

# **URANIUM: FUTURE SOURCES (SOUTH AFRICA)**

DIRECTORATE: MINERAL ECONOMICS



**mineral resources**

Department:  
Mineral Resources  
**REPUBLIC OF SOUTH AFRICA**

# **URANIUM: FUTURE SOURCES (SOUTH AFRICA)**

DIRECTORATE: MINERAL ECONOMICS

by

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*Picture on the front cover (Witwatersrand conglomerate from which gold and uranium are mined) by courtesy of AngloGold Ashanti.*

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# **1. INTRODUCTION**

## **1.1 Spectacular Rise in Prices**

Over the last three years there has been considerable interest in the uranium market, spurred by rapidly rising prices. Spot prices have, in fact, tripled since January 2003, for which explanations vary, but include the following factors:

- Depleting commercial uranium inventories.
- Mine production is unlikely to expand at a sufficient rate to replace falling secondary supplies, over the next few years.
- Uncertainty over the timing and magnitude of secondary supplies on the commercial market (Stephen Kidd, 2005).
- Rising demand from nuclear power utilities in China, India, South Korea and Russia.
- A more positive outlook for nuclear power due to the implementation of the Kyoto Protocol and the start of Emissions (reduction) Trading (nuclear electricity avoids the emission of 100s of millions of tons of CO<sub>2</sub> produced through coal-fired electricity generation).

Currently (March 2007), the uranium spot price stands at \$85/pound, with sentiment still bullish and analysts forecasting a price of \$100/pound before year-end. Some commentators even go as far as saying that uranium might prove to be “flavour of the decade”.

## **1.2 Rising prices spur investment in expansions, new projects and exploration**

The rising prices have encouraged investment in new capacity, new projects and grass roots exploration. Investor interest in the uranium market has also grown significantly, and this combined with the encouraging supply/demand fundamentals has driven prices to the current levels.

Mine production is set to increase in the short-term chiefly because prices are currently at a level that is higher than the marginal operating costs of most mines.

### **1.3 Seeking energy security**

Perhaps as important as the fundamentals themselves, has been a sea-change in attitude towards nuclear power. Some developing countries such as South Africa and India believe that uranium could play a significant role in ensuring energy security, or at the very least a diversification of energy sources away from dependence on coal (associated with high CO<sub>2</sub> emissions). Nuclear power produces base-load energy with negligible CO<sub>2</sub> emissions.

South Africa's Minister of Minerals and Energy recently (February 2007) announced government's intention of declaring uranium "a strategic mineral" and launching a "uranium beneficiation" programme in order to secure nuclear fuel supplies for South Africa's growing electricity needs. The aim of the DME's nuclear energy policy and strategy is to secure SA's supply of uranium for 40 to 60 years, she said. This strategy would outline a vision for nuclear base-load electricity generation capacity (similar to Koeberg) and small to medium-sized nuclear power plants (such as the Pebble Bed Modular Reactor) in South Africa.

### **1.4 Objective of the Report**

In the light of these recent developments in South Africa, this report seeks to assess the most likely sources of future production in South Africa. Some commissioned, brownfields<sup>1</sup>, greenfields<sup>2</sup> and potential projects are reviewed with a view to shedding some light on the questions: How much uranium can South Africa produce in the short term. Where will it come from and when?

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<sup>1</sup> "brownfields" means a project expanded or redeveloped from a previous or existing commercial facility  
<sup>2</sup> "greenfields" means a new project developed from scratch

## 2. SOUTH AFRICAN PRODUCTION IN 2005

In 2005, South Africa's uranium production totalled 795.3t U<sub>3</sub>O<sub>8</sub> (674 tU), a decrease of 10.4 percent compared with the 887.3t U<sub>3</sub>O<sub>8</sub> (746 tU) recorded in 2004. Production was recovered as a by-product of gold mining. South African production in 2005 was a mere 11 percent of its historic peak in 1980 (6 147 tU).

