proliferation of Weapons of Mass Destruction, in order to comply with the international obligations of the Republic.
- Ministerial authority over the management and discarding of radioactive waste and the storage of irradiated nuclear fuel.

### **5.3 National Nuclear Regulator Act, 1999 (Act No. 47 of 1999)**

This Act establishes the National Nuclear Regulator. The main object of the Regulator is to provide for the protection of persons, property and environment against nuclear damage through the establishment of safety standards and regulatory practices.

#### **5.4 Radioactive Waste Management Policy and Strategy (2005)**

The Radioactive Waste Management Policy and Strategy for the Republic of South Africa (2005) establishes a national radioactive waste policy framework setting out the principles for management. It further provides for the necessary management structures for radioactive waste management.

#### **5.5 Secondary Governance Instruments**

Other secondary legislation that govern nuclear energy related matters are the Hazardous Substances Act, 1973 (Act No. 15 of 1973), the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), the Mine Health & Safety Act (Act No. 29 of 1996), the Mineral and Petroleum Resources Development Act, (Act No. 28 of 2002), the National Environmental Management Act (Act No. 107 of 1998), the National Water Act (Act No. 36 of 1998), the Electricity Regulation Act, 2006 (Act No. 4 of 2006) and the National Energy Regulator Act, 2004 (Act No. 40 of 2004).

### ***6. Current Profile of the South African Nuclear Energy Programme***

#### **6.1 Uranium exploration and mining**

South African private sector companies currently mine and export uranium ore without appreciable levels of beneficiation. Due to a high price increase there has been increased interest in the exploration and mining of uranium ore, however without any appreciable increase in the beneficiation of uranium ore concentrates.

## **6.2 South African Nuclear Energy Corporation, Limited**

The South African Nuclear Energy Corporation (NECSA) was established as a public company in terms of the Nuclear Energy Act, 1999 (Act No. 46 of 1999) and is wholly owned by the State. The main functions of NECSA are to undertake and promote research and development in the field of nuclear energy and radiation sciences and technology; to process source material, special nuclear material and restricted material and to co-operate with persons in matters falling within these functions. Apart from its main operations at Pelindaba, including the SAFARI research reactor, NECSA also operates the Vaalputs National Radioactive Waste Disposal Facility presently licensed to receive low & intermediate radioactive waste. South Africa has technical expertise on nuclear technology at NECSA including expertise on uranium conversion and enrichment remaining from South Africa's previous nuclear weapons programme.

## **6.3 Eskom Holdings Limited**

Eskom is the owner and operator of the Koeberg Nuclear Power Station. Construction of Koeberg's two reactors commenced in 1976 under a turn-key contract and they have operated safely in the more than 20 years since their commissioning in 1984 and 1985 respectively. Koeberg supplies 1800 MWe to the national grid when both reactors are operating at full power contributing approximately 6% of South Africa's electricity. With most of South Africa's electricity generating stations situated on the highveld coal fields, Koeberg provides a necessary anchor for the electricity transmission network. South Africa's expertise with respect to the management, operation and maintenance of nuclear power plants resides in Eskom.

#### **6.4 Pebble Bed Modular Reactor (Pty) Limited**

The PBMR Company is developing a fuel manufacturing plant and a demonstration high temperature gas cooled reactor, which is a low power output reactor designed toward meeting Generation IV requirements, applicable to both electricity generation and process heat applications.

#### **6.5 National Nuclear Regulator**

The National Nuclear Regulator (NNR) was established in terms of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999). The main objectives of the NNR are to provide for safety standards and regulatory practices for protection of persons, property and the environment from nuclear damage; to exercise regulatory control related to safety over the siting, design, construction, operation, manufacture of component parts, decontamination, decommissioning and closure of nuclear installations; to exercise regulatory control over vessels propelled by nuclear power or having radioactive material on board which is capable of causing nuclear damage; to exercise regulatory control over other actions to which the NNR Act applies; to provide assurance of compliance and to ensure that provisions for nuclear emergency planning are in place. For purposes of the NNR Act the NNR is also the national competent authority in connection with the International Atomic Energy Agency's Regulations for the Safe Transport of Radioactive Material.

