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A review of the uranium mining industry in Africa

Picture by IAEA

The material contained in this report was compiled by Samantha Herbst and the Research Unit of Creamer Media (Pty) Ltd, based in Johannesburg.

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Report edited by Sheila Barradas, David Shepherd and Ria Theron.

Ordering information
To subscribe to *Research Channel Africa* or purchase this report contact:
Creamer Media (Pty) Ltd
Tel +27 11 622 3744
Email subscriptions@creamermedia.co.za

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List of abbreviations

CGN	China General Nuclear Power Group
CNNC	China National Nuclear Corporation
Cominak	Compagnie Minière d'Akouta
DFS	definitive feasibility study
EDF	Électricité de France
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IRP	Integrated Resource Plan
Jorc	Joint Ore Reserves Committee
KazAtomProm	The National Atomic Company of the Republic of Kazakhstan
LoM	life-of-mine
MWS	Mine Waste Solutions
NEA	Nuclear Energy Association
Nufcor	Nuclear Fuels Corporation of South Africa
ppm	parts per million
REQ	Australia's Office of the Chief Economist's Resources & Energy Quarterly
Somina	Société des Mines d'Azelik
Sopamin	Société du Patrimoine de Mines du Niger
Somaïr	Société des Mines de l'Aïr
U_3O_8	uranium oxide
UxC	Ux Consulting Company
WNA	World Nuclear Association
WRTRP	West Rand Tailings Retreatment Project

Units of measurement

The distinction between tonne (1 000 kg) and ton (1 016.047 kg) is maintained in this report according to the information that is reported in the public domain by each company.

Picture by Flickr – Marcin Wichary

Key developments

February 2016: The Niger government approves Canadian explorer GoviEx Uranium's application for the Eralrar exploration tenement and renews the company's exploration licence for other parts of Madaouela and the Anou Melle tenement. The application for the Agaliouk tenement was, however, not approved.

June 2016: GoviEx acquires fellow Canada-based uranium miner Denison subsidiary Rockgate Capital, which held all Denison's Africa-based uranium interests (collectively DML Africa) in exchange for 56.05-million GoviEx shares and 22.42-million common share purchase warrants of GoviEx.

August 2016: Production ceases at precious metals miner Sibanye-Stillwater's South Africa-based Cooke 4 mine, in Gauteng, which was acquired from Gold One in 2014. The mine proved uneconomical to operate even in a higher gold price environment. The Cooke mines produce uranium as a by-product to reduce the company's gold production costs.

December 2016: Sibanye-Stillwater completes the definitive feasibility study for the West Rand Tailings Retreatment Project, as well as front-end engineering design, rendering the project construction-ready.

December 2016: Swakop Uranium's Husab mine, in Namibia, produces its first barrel of uranium on December 30.

January 2017: The Namibia government lifts a ten-year moratorium on new applications for uranium exploration licences.

January 2017: Kazakhstan, the world's largest uranium producer, announces plans to reduce 2017 output by 10% after a slump in 2016, owing to a global inventory glut. This spiked prices by as many percentage points.

February 2017: Tanzania-based minerals exploration and development company Kibo Mining relinquishes its licences over the Pinewood uranium/coal tenements, near Songea, in southern Tanzania.

March 2017: Australian uranium developer Bannerman Resources signs a subscription agreement with Namibian partner One Economy Foundation, which will become a 5% loan-carried shareholder in the Namibia-based Etango uranium project.

May 2017: ASX- and Aim-listed Aura Energy submits a mining lease application to the Mauritania government for the development of its Tiris uranium project.

July 2017: After acquiring French energy company Areva's nuclear reactor business, New Areva NP, owing to Areva's facing financial issues, France's State-owned electricity utility company Électricité de France (EDF) sells stakes in the new company, uranium-focused Areva Newco, to Mitsubishi Heavy Industries (MHI), which will take a 15% stake, while engineering services company Assystem, will take a 5% stake. MHI's stake could increase to 19.50%.

July 2017: Independent experts determine that the fair market enterprise value of Langer Heinrich Mauritius – the holding company of Namibia-based Langer Heinrich uranium mine – amounts to $583-million.

August 2017: After expressing interest in acquiring Australian uranium miner Paladin Energy's 75% stake in the Langer Heinrich mine, in Namibia, the Chinese National Nuclear Corporation says it is no longer interested.

September 2017: The Southern African Institute of Mining and Metallurgy hosts the Uranium 2017 International Conference in Swakopmund, Namibia, under the theme 'Extraction and applications of uranium – present and future'.

September 2017: GoviEx Uranium receives expressions of interest from export credit agencies and project finance banks to arrange $220-million of senior debt financing to construct the Madaouela uranium project, in Niger.

October 2017: After denying uranium developer Bannerman Resources a mining licence in 2016 for the Etango project, the Namibian Ministry of Mines and Energy grants the Australian miner a mineral deposit retention licence for the project.

October 2017: Areva announces plans to retrench about 200 staff members and 500 contractors, as well as reduce its fleet of mining vehicles at Société des Mines de l'Aïr. This will likely reduce Somaïr's 2018 output by 20%.

Key developments *(continued)*

October 2017: ASX-listed Peninsula Energy announces its decision to divest its 74% interest in South Africa's Karoo projects, owing to ongoing challenges in the uranium market.

October 2017: In his maiden Medium-Term Budget Policy address, South African Finance Minister Malusi Gigaba reiterates that the proposed nuclear build programme will be implemented at a "pace and scale that the country can afford" and that no "firm decisions" have been made on the matter.

October 2017: GoviEx finalises its acquisition of African Energy Resources' Zambia uranium interests, further expanding the Canadian miner's footprint in the country.

October 2017: In addition to Cooke 4, Sibanye-Stillwater's Cooke mines 1 to 3 are placed on care and maintenance, impacting on the jobs of more than 2 000 mineworkers.

November 2017: Canada-based Cameco, the world's second-largest uranium producer, shutters its McArthur River mining and Key Lake milling operations, in Northern Saskatchewan's Athabasca basin, owing to sustained uranium price weakness. As this type of action will reduce excess inventories, many believe Cameco's actions will influence the spot market, boosting the price of uranium.

November 2017: GoviEx Uranium is finally granted an exploration permit for the Niger-based Agaliouk tenement.

December 2017: The world's largest uranium producer, the National Atomic Company of the Republic of Kazakhstan, or KazAtomProm, announces that it will curtail another 20% of uranium output for three years, starting from January 2018. This sends most TSX-listed uranium companies' equities soaring.

Picture by Fission Uranium

Global market

Uranium conversions

Uranium is a relatively common element that is found in the earth worldwide. The most common uranium product from mines is uranium oxide (U_3O_8), or yellowcake, which contains about 85% uranium.

- One-million pounds of U_3O_8 is equivalent to 385 t of uranium.
- To convert tonnes U_3O_8 to pounds U_3O_8, multiply the tonne by 2 205.

Source: World Nuclear Association and Deep Yellow

Despite hope that the global uranium market was beginning to shake off its post-Fukushima nuclear disaster slump, the industry weathered one of its most difficult years in recent history in 2016, as oversupply put pressure on the spot price of uranium oxide (U_3O_8), even though several producers had announced that they would curtail production to boost the price.

The spot price fell to a 12-year low of $17.75/lb U_3O_8 in November 2016, dropping 50% from the start of the year, while the long-term contract price of uranium, which is typically less volatile than the spot price, dropped more than 30% from $44/lb U_3O_8 at the beginning of the year, to $30/lb U_3O_8 at the end of the year. By the end of November 2017, the spot price had recovered slightly to $23.13/lb, while the long-term price had not moved much at $31/lb.

Industry insiders have attributed this dramatic decline in the price of uranium to the disappointing rate of nuclear reactor restarts in Japan, the postponement of utility contracting that was expected to get under way in 2017, and an abundance of secondary supplies entering the market.

This is despite more new nuclear power capacity being added to the global electricity grid in 2015/16 than any other year for a quarter of a century.

According to the World Nuclear Association's (WNA's) latest biannual 'Nuclear Fuel Report', published in September 2017, global nuclear generation capacity is set to increase from 391 GW of electrical output (GWe) in 2017, to 403 GWe by 2025 and 482 GWe by 2035.

A more bullish upper scenario increases capacity to 455 GWe in 2025 and 625 GWe in 2035. In a lower scenario, nuclear capacity stagnates by 2030, before dropping off with several reactor shutdowns before 2035.

In terms of global uranium market demand, 2016 was disappointing, but there are "tentative signs" that it may change. According to Australia's Office of the Chief Economist's 'Resources & Energy Quarterly: (REQ:) Uranium', published in September 2017, prices are expected to recover to $25/lb in 2018 and $29/lb in 2019, owing to promised production cuts. This will be supported by increased Asian demand.

Canadian explorer Denison Mines believes that the forecast for increased demand in the long term will translate into short-term opportunistic buying.

Currently, nuclear constitutes 11% of global electricity generation, with 245 civil research reactors operating across 55 countries. Further, there are 447 nuclear power reactors across 31 countries, with 56 more being built.

Demand

Uranium is a heavy metal and chemical element that has been used as a source of concentrated baseload energy for the past 60 years.

While almost all mined uranium was initially used in the production of nuclear weapons from the 1950s, with this practice ceasing in the 1970s, mined uranium currently is a clean baseload energy source used mainly as a fuel for nuclear power plants. This bodes well for the element, as a rising world population results in an increasing need for more energy, which means that nuclear power has become an important part of the world's energy mix.

Moreover, amid concerns about climate change and greenhouse-gas emissions, the nuclear power industry, which currently supplies about 11% of the world's electricity, is expected to become increasingly popular in the next 20 years, as its emissions are significantly lower than those associated with coal, oil and gas.

Further, according to the International Energy Agency (IEA), governments' commitment to the United Nations Framework Convention on Climate Change to keep the global average temperature increase under 2°C – above pre-industrial levels – can be achieved only

if nuclear power's share in the global energy mix increases from 11% to 17% by 2050.