Only one mining company, AngloGold Ashanti produced uranium in South Africa in 2005. The company's Vaal River Operations was the eleventh largest producing mine in the world in 2005, accounting for 1.6 percent of world production (see Table 1).

TABLE 1 - WORLD RESOURCES AND PRODUCTION OF URANIUM, 2005

COUNTRY	URANIUM RESOURCES*		PRODUCTION*			
	RAR# (kt U)	Rank	2004 (t U)	2005 (t U)	%	Rank
Canada	444	3	11 597	11 628	28.0	1
Australia	1 143	1	8 982	9 519	22.9	2
Kazakhstan	816	2	3 719	4 357	10.5	3
Russian Federation <sup>e</sup>	172	8	3 200	3 431	8.2	4
Namibia	282	6	3 038	3 147	7.6	5
Niger	225	7	3 282	3 093	7.4	6
Uzbekistan	116	9	2 016	2 300	5.5	7
USA	342	4	846	1 039	2.5	8
Ukraine <sup>e</sup>	90	10	800	800	1.9	9
China <sup>e</sup>	60	12	750	750	1.8	10
South Africa	341	5	746	674	1.6	11
Czech Republic	na	na	412	408	1.0	12
India <sup>e</sup>	67	11	230	230	0.6	13
SUBTOTAL	4 098		39 618	41 376	99.5	
Others	645		601	219	0.5	
<b>WORLD TOTAL:</b>	<b>4 743</b>		<b>40 219</b>	<b>41 595</b>	<b>100</b>	

Sources:

\* OECD's NEA & IAEA, *Uranium 2005: Resources, Production and Demand*

+ World Nuclear Association, *Market Report data, 2005*

Notes:

# Reasonably Assured Resources (RAR) plus Inferred Resources, to \$130/kg U

<sup>e</sup> Estimated

According to statistics provided to the Directorate: Mineral Economics (2006), South Africa's entire production of uranium oxide is refined and exported by NUFCOR (Nuclear Fuels Corporation) and no domestic mine sales were reported in 2005. Export statistics show that South Africa exported 873.1 tons of uranium and uranium compounds (HS code 28.44.10) worth about R325 million during 2005.

Preliminary estimates indicate that production in 2006 reached about 640 tons  $U_3O_8$ . Once again all this production was exported and no domestic sales were reported.

South Africa is well endowed with primary uranium resources. According to data published by the OECD's Nuclear Energy Association and the International Atomic Energy Association (2006), South Africa's uranium resources (at 341 kt U) were ranked 5<sup>th</sup> in 2005.

### **3. URANIUM PROJECT SURVEY**

To aid in obtaining up-to-date information on some of the brownfields, greenfields and potential projects, a survey was conducted by sending out a questionnaire to the owners of these projects in February 2007.

Responses to the survey varied from complete to no response at all. Consequently, information from the companies' websites or media reports were used to populate the survey in cases where there were no responses or incomplete responses.

The information on the projects is presented in Table 2 below, and includes the project's or potential project's location, the owner/s, the type and stage of the project, capacity (where available), resources/reserves (where available), and production forecast (where applicable and available).

Since this is the first attempt to compile such a project survey, any company involved with uranium projects in South Africa that is not included here is encouraged to submit its project information for inclusion in the next edition of this report (see feedback details on page 22).

#### **3.1) Production prospects**

The projects in Table 2 range from new mines, expansions, tailings (residue deposits) to other deposits.

The current producing mine is AngloGold Ashanti's Vaal River Operations. The Dominion Uranium project has reportedly produced its first uranium in March 2007. Other projects that are likely to go into production in the short-term include First Uranium Corporation's Ezulwini and Buffelsfontein projects and UraMin's Ryst Kuil Channel project.