## **7. Policy principles for Nuclear Energy use in South Africa**

The Government's vision for nuclear energy shall be guided by the following principles:

*P1. Nuclear Energy shall be used as part of South Africa's **diversification of primary energy sources** and to ensure security of energy supply.*

*P2. Nuclear Energy shall contribute to **economic growth and technology development** in South Africa through investment in infrastructure, creation of jobs and the further development of skilled workers.*

*P3. Nuclear Energy shall form part of South Africa's strategy to **mitigate climate change**.*

*P4. All activities undertaken in pursuit of nuclear energy shall be in a manner that takes the **environmental impact into account**.*

*P5. All Nuclear energy sector activities shall take place within a **legal regulatory framework consistent with international best practice**.*

*P6. Nuclear energy shall be used only for **peaceful purposes** and in conformity with national and international legal obligations and commitments.*

*P7. In pursuing a national nuclear energy programme there shall be **full commitment to ensure that nuclear and radiation safety** receives the highest priority to provide for the protection of persons, property and the environment.*

*P8. South Africa shall endeavour to **use uranium resources in a sustainable manner** through the recognition of the three interdependent and mutually reinforcing pillars of sustainable development, namely economic development, social development and environmental protection. To the*

extent possible technologies chosen for Nuclear Power plant shall be those that allow for optimum utilisation of uranium resources including the use of recycled uranium.

P9. Government shall encourage the **development of appropriate institutional arrangements** and thereby ensure the development of human resources competent to discharge the responsibility of managing a nuclear infrastructure.

P10. South Africa shall strive to acquire technology know-how and skills to enable design, development, construction and marketing of its own nuclear reactor and fuel cycle systems. To this end an **industrial support base** for the nuclear sector shall be developed as appropriate, taking into account the scale of the national programmes. **Technology transfer** shall be optimised in any procurement of nuclear and related equipment.

P11. All facets of the nuclear energy sector shall always be subjected to **appropriate safeguards and security measures** in conformity with South Africa's international obligations.

P12. Government shall **support research, development and innovation** in the use of nuclear technology. Government shall also support participation in global nuclear energy technology innovation programmes.

P13. Government shall put in place effective **mechanisms to protect and safeguard the South African nuclear energy industry Intellectual Property rights and innovative technology designs.**

P14. Government shall create programmes to stimulate public awareness and inform the public about the nuclear energy programme.

P15. Government will ensure that adequate funding will be made available to support the technology development initiatives that are essential to the implementation of this policy. Although the Nuclear Energy Policy aims for the

*development of a globally competitive infrastructure price support mechanisms can be implemented to enable the ongoing operations of key technologies.*

*P16. Government shall endeavour to implement a fleet approach to power reactor procurement which is needed to optimise the industrialization process and ensure economy of scale.*

## ***8. Responsibilities***

### **8.1 Government**

#### **Government shall be responsible for:**

- Overall Policy Making regarding nuclear energy
- Establishing and implementing a legal framework
- Establishing the required Operational and Regulatory Bodies
- Ensuring Cooperative Governance
- Ensuring Coordination of Nuclear Activities at national level
- Fulfilling Obligations in terms of international agreements
- Ensuring adequate national competence and capacity
- Ensuring Implementation of this Policy
- Supporting technology development
- Arranging international and regional cooperation
- Approving Investment plans of State Owned Enterprises in terms of achieving the goals of this policy
- Facilitating foreign government engagements and investment
- Supporting the expansion of the local nuclear manufacturing industry
- Ensuring the required competency and skills base for a local nuclear industry
- Acquiring and managing strategic uranium stockpiles
- Ensuring that cost calculations for nuclear power shall be based on the full nuclear fuel cycle, including decommissioning and decontamination as well as waste disposal.

Where necessary amendments to existing legislation will be made to ensure alignment with the Policy Objectives.