The IEA's 'Tracking Clean Energy Progress Report 2017' notes that this scenario would require nuclear construction starts to increase from an average of 8.5 GW/y to more than 20 GW/y by 2025.

This will directly impact on uranium demand, which took a beating in recent years following the triple meltdown of the Fukushima Daiichi nuclear power plant, in Japan, in March 2011 – an accident that raised global concern about nuclear power plant safety, and dented public acceptance and demand for the power source. There have, however, been no direct radiation-related casualties reported to date and uranium demand seems to be recovering.

However, following the disaster, certain countries, including Germany and Italy, shared their intention to discontinue using nuclear power, while France has stated its intention to reduce the share of nuclear in its energy mix.

Nevertheless, the WNA notes that global nuclear generation capacity will increase by 26% to 2025, with the energy source being essential to combating carbon emissions and contributing to security of power supply.

According to international consulting firm Ux Consulting Company's (UxC's) outlook for the first quarter of 2017, global nuclear power capacity is expected to increase from 379 GW in 2015 (the most recent year of reference) to more than 483 GW by 2030.

Further, the WNA's Harmony programme said in May 2017 that it wanted to supply 1 000 GW of global nuclear capacity by 2050, supplying 25% of the world's electricity.

As of December 2017, 440 nuclear reactors operating in 30 countries were generating 390 GW of electricity and 11% of the world's power requirements. These reactors need about 76 000 t of U_3O_8 concentrate, supplied by mines every year.

Further, 50 nuclear reactors are under construction in 13 countries, notably in China, India, the United Arab Emirates and Russia. In addition, construction on 160 power reactors globally is either planned or will soon be under way, while construction of another 300 reactors has been proposed.

Some existing plants are also adding capacity to meet growing power demands.

Supported by this development of new nuclear power generation capacity, world uranium consumption is expected to increase from 83 400 t in 2016 to 88 300 t in 2017, according to the REQ.

Still, the WNA believes that capacity growth is slow, as reactors are being run more productively, with increasing fuel demand being offset by a demand for increased efficiency, which is dampening uranium demand overall.

The association notes, for example, that from 1970 to 1990, there was a 25% reduction in uranium demand per kWh output, as a result of efficiency improvements that continue to be developed.

The association adds that demand forecasts for uranium depend on installed and operable capacity, regardless of economic fluctuations.

This is because it is cost-effective to keep reactors running once they are built, and for utilities to simply adjust fuel inputs depending on load trends. This means that uranium fuel demand is more predictable than that of other mineral commodities.

Cameco, the world's second-largest uranium producer, has indicated that nuclear reactors can run on one load of fuel for 12 to 18 months, "helping to shield utilities from possible fuel cost swings and supply interruptions".

Therefore, considering the increase in global nuclear capacity currently under way, uranium demand will remain slow but steady, following a medium-term upwards curve.

Moreover, as electricity demand is expected to increase by 67% to 2040, according to the IEA's 'World Energy Outlook 2016' report, the long-term outlook for uranium demand in relation to nuclear capacity growth is positive, especially considering the global concern about limiting carbon emissions.

Supply

While uranium demand is international in scope, supply is geographically concentrated, with a relatively small number of companies from a handful of countries supplying it. In 2016, 71% of the world's uranium production came from three countries – Kazakhstan, which produced 39% of global supply, and Canada and Australia, which produced 22% and 10% respectively. Twelve countries contributed to the remaining 29% of global uranium supply.

Global uranium production from mines by country (tonnes of uranium)								
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Kazakhstan	14 020	17 803	19 451	21 317	22 451	23 127	23 800	24 575
Canada	10 173	9 783	9 145	8 999	9 331	9 134	13 325	14 039
Australia	7 982	5 900	5 983	6 991	6 350	5 001	5 654	6 315
Niger	3 243	4 198	4 351	4 667	4 518	4 057	4 116	3 479
Namibia	4 626	4 496	3 258	4 495	4 323	3 255	2 993	3 654
Russia	3 564	3 562	2 993	2 872	3 135	2 990	3 055	3 004
Uzbekistan (est*)	2 429	2 400	2 500	2 400	2 400	2 400	2 385	2 404
China (est)	750	827	885	1 500	1 500	1 500	1 616	1 616
US	1 453	1 660	1 537	1 596	1 792	1 919	1 256	1 125
Ukraine (est)	840	850	890	960	922	926	1 200	1 005
South Africa	563	583	582	465	531	573	393	490
India (est)	290	400	400	385	385	385	385	385
Czech Republic	258	254	229	228	215	193	155	138
Romania (est)	75	77	77	90	77	77	77	50
Pakistan (est)	50	45	45	45	45	45	45	45
Brazil (est)	345	148	265	326	192	55	40	44
France	8	7	6	3	5	3	2	0
Germany	0	8	51	50	27	33	0	0
Malawi	104	670	846	1101	1132	369	0	0
Total world	**50 772**	**53 671**	**53 493**	**58 489**	**59 331**	**56 041**	**60 496**	**62 366**
Tonnes U_3O_8	**59 875**	**63 295**	**63 084**	**68 976**	**69 969**	**66 089**	**71 343**	**73 548**
Percentage of world demand	78%	78%	85%	86%	92%	85%	90%	98%

Source: World Nuclear Association
* est - estimated
U_3O_8 - uranium oxide

More than half of the world's uranium production, which totals 62 366 t of uranium, is from State-owned mining companies, including the National Atomic Company of the Republic of Kazakhstan (KazAtomProm), Russia's ARMZ Uranium Holding Company, which owns Uranium One, and France's Areva.

Canada's Cameco is the world's largest publicly traded uranium company. Smaller producers include BHP, Paladin Energy and Rio Tinto.

While Kazakhstan remains top of the log in terms of overall production, Canadian producer Cameco owns the two top-producing mines of 2016 – McArthur River and Cigar Lake. Both underground operations produced 6 945 t and 6 666 t respectively, which equates to 11% of world production. They were followed by Kazakhstan's Tortkuduk & Myunkum operation, which produced 4 003 t of uranium, or 6%, of the world's total.

More than half of the world's uranium production is from State-owned companies

Picture by Aura Energy

Top ten uranium producers globally			
Company	**Country**	**Tonnes uranium**	**Percentage of world total**
KazAtomProm	Kazakhstan	12 986	21
Cameco	Canada	10 438	17
Areva	France	8 176	13
ARMZ Uranium Holding (Uranium One)	Russia	7 913	13
BHP	Australia	3 233	5
China National Nuclear Corporation & China General Nuclear Power	China	2 964	5
Rio Tinto	Australia	2 440	4
Navoi	Uzbekistan	2 404	4
Paladin	Australia	1 420	2
Other	-	10 455	17
Total	**-**	**62 366**	**100**

Source: World Nuclear Association

Primary uranium production from mines, which supplies about 86% of the world's current uranium demand (projected by the WNA to be 67 867 t), increased slightly year-on-year from 158.30-million pounds of U_3O_8 in 2015 to 163.40-million pounds of U_3O_8 in 2016, according to Canadian producer Denison Mines, citing UxC. Denison predicts, however, that 2017 production will decrease to below 2015 levels to 157.80-million pounds U_3O_8, which will represent a 3.40% reduction for the year.

This is because production facilities in other parts of the world are reducing output as a result of the flattened uranium spot price, which means that world uranium supply is increasingly being drawn from low-cost secondary sources, such as various forms of stockpiled uranium worldwide. These include reprocessed spent fuel and sales by uranium enrichers, as well as inventories held by utilities and governments, particularly the US Department of Energy.

Top 15 largest-producing uranium mines in 2016					
Mine	**Country**	**Main owner**	**Type**	**Production (tonnes uranium)**	**% of world**
McArthur River	Canada	Cameco (69.80%)	underground	6 945	11
Cigar Lake	Canada	Cameco (50%)	underground	6 666	11
Tortkuduk & Myunkum	Kazakhstan	Katco JV/Areva	*in situ* leach	4 002	6
Olympic Dam	Australia	BHP Billiton	by-product/underground	3 233	5
Inkai	Kazakhstan	Inkai JV/Cameco	*in situ* leach	2 291	4
Somaïr	Niger	Areva (63.60%)	openpit	2 164	4
Budenovskoye 2	Kazakhstan	Karatau JV/Kazatomprom-Uranium One	*in situ* leach	2 081	3
South Inkai	Kazakhstan	Betpak Dala JV/Uranium One	*in situ* leach	2 056	3
Central Mynkuduk	Kazakhstan	Ken Dala JSC/ Kazatomprom	*in situ* leach	2 010	3
Ranger	Australia	Rio Tinto (68%)	openpit	1 994	3
Langer Heinrich	Namibia	Paladin	openpit	1 893	3
Priargunsky	Russia	ARMZ	underground	1 873	3
Kharasan 2	Kazakhstan	Baiken-U	*in situ* leach	1 838	3
Budenovskoye 1, 3 and 4	Kazakhstan	Akbastau JV/Kazatomprom-Uranium One	*in situ* leach	1 743	3
Rossing	Namibia	Rio Tinto (68.60%)	openpit	1 569	2.50
Top 15 total				**42 367**	**68%**

Source: World Nuclear Association

According to Cameco, today's abundant spot material has satisfied utilities' appetite for low-priced pounds to meet near- to mid-term requirements. As a result, strategic inventories have increased across the industry and consumers have not needed to sign significant long-term contracts with producers.

Citing UxC estimates, REQ notes that the inventories held by nuclear utilities are sufficient to meet their current demand for several years. Specifically, inventories in the US can cover forward demand for 30 months, while inventories in Japan and China can cover forward demand for five and seven years respectively.

The abundance of global secondary supply has, however, impacted on primary supply and will soon start impacting on producers. Until recently, existing long-term contracts have protected producers from consumers' reliance on secondary supply, as well as the low uranium spot price, but those long-term contracts are beginning to draw to a close. As a result, several major producers are focused on cutting costs rather than increasing production. They have delayed new projects and reduced production rates to lessen the blow of the current low spot price, which has made extraction unprofitable.