TABLE 2 – URANIUM PROJECT SURVEY

PROJECT / Deposit (Location)	COMPANY	PROJECT INVESTMENT AND/OR COST	TYPE/STAGE (NEW; EXPANSION; TAILINGS)	CAPACITY	RESOURCES / RESERVES	PRODUCTION FORECAST
<b>Vaal River Operations</b> (Klerksdorp, North West Province)	AngloGold Ashanti	Operating gold mine which produces uranium as a by-product	Operating gold mine producing uranium oxide as a by- product.	Treats 3 million tons of uranium- bearing material per annum	(2006) Resource: 58 367 tons Reserves: 11 779 tons	Current production is 760 tons U <sub>3</sub> O <sub>8</sub> increasing to 800 tons in 2008 and 1038 tons in 2011. Decline to 454 tons in 2016.
<b>Dominion Uranium Project</b> (Klerksdorp, North West Province)	SXR Uranium One	Start-up capital costs of \$152 million (to Q1 of 2007). Average cash operating costs over the life of Phase I of \$14.50/pound of U <sub>3</sub> O <sub>8</sub> , net of gold by-product credits.	Brownfields project. Significant gold by-product	CIL gold processing plant in place will form part of complex to recover both uranium and gold from the project.	Probable reserve of 18.5 million tons at an average grade of 0.77 kg/t containing 31.3 million pounds of U <sub>3</sub> O <sub>8</sub> .	Production to start in Q1 2007. Ramp up in production to 3.8 million pounds/year (1 710 tons/y) by 2011. Conceptual work underway to double production to 7.0 million pounds per year by 2012. Large exploration programme, including plans to explore additional properties which lie to the west of the area covered by existing new order mining right.

PROJECT / Deposit (Location)	COMPANY	PROJECT INVESTMENT AND/OR COST	TYPE/STAGE (NEW; EXPANSION; TAILINGS)	CAPACITY	RESOURCES / RESERVES	PRODUCTION FORECAST
<b>Ezulwini Uranium &amp; Gold Project</b> (North West province)	First Uranium Corporation (Simmer & Jack)	Mine life capital totals \$280m (incl. 20% contingency). Pre Production Capital of \$155m expended over 3.5 yrs (i.e. leading up to full production capacity in 2012). Average cash operating cost over life of mine (19yrs) is \$56.7 per tonne milled. Project NPV of \$258m (US\$500 / oz - Au; US\$40/lb - Uranium; R7.4:US\$1)	Developing project. Company's goal is to re-open Ezulwini underground mine, which has been on care and maintenance since 2001.	Up to 200 000 tpm mining from underground. Peak production of 2 168 mtpa (180 000 tpm) by 2012.	Measured and indicated resources total 10.5 million tons at 6.1 g/t, for some 2 million ounces of gold and 6.8 million pounds of uranium.	Uranium production expected at the end of 2008. First Uranium believes that the rectification programme will enable the Ezulwini project to reach a production output of about 130 000 tons/month by 2009 and 180 000 tons/month by 2012.
<b>Buffelsfontein Uranium &amp; Gold Project</b> (North West province)	First Uranium Corporation (Simmer & Jack)	Mine life capital totals \$169m (incl. 20% contingency). Pre Production Capital of \$167m expended over 3.5 yrs (i.e. leading up to full production capacity in 2012). Average cash operating cost over life of mine (14yrs) is \$2.47 per tonne milled. Project NPV of \$211m (US\$500 / oz - Au; US\$40/lb - Uranium; R7.4:US\$1)	Developing project. Company's goal is to construct the Buffelsfontein tailings recovery facility	Nominal initial capacity of 20 000tpd rising over a 3yr period to 60 000tpd (21.6 million tpa) of reclaimed old mine tailings.	Measured and indicated resources total 281 million tons at 0.31 g/t, for some 2.7 million ounces of gold and 69 g/t for some 42.7 million pounds of uranium.	The first uranium and gold production from the Buffelsfontein tailings recovery is expected by the second half of 2008.