## **8.2 Regulatory Bodies**

Regulatory bodies shall be responsible for the efficient and cost-effective enforcement of compliance with legal requirements and internationally benchmarked regulatory requirements as well as provide advice to Government as appropriate.

## **8.3 Operators**

Operators shall be responsible for fulfilling all regulatory requirements and for ensuring that decisions are taken within the confines of this Policy and any applicable legislation.

## **8.4 Investors**

Investment funding to implement the nuclear energy programme envisaged by this policy shall be from government and public entities. Private sector investment will also be promoted in all aspects of the nuclear fuel cycle.

### **9. International Cooperation**

Nuclear activities take place within the framework of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and other international obligations and commitments. National Obligations in this regard include a Comprehensive Safeguards Agreement with the International Atomic Energy Agency (IAEA) and an Additional Protocol. South Africa shall continue to fulfil all its multilateral obligations and commitments under the relevant international non-proliferation instruments.

*When planning and promoting research, development and utilisation of nuclear energy for peaceful purposes, Government will cooperate and collaborate internationally within the constraint of protecting intellectual property in its national programme.*

### **10. Bilateral Cooperation**

With due regard to its international legal obligations and commitments and national legislation, South Africa shall pursue bilateral cooperation with other states:

- that have relevant nuclear programmes from which South Africa can learn from or may benefit from
- that have nuclear programmes from which South Africa requires technology, material or equipment transfer
- that present export opportunities for South African nuclear services and manufactured goods

### ***11. Multilateral Cooperation and Africa Regional Cooperation***

South Africa shall pursue multilateral cooperation on nuclear energy in terms of the national policy approach to multilateral institutions taking into account international obligations arising from treaties and other legally binding instruments. The Government recognises the International Atomic Energy Agency (IAEA) as the leading multilateral institution responsible for promoting the peaceful uses of nuclear energy.

In accordance with the African Nuclear-Weapons-Free-Zone Treaty (also known as the Treaty of Pelindaba) opened for signature on 11 April 1996, South Africa will host the Treaty's African Commission on Nuclear Energy (AFCONE) once the Treaty enters into force. The Commission is the Treaty's mechanism to ensure compliance with the obligations contained in the Treaty, which includes the encouragement and promotion of regional, sub-regional programmes and international co-operation in the peaceful uses of nuclear science and technology. The hosting of the Commission is a demonstration of South Africa's commitment to the Treaty and the promotion of its obligations and undertakings.

*South Africa will actively seek to promote uranium beneficiation on a regional basis.*

## **B. NUCLEAR ENERGY GOVERNANCE FRAMEWORK**

### ***12. Institutional Arrangements***

The following institutional arrangements are considered necessary for the implementation of this policy.

- Executive national coordination.
- An organisation for nuclear energy R&D and Innovation coordination.
- An organisation for electricity generation from nuclear power.
- A national nuclear regulator.
- A national nuclear architectural engineering component manufacturing and construction capability.
- A national radioactive waste management agency.

However, with the implementation of this policy, and as the industry develops, it may be appropriate to adjust these institutional arrangements accordingly.

#### **12.1 National Nuclear Energy Executive Coordination Committee**

The multi-faceted nature of nuclear fuel cycle activities necessitates the formation of a coordination committee at Executive (Cabinet) level, which will ensure coordination of actions and alignment of all actions with national policies and legislation.

*A National Nuclear Energy Executive Coordination Committee, which shall ensure implementation and exercise oversight over all aspects of this nuclear energy policy implementation shall be formed, appropriately structured and funded.*

## **12.2 National Nuclear Research, Development and Innovation**

Government shall maintain one national organisation for the coordination of nuclear energy research, development and innovation in South Africa and perform these functions within the provisions of the Nuclear Energy Act, 1999 (Act 46 of 1999). One of the functions of the national organisation will be to stimulate nuclear related research at universities and within the private sector.