Production from Russia and the US declined in 2016, though production from Kazakhstan, Australia and Africa increased slightly. Canada's yellowcake production increased by 5%, or 1.90-million pounds of U_3O_8, owing to ramp-up activities at Cameco's Cigar Lake mine. According to Denison Mines, this more than offset suspended production at Rabbit Lake mine, which had taken four-million pounds U_3O_8 off the market. Production at Cigar Lake is expected to remain flat at 18-million pounds of U_3O_8 a year until 2025.

Having produced 22% of the world's yellowcake in 2016, Canada remains the world's second-largest uranium-producing nation. This could change in the next couple of years, however, following Cameco's decision, in November 2017, to mothball operations at McArthur River, owing to the sustained weak uranium price. This is expected to remove about 10% of the current world uranium supply. Cameco said at the time that it had been sheltered from the full impact of the depressed uranium market by its portfolio of long-term contracts. However, as those contracts were coming to a close, the company decided to position itself appropriately in case prices did not improve.

Kazakhstan still tops the leader board of uranium-producing nations, having produced about 39% of U_3O_8 in 2016.

Meanwhile, with inventories gradually becoming depleted and prices starting to recover, REQ predicts that mine production will increase by 3 900 t to 77 900 t in 2018, underpinned by production increases at several major operations, including China General Nuclear Power Company (CGN)/Swakop Uranium's Husab mine, in Namibia, Peninsula Energy's Lance mine, in the US, and Cameco's Cigar Lake mine, in Canada.

Sideways market

According to Cameco, industry consultants now estimate that global utilities' cumulative uncovered uranium requirements will total more than 600-million pounds over the next decade. This is lower than the previous estimate of 800-million pounds and evidence of limited contracting activity, delays in construction programmes, early reactor retirements and project cancellations.

Some of these requirements should return as delayed reactor construction is completed; however, it is beyond the 2026 timeframe. As yearly supply adjusts and uncovered requirements grow, Cameco has said it believes that the pounds available in the spot market will not be enough to satisfy demand.

The miner believes that the need to eventually contract for replacement volumes to fill these uncovered requirements will create opportunities for producers that can weather current low prices and provide a recovering market with uncommitted uranium from long-lived, tier-one assets.

On the spot market, where purchases require delivery within one year, the volume reported by Ux Consulting Company (UxC) for the third quarter was about 12-million pounds, which is on par with the third quarter of 2016. In the first three quarters of 2017, about 34-million pounds were transacted in the spot market, compared with 31-million pounds in the first three quarters of 2016.

At the end of the third quarter of 2017, the average reported spot price was $20.33/lb, up $0.18 from the previous quarter.

Long-term contracts usually require deliveries to begin more than two years after the contract is signed, and to use a number of pricing formulas, including fixed prices escalated over the term of the contract, and market-referenced prices (spot and long-term indicators) quoted near the time of delivery.

The volume of long-term contracting reported by UxC for the first nine months of 2017 was about 63-million pounds. Despite being higher than the 38-million pounds reported over the same period in 2016, the volumes were still less than the quantities consumed, and remained mainly discretionary, owing to currently high inventory levels. The average reported long-term price at the end of the quarter was $30.50/lb, down $2.50/lb from the previous quarter.

Source: *Mining Weekly* (October 2017)

Pricing

Uranium does not trade on an open market as other commodities do. Instead, buyers and sellers negotiate contracts privately, with nuclear utilities buying uranium through long-term contracts, which provide for delivery to get under way between four and ten years after they are signed. Utilities' remaining uranium requirements are met through spot and near-term purchases, though spot prices are historically more volatile than long-term prices.

In 2017, the spot price began at $24.50/lb U_3O_8, averaging about $21.60/lb in the first nine months of 2017, which is significantly lower than the 2016 average spot price of $25.60/lb.

The long-term price of uranium, which is published on a monthly basis, started the year at $32.50/lb U_3O_8, averaging about $32.30/lb in the first nine months of 2017 – also lower than the 2016 average long-term price of $39/lb.

Before shipping, yellowcake is packaged into special steel drums

Picture by Cameco

Spot price ($/lb)					
	2013	2014	2015	2016	2017
January	43.88	35.45	37.00	34.70	24.50
February	42.00	35.38	38.63	32.15	23.00
March	42.25	34.00	38.36	28.70	23.88
April	40.50	30.43	37.13	27.50	22.63
May	40.45	28.25	35.00	27.25	19.60
June	39.60	28.23	36.38	26.70	20.15
July	34.75	28.50	35.50	25.45	20.20
August	34.50	31.50	36.75	25.25	20.13
September	35.00	35.40	36.38	23.00	20.33
October	34.50	36.38	36.13	18.75	20.08
November	36.08	39.50	36.00	18.00	23.13
December	34.50	35.50	34.23	20.25	–

Source: Cameco (December 2017)

Long-term price ($/lb)					
	2013	2014	2015	2016	2017
January	56.50	50.00	49.50	44	32.50
February	56.50	50.00	49.50	44.00	33.00
March	56.50	46.00	49.50	43.50	33.00
April	57.00	45.00	49.00	43.00	33.00
May	57.00	45.00	47.50	41.00	32.50
June	57.00	44.50	46.00	40.50	33.00
July	54.50	44.00	44.50	38.00	32.00
August	54.00	44.00	44.00	38.00	31.50
September	50.50	45.00	44.00	37.50	30.50
October	50.00	45.00	44.00	35.50	30.00
November	50.00	49.50	44.00	33.00	31.00
December	50.00	49.50	44.00	30.00	–

Source: Cameco (December 2017)

Uranium prices started bottoming out after the 2011 Fukushima disaster, despite some bullish investment bank analysts predicting that the price would double over the past two years. After falling to what was then a nine-year low of $28/lb of U_3O_8 in May 2014, the spot price recovered briefly in 2015 to an average of $36.50/lb before dropping to as low as $18/lb in November 2016 for the first time in 12 years. In 2017, the uranium spot price averaged about $21.60/lb in the first nine months of 2017. This is significantly lower than the average pre-Fukushima price of about $70/lb, which producers say is the level required to incentivise new mine development projects. The 2017 average is significantly lower than the more than $120/lb recorded in 2007.

Outlook

Uranium has been in a bear market since the early 1990s, and was starting to recover slightly in 2006 before it was hit by the global financial crisis in 2008 and the accident at Fukushima in March 2011. This prompted Japan to shut down all 52 of the country's nuclear reactors and Germany's plan to phase out its nuclear power by the end of 2022.

The year 2016 was labelled the worst year in a decade for uranium miners, with the industry affected by a supply glut compounded by high inventory levels, the recycling of already-mined uranium and the slow reactivation of nuclear reactors in Japan. Where the breakeven spot-price for most uranium mines is between $40/lb and $50/lb, prices in 2016 dropped 50% between January and November to a 12-year low of $18/lb.

The market has since recovered from this shock, but the outlook for uranium remains uncertain, prompting producers to navigate the low-price environment by focusing on their lowest-cost assets and maintaining a strong balance sheet.

Still, uranium miners remain cautiously optimistic about the long-term fundamentals of the commodity, clinging to the hope that the industry will soon see the beginnings of an upcycle.

While all commodity markets are cyclical in nature, uranium ascribes to a longer-term cycle than its counterparts, owing to the long-term nature of nuclear power plants – uranium's primary consumer – and the accompanying buying time frames. With this in mind, uranium stakeholders believe that the current decade-low uranium prices are unsustainable.

Corroborating this, analysts expect a supply shortfall towards the end of the decade, which means that the price will probably start to inch up by the end of 2018/19, despite the current market glut. However, the price is unlikely to recover to as much as $50/lb in the short term, with Fitch Ratings predicting that the spot price will remain under pressure for another ten years, mostly owing to the current build-up in utilities' uranium stockpiles.

According to Fitch, these stockpiles will maintain pressure on prices as demand slowly recovers. Further, given the continued low-price environment, an increasing number of uranium projects are likely to be delayed or cancelled, which will prompt the projected supply shortfall and price increases after 2020.

The ratings agency is, therefore, positive about uranium's prospects in the long term. Fitch expects demand to increase by nearly 45% by 2030, with new global capacity stemming from China, India and Russia.

Until then, Kazakhstan is likely to continue to outperform its peers on a cash-cost basis in this low-price environment. While Cameco's announcement in November 2017 that it would suspend production at its McArthur River and Key Lake operations did little to move the market, KazAtomProm's production cut announcement in December is expected to spur the uranium spot price.

Kazakhstan supply shock to jolt uranium price

In December 2017, Kazakhstan's State-owned KazAtomProm announced intentions to reduce its output of uranium oxide (U_3O_8) by 20% or 11 000 t over the next three years beginning in January 2018. According to the company, about 4 000 t will be cut in 2018 alone "representing approximately 7.5% of global uranium production for 2018 as forecast by UxC".

According to Cantor Fitzgerald MD and head of Canadian metals and mining – Rob Chang, KazAtomProm is assuming a greater leadership role in the market and the bigger-than-expected cut is "the type of supply shock that will spur strength in the spot U_3O_8 price as a significant amount of expected production for 2018-20 is removed". Chang has said that, combined with the halt at McArthur River, an estimated 42.30-million pounds of expected production has been removed from the market. Yearly primary production is estimated at 140-million pounds, according to Cantor Fitzgerald modelling.

"We expect this news to push spot uranium prices to the mid-high $20/lb range and perhaps into $30/lb. However, the degree of movement may be muted at first due to the fact that there are a limited number of qualified purchasers of uranium – making it a less efficient market. "We estimate that less than 10% of total uranium demand for 2018 and 2019 are uncovered, as utilities have shored up what were once large shortages through spot purchases or short contracts. As such, there is less of an impetus for utilities to make purchases immediately.

"Inventory levels are also a concern as we estimate that there are 800-million to 1.20-billion pounds of total above-ground inventory, of which about 700-million to 800-million pounds are held by utilities. We do not believe that all of it is available for sale as significant portions are held for strategic purposes and necessary utility needs. It will be interesting to see how much of a dampening effect these inventories will have on this news." At the beginning of the year, KazAtomProm announced output cuts of 5.20-million pounds, equal to 3% of global production, while in May the US Department of Energy also curtailed the amount of uranium that it disperses into the market.