PROJECT / Deposit (Location)	COMPANY	PROJECT INVESTMENT AND/OR COST	TYPE/STAGE (NEW; EXPANSION; TAILINGS)	CAPACITY	RESOURCES / RESERVES	PRODUCTION FORECAST
<b>Ryst Kuil Channel</b> (Karoo, Northern Cape)	UraMin Inc	The Company expects to complete a Definitive Feasibility Study by March 2008.	Exploration underway. Feasibility stage.	Not available.	Total "historical mineral resource" is 19 million tons at a grade of 0.1%). Exploration is underway and a resource and mineral reserve statement is expected in the second quarter of 2007.	The Company believes that this property is capable of being placed into commercial production by late 2009 at the rate of 2.6 to 3.0 million pounds uranium per year.
<b>Sutherland</b> (Karoo, Northern Cape)	UraMin Inc	The Group has identified several areas of interest in the Sutherland district and proximate areas and 34 applications for prospecting rights have been submitted to the DME by and on behalf of Mago Resources, the Company's 70% owned subsidiary. The Group is awaiting a decision by the DME on each of these applications.	Applied for prospecting rights.	Not available / No response from company.	Not available / No response from company.	According to RSG Global, historical summary reports indicate a total mineralisation at various cut off grades of approximately 27 million pounds of U <sub>3</sub> O <sub>8</sub> on the properties in Sutherland and proximate areas. These historical estimations have not been verified and are not in accordance with the requirements of any international reporting code.

PROJECT / Deposit (Location)	COMPANY	PROJECT INVESTMENT AND/OR COST	TYPE/STAGE (NEW; EXPANSION; TAILINGS)	CAPACITY	RESOURCES / RESERVES	PRODUCTION FORECAST
<b>Springbok Flats</b> (Gauteng)	UraMin Inc	The Group has identified several areas of interest in the Springbok Flats district and twenty-two applications for prospecting rights have been submitted to the DME by and on behalf of Mago Resources, the Company's 70% owned subsidiary. Prospecting rights were granted on the Lefifi Block and Mocha Block respectively to Mago and a third party under contractual obligation to transfer these rights to Mago Resources upon the Minister's consent, which is still pending. The Group is awaiting a decision by the DME on each of its twenty other applications in the region.	Applied for prospecting rights.	Not available / No response from company.	Previous exploration work focused on the central and north-eastern sectors of the coal field and several deposits containing between 0.016% and 0.1% U over a 1 m width were delineated. According to a publication released by the Council of Geoscience in 1998, resources for the entire Springbok Flats coal field were estimated at 55 000 tons of U in 1994.	Not available / No response from company.

PROJECT / Deposit (Location)	COMPANY	PROJECT INVESTMENT AND/OR COST	TYPE/STAGE (NEW; EXPANSION; TAILINGS)	CAPACITY	RESOURCES / RESERVES	PRODUCTION FORECAST
<b>Waterval and Rietkuil prospects</b>	Western Uranium Limited a subsidiary of Brinkley Mining Plc (in which Lonrho Africa Plc has a 9.8% interest)	Not available / No response from company.	Prospecting Rights	Not available / No response from company.	Waterval property has a "non-compliant historical mineral resource of between 39 000 and 50 590 tons uranium. "Exploration potential" in the Rietkuil property is estimated at between "12 million and 25 million pounds of uranium oxide"	Not available / No response from company.
<b>Harmony Gold's residue deposits</b> (Free State & Gauteng)	Harmony Gold	Not applicable	Harmony Gold's residue deposits, i.e., slimes dams and dumps	Not applicable	Study of the resources contained in slimes dams was reportedly underway.	Unknown. Many companies interested in ownership of the uranium in residue deposits.
<b>Wits Gold - possible uranium opportunities</b> (North West province)	Witwatersrand Consolidated Gold Resources (Wits Gold)	Not applicable. Company is focussed on gold resources. Potential to produce by-product uranium.	Company is focussed on gold resources. Potential to produce by-product uranium.	Not applicable	Not available	Not available
<b>Palabora</b> (Phalaborwa, Limpopo Province)	Palabora Mining Company Ltd.	Copper mine that ceased uranium production in 2001 from the Heavy Minerals Plant.	The Heavy Minerals Plant was decommissioned in 2001 and subsequently dismantled.	Last reported (2001) production was 8.1 tons U <sub>3</sub> O <sub>8</sub>	Unknown	Palabora Mining Company stated that it has no intention of recovering uranium from the tailings.