*NECSA shall serve as the anchor for nuclear energy research, development and innovation in South Africa.*

## **12.3 National Nuclear Power Generation Organisation**

It is necessary to create certainty in the nuclear energy sector so that there is no doubt as to who is mandated to fulfil certain roles in particular ownership, operation and maintenance of nuclear power plants.

*Eskom shall be the main owner and operator of nuclear power plants in South Africa. Ownership of nuclear power plants may also take the form of Public Private Partnerships with Eskom retaining the controlling shareholding as the Public sector player.*

## **12.4 National Nuclear Regulator**

The National Nuclear Regulator shall remain responsible for the protection of persons, property and the environment through the establishment of safety standards and regulatory practices, regulatory control over the siting, design, construction, operation, manufacture of component parts, decommissioning & decontamination and security of nuclear installations and regulatory control over other actions to which the NNR Act applies.

### **12.5 National Nuclear Architectural Capability**

South Africa lacks a national nuclear architectural capability and do not have a coordinated national approach for integrating Government and Private Sector initiatives.

*To fulfil Government's intent of developing a national capacity to supply nuclear equipment and nuclear reactors, a national nuclear architectural engineering, component manufacturing and construction capability will be established. This will include the ability to design, manufacture, market, commercialise, sell and export nuclear energy systems & services. Private sector participation will be encouraged.*

### **12.6 National Radioactive Waste Management Agency (NRWMA)**

In terms of the Radioactive Waste Management Policy and Strategy, the NRWMA shall be responsible for the Management of radioactive waste disposal on a national basis.

### **13. Nuclear Fuel Cycle**

*In order to implement a sustainable nuclear programme and obtain all the potential economic benefits South Africa shall endeavour to implement, or obtain interests in, **the complete nuclear fuel cycle** as follows:*

#### **13.1 Uranium Mining and Milling**

Although South Africa is 5<sup>th</sup> in terms of uranium resources in the world, the country ranked 11<sup>th</sup> in terms of production in 2005. This is mainly due to existing infrastructure for concentration of ores as well as a lag between response to the increased uranium price and renewed investment in uranium exploration and mining. There has been an upsurge in uranium exploration and there is now a need to increase capacity of uranium ore processing (calcining).

*Government shall ensure that the exploitation of our mineral resources and the securing of a long term supply of these resources is balanced in a sustainable fashion, bearing in mind the country's own needs and the creation of a viable market for local investors. In addition, government shall actively promote investment in uranium exploration and mining, and in very specific instances shall make investments in these industries, as a way of ensuring security of nuclear fuel supply for South Africa.*

*The South African Nuclear Energy Corporation (NECSA) shall be encouraged to participate in the uranium value chain, beneficiation thereof and will be responsible for storing uranium supplies acquired by the State.*

### **13.2 Uranium Conversion**

In order to achieve the vision of this policy, South Africa will need to invest in world class conversion facilities.

*Government, through NECSA, shall undertake and lead the development of uranium conversion capabilities as part of the beneficiation of uranium. Private sector participation in the conversion process will be promoted.*

### **13.3 Uranium Enrichment**

South Africa had an enrichment plant but this was shut down in the 1990's and subsequently dismantled. Although there is presently no uranium enrichment infrastructure or economically proven technological capabilities in South Africa, Government's intention is to investigate the re-establishment of a uranium enrichment capacity as part of uranium beneficiation for peaceful purposes.

*Government, through NECSA, shall investigate the viability of developing its own uranium enrichment capabilities and will simultaneously actively seek to obtain access to established uranium enrichment programmes to ensure security of supply.*

### **13.4 Fuel Fabrication**

The South African facility for nuclear fuel fabrication for light water reactors was shutdown in the 1990s and dismantled. PBMR is in the process of establishing a pebble fuel manufacturing facility at Pelindaba. It is recognised there is currently sufficient capacity and diversity of nuclear fuel supply globally for conventional nuclear reactors. However, as part of uranium beneficiation and the strategic intent of building a globally competitive nuclear

fuel cycle industry and securing the supply chain, South Africa will have to develop a plan for the development of a fuel fabrication capacity.