Source: Mining.com (December 2017)

Uranium mining in Africa

Before the turn of the millennium, significant quantities of uranium in Africa hailed from Congo, in the 1940s, when it was still known as Belgian Congo, and from Gabon, between 1960 and 1999.

Today, however, known recoverable resources of uranium on the continent can be found in Niger, Namibia, South Africa and Malawi, which together account for nearly 20% of the world's estimated measured resource of 5.90-million tonnes of uranium.

According to the World Nuclear Association (WNA), Niger holds the continent's largest known recoverable resources of the heavy metal, with 404 900 t, or 7%, of the world's known resources. Namibia holds 382 800 t, or 6%, of the world's resources, followed by South Africa, with 338 100 t, or 6%, of the world's resources.

Africa's mined uranium output

Country	2015 production (tonnes of uranium)	2016 production (tonnes of uranium)
Niger	4 116	3 479
Namibia	2 993	3 654
South Africa	393	490
World total	**60 496**	**62 366**

Source: World Nuclear Association

While Niger's mined uranium production of 3 479 t fell by 15% year-on-year in 2016, from 4 116 t in 2015, it remains Africa's number one producer, accounting for 7.50% of global production. The country has two producing uranium mines, Société des Mines de l'Aïr (Somaïr) and Compagnie Miniere d'Akouta (Cominak), capable of producing a combined 10% of global output.

Namibia's mined uranium production, from the country's Rössing and Langer Heinrich mines, rose by 22% to 3 654 t in 2016, from 2 993 t in 2015, marking the first year that the country's output increased since 2013, though production was significantly lower than the 4 323 t produced in 2013.

Mined uranium output from South Africa, the continent's third-largest uranium producer, increased by 24% year-on-year, from 393 t in 2015 to 490 t in 2016. Uranium from South Africa is a by-product of gold and copper mining.

Malawi was Africa's fourth-largest producer, until operations were suspended at Australia-based Paladin Energy's Kayelekera mine in 2014, owing to low prices. According to Berlin-based consultancy Open Oil, Kayelekera needs a breakeven price of $58/lb to reopen.

Niger

While Niger's uranium production dropped by 15% year-on-year from 4 116 t in 2015 to 3 479 t in 2016, it has retained its position as Africa's largest producer of uranium and the fourth-largest producer worldwide, with 291 500 t of known recoverable resources of uranium, or 5%, of the world's total.

Albeit a poor country, the West African nation has captured the interest of several international mining, exploration and development companies, although some foreign companies began to cease exploration efforts in 2011, owing to geopolitical tensions, security risks and rocky market conditions.

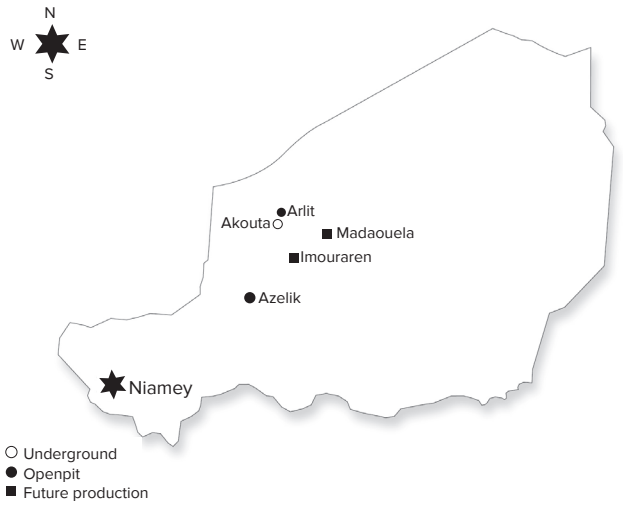
According to the Organisation for Economic Cooperation and Development's Nuclear Energy Agency (NEA) and the International Atomic Energy Agency's (IAEA's) 'Uranium 2016: Resources, Production and Demand' report, known as the Red Book, foreign companies were exploring 160 concessions in 2011.

Niger has two long-running mines, Somaïr and Cominak, which are nearing the end of their life and currently supply 7.50% of the world's mined uranium from Africa's highest-grade uranium ores.

These operations border the Sahara desert and the western range of the Aïr mountains. The deposits are located in the Tim Mersoï basin, close to the twin mining towns of Arlit and Akokan, 900 km north-east of Niger's capital, Niamey. Uranium concentrates from the mines are trucked to Parakou, in Benin, then railed to the Port of Cotonou before they are exported for conversion, mostly in France.

Somaïr and Cominak are owned and operated by French uranium mining and nuclear fuel group Areva Newco, which separated from multinational integrated nuclear group Areva in July 2017 and was sold to electricity utility company Électricité de France, owing to financial issues faced by Areva.

Uranium mines in Niger



Source: NEA & IAEA, Uranium 2016: Resources, Production and Deman

Somaïr and Cominak were initially licensed to the end of 2013, when they were shut down for maintenance pending the resolution of Areva's negotiations with the Niger government on licence renewal. These negotiations were protracted into 2014 and compounded by low uranium prices, which limited the scope for higher tax demands from government. Areva and the Niger government eventually signed a five-year agreement for the two mines in May 2014, based on the country's 2006 mining law.

Under the agreement, the Niger government sought to raise royalty taxes from 5.50% to between 12% and 15%, depending on profits, as well as more than $39-million in additional tax revenues yearly. Moreover, Areva agreed to provide $122-million to finance the construction of a road from Tahoua to Arlit, near the company's uranium developments. It also agreed to give $23.10-million for the development of the surrounding Irhazer Valley. Further, abiding by additional requirements stipulated in the agreement, Cominak appointed a local MD to its board in 2016, with Somaïr following suit in 2017.

Somaïr

Created in 1968, Société des mines de l'Aïr (Somaïr) is a subsidiary of Areva, which is a majority 63.60% shareholder. Nigerien State agency Société du Patrimoine de Mines du Niger (Sopamin), owns the remaining 36.40% of Somaïr.

The world's sixth-largest producing uranium mine, Somaïr, started production from the Arlette deposit through opencut mining, in 1971. In 2016, the company produced 2 164 t of uranium, or 4% of the world's total, in the form of sodium uranate bringing the operation's total tons produced to more than 67 900 t.

Focused on supporting local development in Niger, 99.60% of the Niamey-headquartered company's 934 employees are Nigerien. However, Areva has been facing significant strain in recent years, owing to the low uranium price, and has reportedly suffered losses as a result of cost overruns at a Finland nuclear plant currently under construction.

Under the circumstances, the French energy company announced in October 2017 that it planned to retrench about 200 staff members and 500 contractors, as well as reduce its fleet of mining vehicles at the operation. According to Bloomberg news service, output at Somaïr would, therefore, be cut by 20% in 2018 to 1 700 t.

Cominak

Cominak, which started producing from the Akouta deposit in the 1970s, is the world's largest underground uranium operation. It is owned by a consortium of companies including Areva, which holds a 34% stake, Sopamin (31%), Japan's Overseas Uranium Resources Development company, or OURD (25%), and Spain's Empresa Nacional de Uranio (10%).

With a capacity of 2 000 t/y, Cominak produced 1 313 t of uranium in 2016, which brings the total tons mined since operations began in 1978 to 70 822 t. Ninety-nine per cent of Cominak's 880 employees and 750 subcontractors are Nigerien. Cominak is also headquartered in Niamey.

According to the WNA, Cominak's production will decrease by 13% by the end of 2017, compared with 2015 output. The mine is due to close by about 2034. Meanwhile, to improve competitiveness, Cominak is switching production to a new deposit, Ebba/Afasto, which is situated south of Akouta and Akola.

Imouraren

The 5 000 m^2 Imouraren project, one of the largest uranium mines in the world, located about 80 km south of Arlit and 160 km north of Agadez, is 57.65% owned by Areva, 33.35% owned by Sopamin and the Niger government, and 9% owned by the Korea Electric Power Company.

The 174 196 t deposit will be the largest mining project ever undertaken in Niger, the largest openpit uranium mine in Africa and the largest mine in the world to implement acid heap-leaching.

According to the WNA, the project's acid heap-leaching facility will process 20 000 t/d of ore with an expected 85% rate of recovery. It will be the first time that this processing method is used on a deposit of this size.

While Areva was aiming for initial production in 2014, the French multinational and the Niger government decided to put the project on hold until uranium prices improved.

The two entities have established a joint committee that will determine when mining will get under way, depending on market changes, though this is not expected to happen until about 2020, or when Cominak resources are depleted.

Imouraren's life-of-mine (LoM) is expected to be about 35 years and production capacity is expected to peak at about 5 000 t/y. Four-billion tonnes of ore and overburden will need to be moved over the LoM.

In addition to the initial capital expenditure of about €1.90-billion, Areva has agreed to spend €6-million a year on ensuring that the local community receives adequate health services, education, training, transport and access to water and energy.

In the 2015/16 financial year, Areva recovered impairment charges of €194-million and then €316-million on the project, writing it down to €348-million.

Madaouela

Canada-based GoviEx Uranium is developing the 1 040 t/y Madaouela project, located 15 km from Somaïr's Arlit mine and Cominak's Akouta mine, in the Arlit region of the Aïr Massif.

GoviEx completed an environmental- and social-impact assessment in March 2015 and applied for a mining permit in June that year, before the Niger government issued a mining permit in February 2016 for certain deposits that comprise the project.

As of November 2017, the project reflects aggregate mineral resources of 110.76-million pounds U_3O_8 in measured and indicated resources and 27.66-million pounds U_3O_8 in the inferred category.

This was updated after GoviEx was granted an exploration permit for the Agaliouk tenement, adjacent to Madaouela, adding 11.67-million pounds U_3O_8 in the measured and indicated categories and 9.35-million pounds U_3O_8 in Madaouela's inferred categories.

Excluding the Agaliouk exploration permit, the fully permitted project proposes a base case that envisions a production of 2.69-million-pounds-a-year U_3O_8 over an 18-year mine life, with total production of 45.60-million pounds U_3O_8 and forecast cash operating costs of $24.49/lb U_3O_8.