## 4. PRODUCTION FORECAST

**(NB: conservative forecast with caveats and assumptions)**

It is estimated from the information provided that production in 2007 could pass the 1 400 t U<sub>3</sub>O<sub>8</sub> level, with production coming from AngloGold Ashanti's Vaal River Operations and SXR Uranium One's Dominion Project.

By the year 2009, production could more than double to over 2 800 t U<sub>3</sub>O<sub>8</sub>, if First Uranium's projects (including Ezulwini, Buffelsfontein and Ryst Kuil) go into production as projected.

Five years from now (2011), production could pass the 5 000 t U<sub>3</sub>O<sub>8</sub> level, if all the projects that are scheduled to start producing in the next few years, are producing at levels forecast.

These forecasts are based on many assumptions and caveats which include the following:

- A major caveat is that this survey was incomplete;
- Some production forecasts are rough estimates, and these could change (increase or decrease) in the coming years as projects move into production;
- Some potential tailings' production was not included in this forecast and that could provide the upside for production in South Africa;
- Upside could also be provided by some companies adding by-product uranium production to their portfolios.
- It is assumed that the demand/supply fundamentals continue to be positive in the forecast period.
- It is also assumed that regulatory changes do not affect production in South Africa.

Also of interest to the reader would be a map showing the geographic spread of issued mining/prospecting rights in South Africa as it appeared in the National Mining Promotion System (NMPS) database (February 2007). This has been appended to this report (see Appendix 1).