*Government, through NECSA shall design a strategy to develop nuclear fuel fabrication capabilities. Government will in the intervening period actively seek to obtain access to established fuel fabrication programmes to ensure security of supply.*

### **13.5 Used (Irradiated) Nuclear Fuel and Radioactive Waste Management**

In 2005 Government approved the Radioactive Waste Management Policy and Strategy for South Africa. The strategy talks to management of radioactive waste on a national scale. Legislation giving effect to the policy is being developed.

*Radioactive Waste including used nuclear fuel shall be managed in terms of the radioactive waste management policy and strategy.*

### **13.6 Reprocessing of Used (Irradiated) Fuel and Recycling of Fissile Materials**

In order to fully implement the principles of the radioactive waste management policy and meet the objective of sustainability, the reprocessing of used nuclear fuel and recycling of fissile materials for re-use will have to be considered.

*Government, through NECSA, shall investigate the viability of building an indigenous reprocessing facility. In the short-term South Africa shall make use of existing commercial reprocessing facilities in other countries.*

### **13.7 Implementation Considerations**

In investigating the feasibility of expanding South Africa's nuclear energy programme and in implementing any phases of the nuclear fuel cycle, government will consider and clarify the responsibilities of all role players and identify the challenges involved.

*Timeframes will be allocated to the completion of all activities/phases and be monitored by the Executive Co-ordination Committee.*

## **14. Nuclear Reactor Construction and Operation**

South Africa has a declared intention to pursue a Pressurised Water Reactor (PWR) Programme and a nationally developed Pebble Bed Modular Reactor Programme subject to the success of the first demonstration unit. Government, through Eskom, is taking the lead in respect of the extensive PWR programme to substantially diversify the generation base and reduce overall carbon emissions. Government, through the PBMP Company, is focused on the electricity and process heat applications of Pebble Bed technology.

*Government's intention is to use the opportunity created by these programmes to establish a modern nuclear technology industry including manufacturing and construction capabilities as well as services. In particular, where viable, the conventional nuclear build programme must be associated with technology transfer, an investment programme and the building of institutional capacity to establish a national industrial capability for the design, manufacture and construction of nuclear energy systems.*

## Implementation Guideline towards Achieving National Objectives

In order to systematically proceed towards meeting the national objectives on nuclear energy, a phased approach will have to be adopted. These phases could proceed as outlined below:

### Phase 1 2008 – 2010

1. Maintain and enhance current national nuclear infrastructure
2. Conduct preparatory work for expansion of the nuclear infrastructure across the nuclear fuel cycle including funding and preparations for the construction of nuclear power plants
3. Continue research into advanced nuclear energy systems
4. Accelerate skills development initiatives in line with expected expansion including increased capacity at institutions of higher learning.
5. Promote uranium exploration and mining
6. Roll-out aspects of the Radioactive Waste Management Policy
7. Roll -out the public information programme.

### Phase 2 2011 – 2015

1. Construction of new nuclear infrastructure including nuclear power plants
2. Continued maintenance of existing nuclear infrastructure
3. Demonstration of advanced nuclear energy systems
4. Initiate localisation of nuclear equipment and component manufacturing – construction of heavy machinery infrastructure
5. Build capacity for nuclear technology transfer

### Phase 3 2016- 2025

1. Operation of new power plants
2. Maintenance of existing nuclear infrastructure
3. Local manufacturing of nuclear equipment and components
4. Commercialisation of advanced nuclear energy systems
5. Accelerate research into further advanced nuclear energy systems

## **15. Cross Cutting Issues**

### **15.1 Security of Uranium Supply**

The growing demand for energy in South Africa may necessitate that the export of unprocessed uranium ore be restricted. A minimum level of uranium ore concentrates shall always be safely secured in order to ensure that local utilities have adequate and reliable supplies for the nuclear power stations.