The start-up capital cost of the project is expected to be $359-million, with operating costs pegged at $24.50/lb U_3O_8, though Denison Mines – which has a 24.6% stake in GoviEx – has said that the project needs a uranium price of $70/lb to be developed.

However, Creamer Media's *Mining Weekly* reported in September 2017 that GoviEx had received expressions of interest from export credit agencies and project finance banks regarding financing the construction of Madaouela, which is in line with the company's strategy to advance Madaouela towards a production decision.

The expressions of interest, however, remain subject to final due diligence, as well as credit committee and board approvals.

Dasa

Private Canadian company Global Atomic Fuels Corp is developing four uranium deposits in Niger, including its flagship Dasa deposit, which is undergoing a preliminary economic assessment.

Dasa forms part of the Adrar Emoles tenement, halfway between Arlit and Agadez, about 30 km south-east of Imouraren.

The company expects to complete a prefeasibility study on the Dasa underground project in early 2018 and, by year end, it hopes to apply for a mining licence.

Global Atomic signed an ore sales agreement with Areva Mines in July 2017 through which the developer agreed to sell its ore to Areva for processing by Somaïr, at Arlit.

Global Atomic's other Niger-based deposits – Tin Negouran, Isakanan and Daju – are less advanced than Dasa.

Dasa's indicated resources are estimated at 12 250 t of uranium, while inferred resources for the 1.2-km-strike-length deposit are more than double that.

Other Projects

Australia-based Paladin Energy owns the Agadez project, which includes three exploration concessions covering 990 km^2. The company has suspended all field activities in the area, owing to security risks, and has requested a force majeure from government authorities for an indefinite suspension of expenditure requirements.

Further, owing to tight cash flow, the 700 t/y Azelik mine has been put on care and maintenance. Azelik is owned by the China National Nuclear Corporation

(CNNC) (37.20%), the Niger government (33%) and a second Chinese investor, Zhongxing Joy Investment Company (24.80%).

Located 160 km south-west of Arlit, Azelik is smaller than Somaïr and Cominak, and was built with Chinese equity and operated in a joint partnership called Société des Mines d'Azelik, or Somina. It has inferred recoverable resources of 15 900 t of uranium.

CNNC, through its subsidiary China Nuclear International Uranium Corporation, agreed in 2006 to develop the 12 790 t Abokorum deposit, in the Agadez region, though no efforts towards development have been made yet.

Niger mine production (tonnes uranium)						
	2011	**2012**	**2013**	**2014**	**2015**	**2016**
Somaïr	2 726	3 065	2 730	2 331	2 509	2 164
Cominak	1 075	1 506	1 508	1 501	1 607	1 313
Somina	64 est*	96 est	290 est	225 est	0	0
Total	**3 865**	**4 667**	**4 528**	**4 057**	**4 116**	**3 477**

Source: World Nuclear Association
* est – estimated

Namibia

Namibia's economy relies heavily on the mining industry, which contributes about a quarter of its gross domestic product. In 2015, mining accounted for about 19 000 direct jobs, contributing indirectly to the lives of about 100 000 people. Many mining towns, including Tsumeb, Arandis and Rosh Pinah, rely on the mining industry and would suffer economically and socially if some of the larger mining companies were to close.

In addition to the global economic downturn, Namibia's mining industry faces several headwinds, including a drought and severe water shortages, compounded by the country's vast, empty landscapes and dry desert terrain, which makes it difficult to provide electricity and water for some of the country's mining operations, especially those in more remote areas.

Nevertheless, Namibia's mining sector continued to perform comparatively well in 2016, according to the Namibia Chamber of Mines' yearly report, and was not hindered by the rest of the country's economic woes, as long-term investments in the mining industry started paying off.

Further, the mining industry has started to become a lot more conscious about its impact on the environment and its role in the overall development of the country.

Namibia holds a variety of natural resources, including copper, gold, lead, tin, lithium, cadmium, zinc, salt and vanadium – but diamonds and uranium are considered the country's two most vital industries and are closely monitored by government.

According to Fitch-affiliated market research firm BMI, Namibia's mining sector will be bolstered by a low-risk political environment and an uptake in the uranium sector, despite being hampered by government proposals to restrict the country's regulatory framework, which will negatively affect investor sentiment.

The country's mining industry will, therefore, rest greatly on the uranium sector over the coming years, primarily owing to an increase in uranium production, with Swakop Uranium's Husab mine – the second-largest uranium mine in the world – reaching full capacity in 2017.

According to BMI's Namibia Trend Analysis Report, 'Uranium Boom to Sustain Mining Sector Growth', production growth from 2017 to 2021 will be the fastest in the uranium sector, averaging 7.20% year-on-year.

As a result of uranium's strategic importance to the economy, BMI predicts that the Namibian government will remain particularly supportive of the uranium sector moving forward, as evidenced in government's lifting of a ten-year moratorium in January 2017 on new applications for uranium exploration.

With about 5% of the world's known total of identified uranium resources, Namibia is the second-largest uranium producer in Africa and the fifth-largest in the world. This Southern African Development Community nation produced 3 654 t of uranium from mines in 2016, up 22% from 2 993 t produced in 2015.

In 2016, Paladin Energy's Langer Heinrich mine produced 1 893 t, or 3%, of the world's total, while Rio Tinto's Rössing uranium mine produced 1 569 t of uranium, or 2.50%, of the world's total. In 2017, the country's output is expected to triple, with Husab mine having produced its first barrel of uranium on December 30, 2016.

Husab's output for the year will soon push Namibia ahead of Niger as Africa's largest uranium producer and the third-largest producer in the world, ahead of Australia.

Husab

Located near Swakopmund, in the Erongo region of western-central Namibia, Husab uranium mine is the world's second-largest uranium mine after Canada's McArthur River mine, and the largest openpit mine in Africa.

Owner and developer Swakop Uranium is 90%-owned by Taurus Minerals, which is 60% owned by China's CGN-Uranium Resources and 40%-owned by the China–Africa Development Fund. State-owned mining company Epangelo Mining owns the remaining 10% of the company.

Development at Husab got under way in February 2013; production started at the end of 2016 with 192 t, which will soon ramp up to about 5 500 t/y.

According to Swakop Uranium, Husab's potential production is more than Namibia's total current uranium production. Its expected output is 6 800 t/y, which is more than double Namibia's 2016 output of 2 900 t/y.

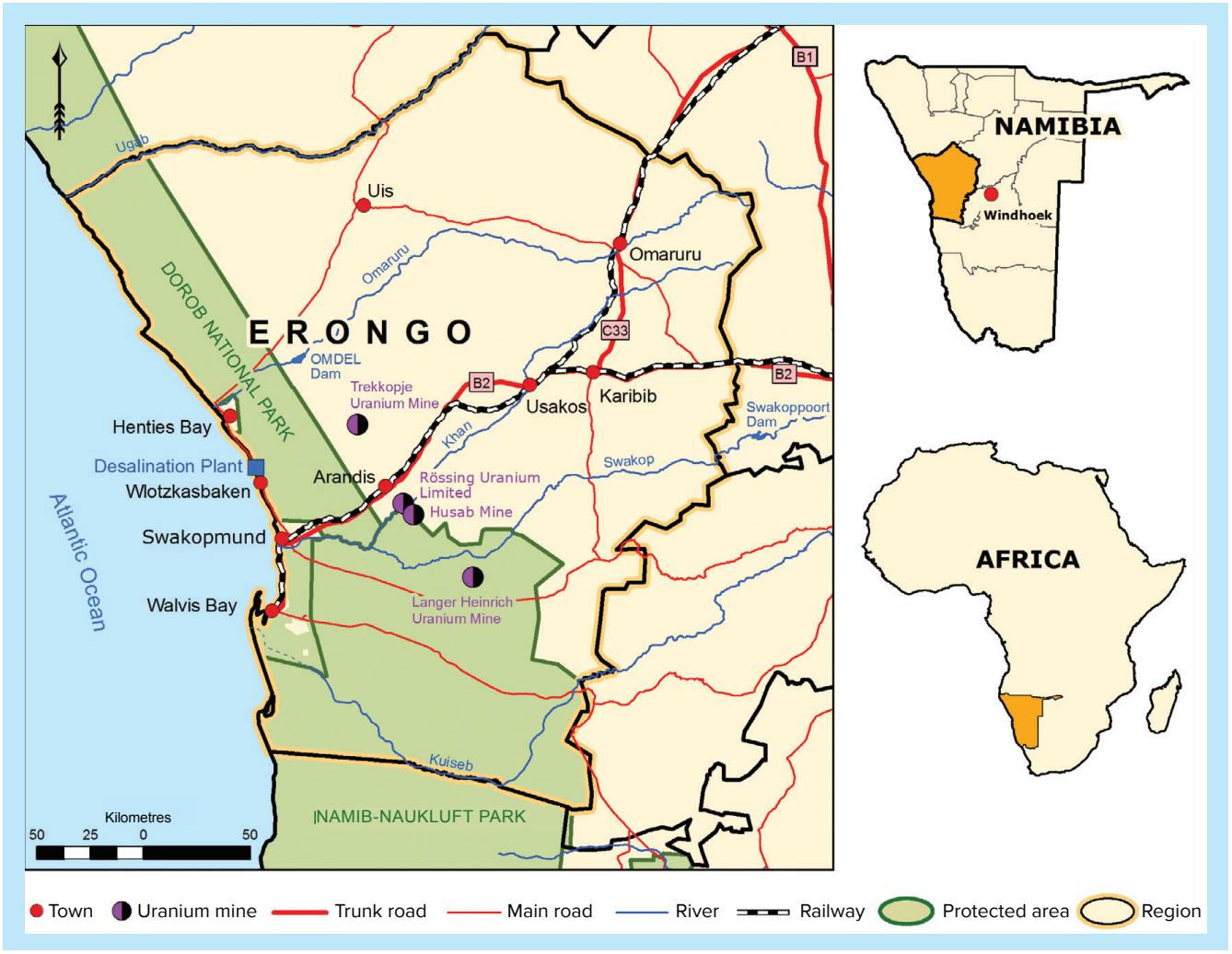
With this in mind, BMI predicts that the country's uranium production will expand by as much as 70% year-on-year in 2017, leapfrogging Niger and Australia and becoming the world's third-largest uranium producer by 2021, when yearly output is expected to reach 8 500 t/y.