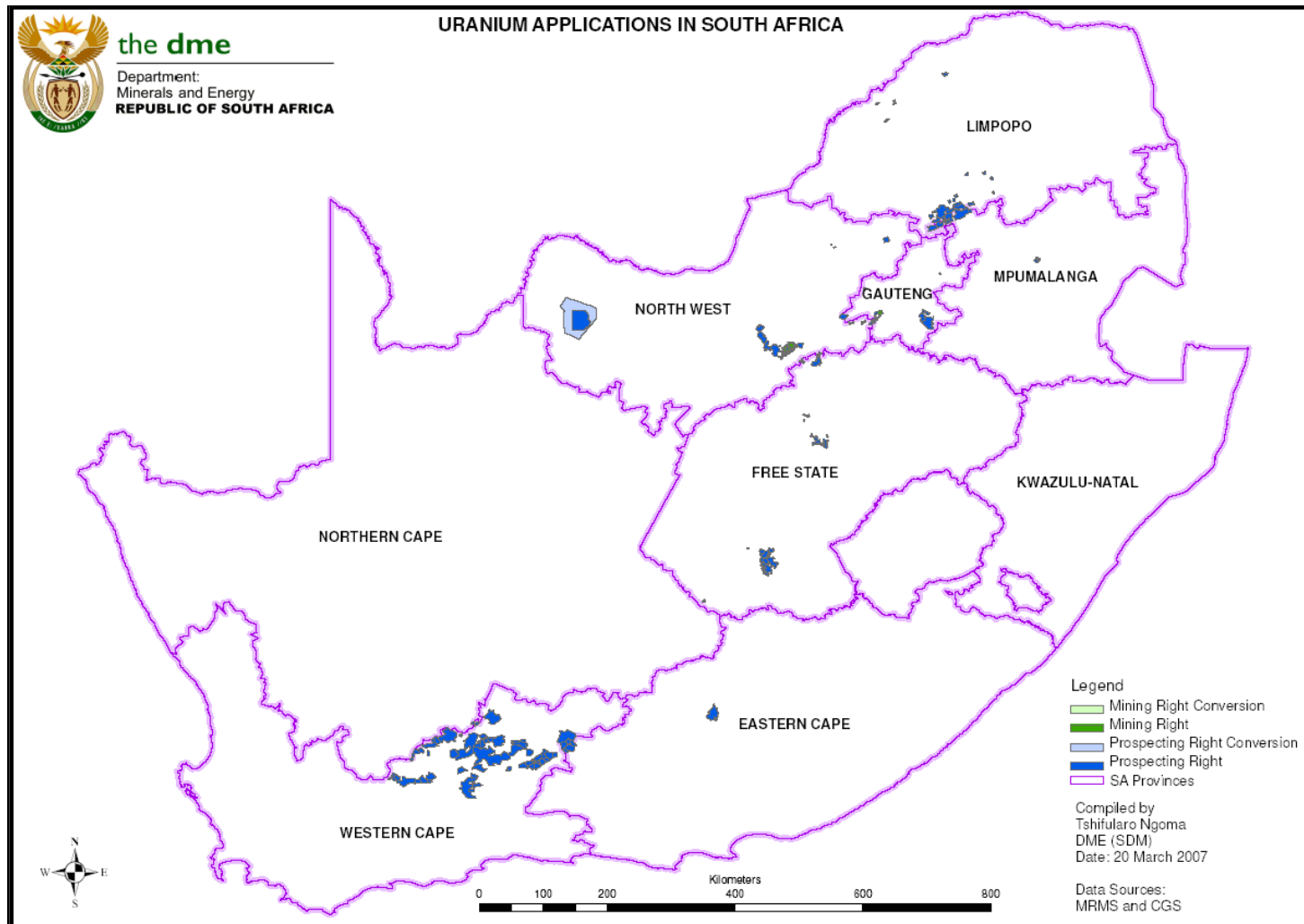
## **5. CONCLUSION**

The encouraging demand/supply fundamentals and a much more positive attitude towards nuclear power are underpinning rapid uranium price increases, which in turn are fuelling investment in greenfields and brownfields projects in South Africa.

The project survey conducted suggests that South Africa's uranium production is set to increase to over 5 000 tons  $U_3O_8$  over the next five years dominated by projects in the North West province.

Currently South Africa's uranium production is exported, but this could change in future as government has indicated its intention of launching a "uranium beneficiation" programme in order to secure nuclear fuel supplies for South Africa's growing electricity needs.

6. **Appendix 1: Map showing location of issued mining/prospecting rights in South Africa**



## 7. USEFUL CONTACT DETAILS

### **AngloGold Ashanti**

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## 8. REFERENCES AND BIBLIOGRAPHY

1. Business Day (2007). *Country Gears Up to start Enriching Uranium*, Internet: <http://allafrica.com/stories/>, accessed 5 March 2007.
2. Directorate: Mineral Economics (2006). *Uranium production and sales, 2005*, statistics accessed on 15 December 2006.
3. Directorate: Systems Development & Maintenance (2007). *Uranium applications issued*, map generated 20 February 2007.
4. Gagiano, M. (2007), AngloGold Ashanti, personal communication.
5. Kidd, S. (2005). *Uranium 2005*, Internet: [www.mining-journal.com](http://www.mining-journal.com), accessed August 2006
6. Mining Weekly (2007). *Wits Gold seeks to make most of uranium opportunities*, Internet: [www.miningweekly.co.za/](http://www.miningweekly.co.za/), accessed 2 March 2007.
7. Mining Weekly (2007). *Uranium One may be interested in Harmony's uranium resources*, Internet: [www.miningweekly.co.za/](http://www.miningweekly.co.za/), accessed 2 March 2007.
8. OECD NEA & IAEA, 2006. *Uranium 2005 - Resources, Production and Demand*: OECD, Paris, 362 pp.
9. Sobey, S. (2007), First Uranium Corporation, personal communication.
10. UraMin Inc. (2007). *Projects, South Africa*, Internet: [www.uramin.com/](http://www.uramin.com/), accessed 1 February 2007.
11. Van Dyk, J.H. (2007), Palabora Mining Company Limited, personal communication.