*Due to the expected level of local demand for uranium, the granting of uranium mining rights will have to be made conditional to production being availed for domestic use as and when the need arises at the prevailing market prices. Government shall ensure that the granting of uranium mining rights provide sufficient guarantees of enough resources remaining in reserve for future allocation, to cater for local demand.*

### **15.2 Security of Energy Supply**

The operation of a nuclear power plant requires fuel which is currently and for the foreseeable future mainly being provided by uranium, and to a lesser extent mixed oxide fuel from reprocessed & recycled irradiated uranium fuel. South Africa therefore has to ensure reliable and sustainable supply of uranium. The country has uranium resources and as such can provide for the needs of its nuclear programme.

*A nuclear fuel supply strategy will have to be developed in order to maximise the use of South African nuclear fuel mineral resources.*

### **15.3 Employment**

The vision of Government for the nuclear sector can contribute significantly to the country's social and economic development through amongst others the creation and maintenance of jobs. Uranium mining alone is conservatively expected to create and sustain at least 10000 additional jobs in the next decade.

*Activities in the sector shall therefore be undertaken in a manner that seeks to maximise job creation while maintaining the necessary efficiency and safety.*

### **15.4 Awareness Creation**

The use of nuclear energy is generally misunderstood by the public due in part to the lack of appropriate information. For this reason it is important to inform the public about the risks, benefits and safety of nuclear energy.

*To this end Government shall initiate and sustain public awareness campaigns, education programmes and information dissemination by conducting public seminars and consultative meetings amongst others as and when appropriate.*

### **15.5 Human Resource Development**

Competent personnel are critical to the success of this programme. Only suitably qualified, skilled persons should be utilised in activities covered in this policy. Consistent with achieving technical excellence, there shall be commitment to workforce diversity in order to increase the representation of women, previously disadvantaged communities and where appropriate people with disabilities.

*Government is committed to developing and maintaining a technically competent workforce to accomplish the objectives of this policy. To this end a strategy and implementation plan for development and recruitment of suitable persons will be developed.*

### **15.6 Environmental Protection**

*In implementing the country's nuclear energy policy existing environmental protection legislation and regulations need to be applied and updated as necessary.*

### **15.7 Funding**

A number of the initiatives forming part of the strategic framework will require substantial level of funding. The initiatives can be categorized in the following manner:

**Institutional:** The establishment of the various Entities identified in the policy as well as amalgamation of some existing ones. Examples are the consolidation of the Nuclear and Radiation Safety Regulation as well as the establishment of the National Nuclear Architectural engineering, component manufacturing and construction capability.

**Technological:** This includes funding for research, development and innovation as well as conversion, enrichment, fuel fabrication, and waste management (including reprocessing/recycling and disposal)

**Industrial:** The scope to which conversion, enrichment, nuclear fuel fabrication, reprocessing or recycling and nuclear power plant is actually rolled out, will influence the requirement for a sectoral industrial strategy, and hence the level of funding required.

*Government shall investigate appropriate funding mechanisms, including price support mechanisms.*

### **15.8 A Reserve of Nuclear Sites**

The site of the Koeberg Nuclear Power Station can accommodate several additional nuclear power reactors. However to sustain a nuclear energy programme in the long run it will be important to establish a strategic reserve of nuclear sites and associated servitudes for transmission lines. Land suitable for siting nuclear power plant is a scarce resource and it is therefore essential that suitable sites be identified, reserved and that their future viability be protected and secured before development pressures make them unsuitable or creates major safety and emergency planning difficulties. The NNR Act provides for such a mechanism whereby Eskom can apply to the National Nuclear Regulator for a Nuclear Installation Licence for siting and after which development surrounding the licensed site can be controlled in terms of the NNR Act.