Rössing

Located in Namibia's uranium-rich Erongo region, 12 km from the town of Arandis and 70 km inland from Swakopmund, Rössing uranium mine is situated in a hyperarid environment with wide-ranging day-time temperatures, especially during winter.

Rössing is Namibia's first commercial uranium mine, having started operations in 1976. It is also the longest-running openpit uranium mine in the world and has

Map of the Erongo mining region, Namibia



Source: www.rossing.com

produced the most uranium of any mine. By the end of 2016 – its fortieth year since beginning first commercial production – Rössing had supplied 130 500 t of U_3O_8 to the world market.

Despite a nameplate capacity of 4 500 t/y of uranium, Rössing has been operating significantly below those levels since August 2014, when Rio Tinto curtailed operations, owing to the weak uranium price.

The mine is operating on a noncontinuous basis and is producing only enough uranium to meet its long-term sales commitments. Nevertheless, it still produces about 2.50% of the world's output, with an output of 1 850 t U_3O_8 in 2016, up 48.60% from its 2015 output of 1 245 t U_3O_8.

Rössing is majority-owned by Anglo-Australian mining major Rio Tinto, which owns and manages a 69% stake in the mine. The Namibia government owns 3% (and a 51% majority vote on issues of national interest), the Iran government 15%, South Africa's Industrial Development Corporation 10% and locals a combined 3% interest.

Langer Heinrich

Located at the foot of the Langer Heinrich mountain in Western Namibia's Namib desert, the openpit Langer Heinrich mine is close to the Port of Walvis Bay and the tourist town of Swakopmund. It is about 40 km south-east of Rössing uranium mine.

Langer Heinrich started operation in 2006, with an initial capacity of 1 000 t/y uranium. This was before Stage 3 development of the mine boosted production capacity to 2 000 t/y uranium, or 5.10-million pounds U_3O_8 a year from 2011. Stage 4 expansion is expected to lift capacity to ten-million pounds a year of U_3O_8, but this is on hold until uranium prices are higher to incentivise new production.

Langer Heinrich mine

Meanwhile, Langer Heinrich is operating efficiently and near its design capacity, having produced 1 893 t of uranium in 2016, compared with 1 937 t in 2015 – a 2.30% drop in production year-on-year. Embattled Australian uranium miner Paladin Energy currently has a 75% stake in the mine, despite joint venture partner CNNC expressing interest in acquiring this stake for $416-million.

CNNC initially acquired a joint equity stake in 2014 for $190-million, and planned to buy another 24% of the equity for $175-million in mid-2016, though this plan did not proceed. In March 2017, the Chinese company expressed interest in exercising an option to acquire Paladin's majority share of the mine, asking Paladin to determine 'fair market value of the operation'. The fair market value of Paladin's 75% share in the mine was valued at $170-million, which would fall to $162-million after a 52% discount to CNNC.

In July, Paladin Energy called in administrators after failing to secure a standstill agreement with Électricité de France (EDF). Paladin was due to make repayments of a $227-million debt to EDF on July 10.

Following this, the administrators immediately started undertaking a financial and operational assessment of Paladin with the intention that Paladin would continue to operate on a business-as-usual basis.

In the meantime, the company said that its management and directors were committed to working with the administrators on a restructure and recapitalisation of the company.

In August 2017, CNNC announced that it had decided not to pursue Paladin's 75% interest in the mine.

Meanwhile, following an agreement in June, ASX-listed mineral and exploration development company Marenica Energy has been collecting low-grade ore samples from Langer Heinrich to conduct amenability testwork on them for the development of its U-pgrade process technology.

This technology purports to reduce unit operating costs at the mine and could potentially enhance its future production expansion opportunities. The U-pgrade technology is applicable to surficial uranium deposits, with a particular emphasis on calcrete-hosted deposits.

Trekkopje

Located in western Namibia, about 65 km north-east of Swakopmund, Trekkopje mine has about 340-million tons of uranium resources over 129 000 ha.

Areva acquired a 100% stake in the mine after obtaining the mining licence in June 2008 from the Namibian government. It has since invested more that $900-million in the project.

Trekkopje was poised to become the largest uranium mine in Southern Africa, and the tenth-largest in the world. The mine was, however, put on care and maintenance in 2012, owing to depressed uranium prices, but is, nevertheless, considered a strategic asset. Areva's plan is for Trekkopje to have the capacity to produce 3 000 t/y of U_3O_8, with an estimated mine life of 12 years.

Other projects

Other uranium development and exploration projects in Namibia include Canada-based developer Forsys Metals' Norasa project, Australia-based Bannerman Resources' Etango project, Deep Yellow's Omahola and Tumas Sand projects, and the China-owned Zhonghe project.

Norasa is Forsys' 100%-owned flagship project, located about 75 km south-west of Usakos, in central-west Namibia. It comprises the wholly owned Valencia project and a 100% interest in the Namibplaas project and, according to Forsys, is one of the very few uranium projects worldwide that is construction-ready, with a mining licence.

Forsys completed a definitive feasibility study (DFS) on the project in 2015, which confirmed the robustness of Norasa's economics. However, owing to the current depressed market for uranium, the company has delayed the next stage of development. Once operational, Norasa will have a processing capacity 11.20-million tonnes a year of uranium, which will produce an average of 5.20-million pounds a year of U_3O_8 over a 15-year mine life.

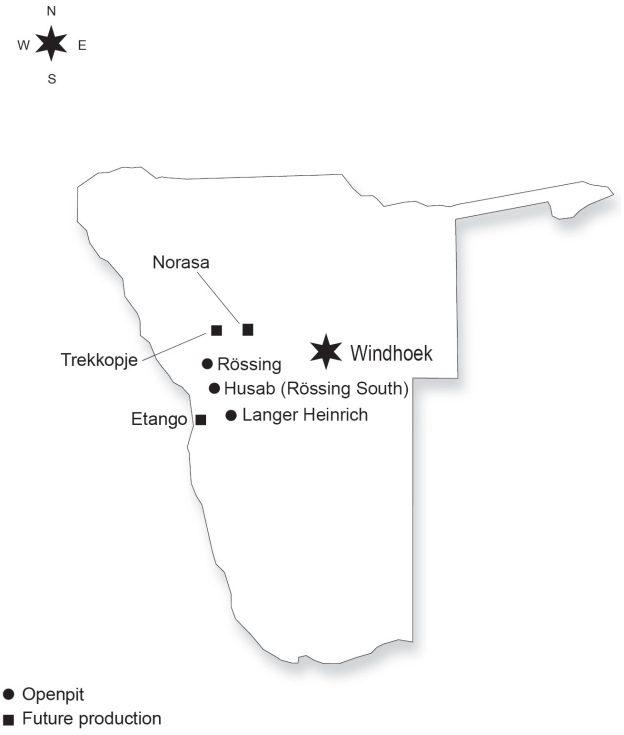
The highly developed **Etango** uranium project, currently being developed by Australia's Bannerman Resources, which owns 95% of the project, is expected to deliver average yearly production of 7.20-million pounds of U_3O_8 over an initial mine life of 16 years.

According to Bannerman, Etango is one of the world's largest undeveloped uranium projects and will be a top-ten producer once fully developed. The project was estimated to cost about $793-million to develop, according to a previous optimisation study estimate, however, this was reduced significantly by about $73-million following a processing optimisation study completed in November 2017.

The Namibian government denied Bannerman's mining licence application in July 2016, originally applied for in 2009. Bannerman said at the time that the outcome was not unexpected and could be attributed to the low uranium price. However, the company retains the right to re-apply for a mining licence when the market recovers.

The Namibian Ministry of Mines and Energy granted Bannerman a five-year mineral deposit retention licence for Etango in October 2017, which Bannerman CEO Brandon Munro described as "the ideal tenure" for the project, as it ensures that Etango will be able to "move quickly to a mining licence when the uranium price recovers".

Uranium projects under way in Namibia



Source: IAEA & NEA, Uranium 2016: Resources, Production and Demand

Meanwhile, through its wholly owned subsidiary Reptile Uranium Namibia, Australian explorer and project developer Deep Yellow is focused on the **Omahola** project, which has the potential to produce between 2.50-million pounds a year of U_3O_8 and 2.50-million pounds a year of U_3O_8 over a 10- to 14-year mine life.

Further, Deep Yellow started a 2 000 m reverse-circulation drilling programme on its Tumas 3 deposit in November 2017. The drilling is designed to confirm continuation of the uranium mineralisation at the **Tumas Sand** project and is also preparatory to the larger drilling programmes scheduled to start in February 2018.

Zhonghe Resources (Namibia) Development is developing the **Zhonghe** project, which is 58%-owned by CNNC subsidiary China Uranium Corporation and

42%-owned by Namibia China Mineral Resources Investment and Development. Zhonghe is expected to be an openpit mine capable of producing between 700 t/y and 1 000 t/y of uranium over a 10- to 15-year mine life. The total project investment is estimated to be between $600-million and $700-million.

Dovetailing with its interest in acquiring uranium from Namibia, China has played a major role in providing capital to fuel the country's uranium development and has taken major equity positions in several operations, including Husab and Langer Heinrich. India, is also interested in acquiring uranium from Namibia and is currently in talks with government, despite the country's Nuclear Non-Proliferation Treaty commitments.

Water supply

Namibia is running short of water for the coastal towns of Walvis Bay and Swakopmund, near which the country's uranium mines and projects are located.

France's Areva built a desalination plant in 2010 that converts 20-million cubic metres of seawater into fresh water every year. The plant was built to supply its now-mothballed Trekkopje uranium project, but through Namibia Water Corp it also supplies water to other mines, including Rössing, Langer Heinrich and Husab.