*Government through Eskom shall identify, acquire and licence under the NNR Act potential nuclear sites to ensure a strategic reserve of nuclear sites.*

## ANNEXURE A

### ***A. Key Role Players Directly Involved in the South African Nuclear Energy Sector***

#### **A.1 Department of Minerals and Energy (DME)**

The DME through the Minister of Minerals and Energy has overall responsibility for nuclear energy in South Africa. The DME administers the Nuclear Energy Act and the National Nuclear Regulator Act. The DME is responsible for the national implementation of South Africa's international obligations in the area of IAEA safeguards, as well as the safety and security of nuclear material and facilities.

#### **A.2 Department of Science and Technology (DST)**

The DST administers the PBMR Human Capital Development Research and Innovation Frontier Programme (PHRIFP), which oversees the University Chairs Nuclear Energy Development Programme.

#### **A.3 Department of Health (DOH)**

The DOH issues licences for Group III and Group IV Hazardous Substances, medical use of radioactive materials, and oversees nuclear medicine research facilities.

#### **A.4 Department of Trade and Industry (DTI)**

The DTI administers the SA Council for Non-Proliferation of Weapons of Mass Destruction (NPC). The control obligations in the area of nuclear dual-use goods and technology resort under the NPC. The DTI is also the custodian of the country's industrial policy.

#### **A.5 Department of Public Enterprises (DPE)**

Exercises oversight for state-owned enterprises (SOEs): Alexkor, Denel, Eskom, the PBMR, SAA, Transnet and Safcol. The DPE is coordinating the

SOE Competitive supplier development Programme which provides an alternative policy to the National Industrial Participation Programme for achieving the goal of leveraging expenditure on infrastructure investment and local industrial development.

#### **A.6 Department of Foreign Affairs (DFA)**

The DFA, through the Minister of Foreign Affairs, is entrusted with the formulation, promotion and execution of South Africa's foreign policy and with the daily conduct of South Africa's international relations. The DFA has the primary responsibility for discharging South Africa's international obligations, including those in the nuclear disarmament and non-proliferation arena

#### **A.7 South African Nuclear Energy Corporation, Limited (NECSA)**

A wholly-owned state company established by the Nuclear Energy Act of 1999. Commissioned in 1965, it operates the 20MW SAFARI research reactor. The main functions of the Corporation are to undertake and promote research and development in the field of nuclear energy and radiation sciences and technology. It also undertakes radioisotope production, nuclear liabilities management, as well as decommissioning. It operates the Vaalputs National Radioactive Waste Disposal Facility for Low Level Waste (LLW) and Intermediate Level Waste (ILW). It also hosts the development laboratories for the PBMR fuel and the PBMR Helium Test Facility (HTF).

#### **A.8 National Nuclear Regulator (NNR)**

The NNR oversees safety and regulation of nuclear installations and certain mines, and issues operating licences.

#### **A.9 Eskom Holdings Limited**

Eskom Holdings Limited ("Eskom") is South Africa's national vertically integrated electricity utility, engaged in the generation, transmission and distribution of electricity to industrial, mining, commercial, agricultural and residential customers as well as to redistributors. The Government, through the Department of Public Enterprises, is the sole shareholder. Eskom supplies approximately 95% of South Africa's electricity and approximately 50% of the

total electricity consumed on the African continent. Eskom is the owner and operator of the Koeberg Nuclear Power Plant, which provides a necessary "anchor" for the electricity transmission network.

#### **A.10 iThemba Laboratories**

Established in 1977, the research centre consists of site in Faure, Western Cape, as well as another in Gauteng and produces isotopes for medical applications. The centre has sub-atomic particle accelerators including a 200MeV proton accelerator and a 6MV van der Graaff accelerator. Facilities provide for basic and applied research using particle beams, particle radiotherapy for cancer treatment and production of radioisotope for nuclear medicine research. It is administered by the DST.

#### **A.11 PBMR (Pty) Ltd**

The PBMR Company is currently developing a fuel plant and a demonstration High Temperature Gas Cooled Reactor known as the Pebble Bed Modular Reactor.

**Note:** The above-mentioned list of organisations is not meant to be exhaustive as there are various other organisations that have some role in the nuclear sector. Some of the indicated roles are also likely to change during the implementation of this policy.