Areva wanted to sell the plant to government, retaining between only 10% and 20% to provide water for Trekkopje. In 2016, Areva put a $216-million price on the plant, but the Namibian government declined the offer and said it would build a new $145-million plant through a public–private partnership, which could be operational by 2019, with Namibian Water Corp holding an initial 30% of the project.

Rio Tinto's Rössing unit is considering building its own desalination plant with a capacity to supply three-million cubic metres of water, which is more than the mine's yearly consumption of two-million cubic metres. However, should the Namibian government proceed with plans to build its own plant, Rio Tinto will not go ahead with its water project.

Government announced its intention to build a desalination plant in a public–private partnership in 2013. The plant will have the capacity to produce 60-million cubic metres a year of water.

Sources: Bloomberg News and World Nuclear Organisation

South Africa

South Africa was once a prominent figure in African mined uranium production and was among the top three global producers in the late 1970s and early 1980s. Over nearly 30 years to 1980, it produced about 100 000 t of U_3O_8. Production peaked at almost 6 000 t/y in 1960.

Currently, the country produces less than a tenth of this, with an output of 393 t of uranium in 2015, which rose by 24.70% to 490 t of uranium in 2016, placing South Africa as the world's eleventh-largest producer, contributing just under 1% of global production. The country is currently Africa's third-largest producer, after Niger and Namibia.

South Africa's uranium production has generally been a by-product of gold or copper mining through the exploitation of uranium-rich slurries, mostly from tailings dams and dumps, of which there are about 400 that have arisen from gold mining in the Gauteng province's Witwatersrand area.

There is a possibility that South Africa's demand for uranium could increase significantly in the coming decades, with a revised draft of the country's Integrated Resource Plan (IRP) outlining government's commitment to add 6 800 MW of new nuclear capacity to the electricity mix by 2041, and as much as 20 400 MW by 2050.

Owing to lower demand projections and increased capital cost, this draft version of the IRP envisages a slower pace of nuclear deployment than the initial 9 600 MW by 2030, which has been endorsed by the South African government. The latest draft IRP was opened for public consultation in February 2017 and was approved by cabinet during a marathon 12-hour meeting. The newly revised version of the IRP is expected to be released soon, without any further public consultation. This could again alter the outlook for nuclear build in South Africa, which will impact on the country's uranium demand.

Until then, South Africa's nuclear plans remain uncertain and are not likely to go ahead until the economy rebounds. In his maiden Medium-Term Budget Policy address in October 2017, Finance Minister Malusi Gigaba reiterated that the proposed nuclear build programme would be implemented at a "pace and scale that the country can afford" and that no "firm decisions" had been made on the matter.

This sentiment, however, did not stop the Department of Environmental Affairs granting State-owned power utility Eskom authorisation, in October 2017, to construct the 4 000 MW Duynefontein nuclear power plant, in the Western Cape, close to Koeberg, South Africa's only existing nuclear site. Construction will, however, go ahead only once the National Nuclear Regulator has granted an installation site licence, which is likely to be granted in June 2018, according to the regulator.

If a nuclear build programme does go ahead in South Africa, most of the uranium to support it will be sourced from the gold-rich Witwatersrand basin, which stretches from Evander, in Mpumalanga, westward through Gauteng and into the southern and western Free State. The basin holds about 81% of the country's total identified uranium resource.

In addition to the Witwatersrand basin, historical and recent exploration and trial mining results have indicated significant uranium resources in the Western Cape's Karoo region, dubbed the Karoo Uranium province, which extends into the Eastern Cape and Free State. Uranium is also present in the Springbok Flats coalfield, north of Pretoria, in Limpopo.

The Witwatersrand's underground operations hold about 49% of the national identified resources, while the associated tailings facilities hold 32%. The Springbok Flats basin holds about 14% of the national identified resources and about 5% can be found in the Karoo basin's sandstone deposits.

South Africa has only ever had two primary uranium producers – Beisa mine, in the Free State, which operated in the early 1980s, and Dominion Reefs, in the North West, which operated in the early 2000s.

Vaal River & Mine Waste Solutions

In October 2017, gold mining major AngloGold Ashanti sold its various South African gold and uranium mining assets in the Vaal river region to Harmony Gold Mining for $300-million.

The transaction comprised the Moab Khotsong mine, the Great Noligwa mine and related infrastructure, AngloGold's entire interest in uranium calcining facility Nuclear Fuels Corporation of South Africa (Nufcor), and AngloGold Ashanti's entire interest in Margaret Water Company.

Harmony CEO Peter Steenkamp said at the time that the value-accretive acquisition was in line with the company's strategy to grow and produce safe profitable ounces and increase margins. He noted that buying Moab Khotsong meant that Harmony would boost its cash flows by more than 60%, increase its average overall underground recovered gold grade by 12% and grow its South African resource base by 38%.

Through its newly acquired surface operations, Harmony will produce uranium as a by-product. It will extract gold from marginal ore dumps and tailings storage facilities on the surface at the Vaal River and West Wits operations. At the end of 2015, AngloGold had quoted by-product resources of 130 560 t U_3O_8, including by-product reserves of 53 700 t U_3O_8.

The Vaal River operation, situated on the border of the Free State and North West, within the Witwatersrand basin, is the largest uranium producer in South Africa. At Vaal River, reef material is processed from the Moab Khotsong, Great Noligwa and Kopanang gold mines, which are all located adjacent to Buffelsfontein mine, 160 km from Johannesburg. Reef ore is milled at the Noligwa gold plant and processed at the South Uranium plant for U_3O_8. Ammonium diuranate, or yellowcake, is then transported to Nufcor, near Johannesburg, where the yellowcake is calcined and shipped for conversion. Vaal River produced 423 t of uranium in 2016, up 22% from 346 t produced in 2015.

AngloGold's remaining South Africa-based operation, the Mine Waste Solutions (MWS) project, acquired from Canada's First Uranium in 2012 for $335-million, is situated in the Klerksdorp goldfield of the Witwatersrand basin. The MWS project spans 14 km and includes tailings dams that originated from ore processed at the Buffelsfontein, Hartebeestfontein and Stilfontein gold mines. At the time of the acquisition, the project was purported to increase AngloGold's uranium production to between 3-million and 4.5-million pounds a year. The $260-million processing plant, which First Uranium had started to build, was commissioned by AngloGold in 2014; first deliveries got under way at the end of 2014.

South Africa's largest uranium operation

Uranium by-product from the Vaal River operation is produced as oxide concentrates, or U_3O_8, in the form of a powder extracted from gold-bearing ore. It is then processed into a 'yellowcake' material that is transported in special purpose road tankers from the mine to the Nuclear Fuels Corporation of South Africa (Nufcor) for further filtration and calcining, resulting in uranium diuranate (in slurry form). The final product is shipped to Nufcor's major customers – nuclear electricity-generating utilities worldwide. Nufcor is arguably the world's longest continuous producer and marketer of uranium.

Source: AngloGold Ashanti's Integrated Annual Report 2016

Cooke

Located near Randfontein, about 30 km south-west of Johannesburg, precious metals miner Sibanye-Stillwater's Cooke operation is South Africa's second-largest uranium producer. The operation comprises four shallow- to intermediate-depth mines – Cooke 1 to 3 and Cooke 4, incorporating the Ezulwini uranium plant, which was acquired from Gold One in 2014. When operational, the Cooke mines produce uranium as a by-product to reduce gold production costs; the Ezulwini

uranium plant allows for the recovery of uranium as a by-product from about 4 t/y of produced gold.

The entire operation was, however, placed on care and maintenance on October 31, 2017, after Sibanye initially ceased Cooke 4 mining operations in August 2016. This has affected the jobs of more than 2 000 mineworkers and will impact on Sibanye's 2017 uranium production.

Sibanye has described the Cooke operation as a short- to medium-term asset, with a life-of-mine (LoM) that was initially expected to extend to 2023.

When operational, underground material from Cooke 1 to 3 is processed at gold mining major Harmony Gold's Doornkop plant, while run-of-mine ore from Cooke 4 is treated at Ezulwini. Ore from Cooke 3's uranium section is hoisted separately and trucked to Ezulwini for treatment.

The Cooke operation sent its first consignment of 10 t ammonium to Nufcor for calcining to U_3O_8 in 2014. That year, the company stockpiled 69 t of by-product uranium. In 2015, Cooke produced 47 t and, in 2016, production was up 43% to 67 t. Instead of selling into the spot market, Sibanye is holding out for a better uranium price, with plans to enter into long-term uranium supply contracts.

Uranium production in South Africa (tonnes uranium)

	2011	2012	2013	2014	2015	2016
Ezulwini-Cooke	34	0	0	69	47	67
Vaal River	548	465	531	504	346	423
Total:	582	465	531	573	393	490

Source: World Nuclear Association

West Rand Tailings Retreatment Project

Located in Gauteng, Sibanye-Stillwater's West Rand Tailings Retreatment Project (WRTRP), which comprises historical tailings from Driefontein, Kloof and Cooke (when operational), is a large-scale, long-life surface tailings retreatment opportunity.

According to the company, the combined WRTRP reserves amount to 677.30-million tonnes of tailings containing 6.20-million ounces of gold and 97.20-million pounds of uranium.

Sibanye-Stillwater completed the DFS for this project, as well as front-end engineering design, in the fourth quarter of 2016, which rendered the project construction-ready.

The first phase of the project is expected to reap a steady-state production of about 100 000 oz/y of gold and 900 000 lb/y of uranium, allowing for the recovery of about 2.70-million ounces of saleable gold and about 31-million pounds of saleable uranium over the first 40 years of the project.

WRTRP is awaiting regulatory approval and is scheduled to start operations in 2020, with a uranium metal production capacity of 907 t/y.

Beatrix

Sibanye-Stillwater's low-cost, high-productivity operation at Beatrix mine, 20 km south of Welkom, in the Free State, has an LoM to about 2029. The mine contains a probable uranium reserve of 10.20-million tonnes grading 0.71 kg/t, as well as measured, indicated and inferred resources of 11.40-million tonnes of uranium grading at 1.07 kg/t.

The company has indicated that it might build a uranium plant at Beatrix, or it may ship uranium from Beatrix north to the Cooke 4 Ezulwini plant to be processed (depending on whether Ezulwini is operational). Sibanye-Stillwater completed a feasibility study on the project in early 2016.

Shiva

Located in the North West's Hartebeesfontein district, Oakbay Resources and Energy's Shiva uranium mine is firmly within the uranium-rich Witwatersrand basin. Oakbay, which acquired Shiva in 2010 from Uranium One for $37-million, owns 74% of the operation. At the time, Shiva had been on care and maintenance but resumed production in early 2011. However, Shiva has produced only gold since then, while Oakbay develops the mine's uranium workings to progress towards substantial production in future.

Shiva mine

Picture by Oakbay Resources and Energy

The mine's on-site uranium plant is the only one in the country that uses reverse-pressure leaching. According to the World Nuclear Association (WNA), this achieves uranium recovery of up to 92% – significantly more than other leaching methods, which yield between 62% and 65%.

The plant beneficiates uranium to yellowcake and has a dedicated production line to further beneficiate the uranium to export stage. According to Oakbay, Shiva's total processing capacity for uranium is 250 000 t/m run-of-mine. The mine comprises a resource base of 196-million pounds of uranium.

Karoo

With an exploration target of between 250-million pounds and 350-million pounds U_3O_8, the Karoo uranium project, which straddles the Eastern Cape and Western Cape, has a Joint Ore Reserves Committee-(Jorc-) compliant resource base of 21 930 t of uranium, including an indicated resource of 8 440 t grading 0.09% uranium in sandstone.

Australia-based Peninsula Energy had a 74% in the project, which comprises 40 prospecting rights covering 7 800 k m^2 in the Karoo basin, 35 of which the company bought from Areva in 2013.

The company had initially planned first production in 2017/18, building up to three- to four-million pounds of U_3O_8 a year over three years. However, the company announced in October 2017 that it had decided to divest of its assets in South Africa, owing to the ongoing challenges in the uranium market.

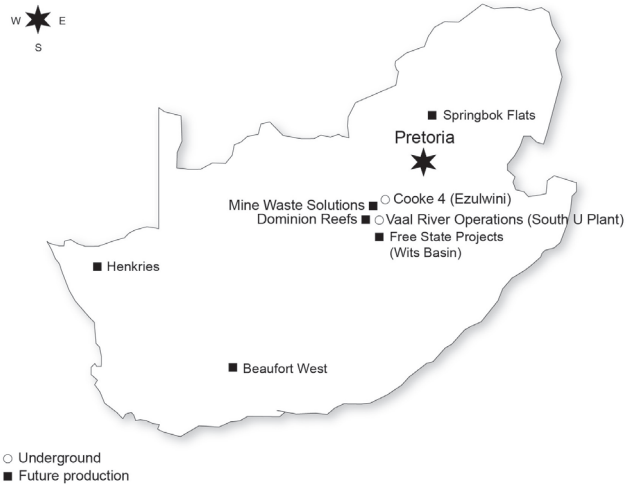
With this in mind, the likelihood that this project will advance is questionable. Quoting SA Faith Communities' Environment Institute, or Safcei, science adviser Stefan Cramer, national daily newspaper Business Day reported that the Karoo project's resource was not good enough when compared with other world-class deposits and the cost of production in the Karoo was also too high. "South Africa's mining sector is not attracting any foreign investment at present. Peninsula hopes to sell its assets. But how do you sell a house you yourself do not want to live in?" asked Cramer.

Other projects

Located in the Northern Cape and spanning 58 375 ha, the Namakwa/ Henkries uranium project is being explored by Namakwa Uranium, which is 74%-owned by Aardvark Uranium and 26%-owned by empowerment partner Gilstra Exploration. Xtract Resources investigated the deposit in 2014, but did not proceed with the acquisition, as the project did not meet its investment criteria.

There are several other uranium-related projects in South Africa, such as HolGoun's Springbok Flats deposit, although limited information is publicly available on this.

Uranium projects under way in South Africa



Source: IAEA & NEA, Uranium 2016: Resources, Production and Demand

Other African Countries

Exploration and mine development is continuously under way in Africa, and several countries on the continent that have not until now supplied uranium are exploring the possibility. Uranium production on the continent could, therefore, increase significantly if the market improves.

Botswana

Australia-based explorer A-Cap Resources is developing the $350-million Letlhakane project in the north-east of Botswana and hopes to produce about three-million pounds a year of uranium, to be exported through Namibia, over a mine life of more than 18 years.

Letlhakane is one of the world's largest undeveloped uranium deposits, with a Jorc-compliant resource of 365.70-million pounds U_3O_8 and a high-grade resource of 103.80-million tonnes at 450 parts per million (ppm) U_3O_8.

After its environmental-impact study was approved by Botswana's Department of Environmental Affairs in May 2016, A-Cap received a 22-year mining licence in September that year. With construction due to get under way in 2018, A-Cap plans to prepare Letlhakane for early development so that it can capitalise on industry growth once the uranium price recovers.

China Growth Minerals and parent company Ansheng Investment are the two largest shareholders in A-Cap,

with a 10.74% and 21.84% share in the company, respectively. As a result, A-Cap plans to list on the Hong Kong stock exchange. It is already listed on Australia's and Botswana's relevant exchanges – ASX and BSE.

Meanwhile, along strike from Letlhakane, Western Australia's Impact Minerals is exploring some prospective deposits in eastern Botswana, including Lekobolo, Shoshong and Ikongwe.

Malawi

Malawi was previously Africa's fourth-largest uranium producer, until Australian developer Paladin Energy put its 85%-owned Kayelekera uranium mine on care and maintenance in May 2014, owing to weak uranium prices and nonprofitability. According to WNA, this costs the miner about $12-million a year, compared with operating losses of double that.

Paladin has said, however, that a mine restart will be considered once the market improves. According to the company, once Kayelekera is operational again, it could produce 2.50-million pounds a year for at least another six years and will have the potential to expand the company's overall uranium production by more than 40%.

Until then, Paladin is maintaining the plant, infrastructure and critical aspects of intellectual property and operational know-how to allow for a quick restart.

The State of Malawi owns the remaining 15% of Kayelekera, which is located in northern Malawi's Karonga district. The mine has a nameplate capacity of 3.30-million pounds of U_3O_8. It produced 10.70-million pounds of U_3O_8 in its five years of operations – from 2009 to 2014.

About 50% of Kayelekera's total reserves and resources remain for future development. Further, its orebody remains open to the west and Paladin has proceeded with exploration here and on nearby leases, including Mpata to the east and Juma to the south.

Mauritania

Located in northern Mauritania, close to Algeria and Mali in the Sahara desert, Australian minerals company Aura Energy's Tiris project is based on a major greenfield uranium discovery, with 49-million pounds U_3O_8 in current resources from 66-million tonnes at 334 ppm U_3O_8.

In May 2017, Aura Energy applied for a mining licence for the project and, by the end of the year, the company expects to complete a definitive feasibility study on the project – a simple truck-and-shovel mine that will feed a $45-million plant. It is expected to produce about 400 t/y of uranium from 2019, over a mine life of more than 15 years.

The project has been financed through an offtake agreement between Aura and Guangdong Power Engineering, which was signed in February 2016. Guangdong, a subsidiary of China General Nuclear Power Group, will also provide engineering services for the project. The Mauritania government has a 10% interest in the project.

Tanzania

Uranium One, a wholly owned subsidiary of Russian State Corporation for Nuclear Energy Rosatom's uranium mining division, ARMZ Uranium Holding, is developing the Mkuju River project, which will be Tanzania's first uranium mine, once operational, and will establish the country among the world's top five uranium producers.

Owned by Mantra Tanzania, a division of Australia's Mantra Resources, in which Uranium One has a minority interest, Mkuju River is located in the Namtumbo district of southern Tanzania, about 470 km south-west of the commercial capital Dar es Salaam. It has proven and probable reserves of 25 876 t at 0.04% uranium as of early 2016.

While Uranium One expected to start mining in 2013 at an eventual rate of 1 400 t/y of uranium, the project has been suspended until further notice, owing to the depressed uranium price.

The capital cost of Mkuju River is expected to be $430-million for the treatment plant and infrastructure. Further, while Uranium One will contract out openpit mining at the project, a preliminary feasibility study on heap leaching lower-grade ore, also known as *in situ* recovery – as Phase 2 of the project – is under way. According to the company, the results look promising.

South of the Mkuju River project, Australia's Uranex NL was developing the Mkuju uranium project, but developments were suspended in 2014, as Uranex turned to graphite under the name Magnis Resources. Other companies that have had interests in Tanzania's uranium resources in recent years include Perth-based East Africa Resources, which had been investigating the Madaba-Mkuju deposits before it exited uranium exploration in 2015; US company Uranium Resources Inc, which has yet to publish resource data on its Mtonya project after undertaking drilling in 2010; and Tanzania's own Kibo Mining, which in February 2017 relinquished its licences over the Pinewood uranium/coal tenements, near Songea, in

southern Tanzania. Kibo had been part of a 50:50 joint venture with investment company Metal Tiger.

Meanwhile, Tanzania's mining industry is transitioning after President John Magufuli announced a new mining law in July 2017, which, in addition to demands for increased royalties, stipulates that the Tanzania government should own at least 16% of a project. Magufuli announced at the time that government would not be issuing any new mining licences until the country had "put things in order". Further, government would review all existing mining licences with foreign investors.

Zambia

Once uranium prices improve beyond $65/lb, Canada-based GoviEx Uranium will start developing the $118-million Mutanga uranium project, which is located in southern Zambia, 200 km south of Lusaka, north of Lake Kariba and close to the Zimbabwe border.

As of mid-2017, Mutanga's measured and indicated resources were estimated at 3 000 t of uranium, with inferred resources of 16 000 t. The project has two contiguous mining licences, with a term of 25 years to April 2035. It also has environmental approval and a radioactive materials licence. Further, Mutanga has been declared feasible for openpit mining with acid heap leaching.

Formerly known as Kariba, Mutanga was initially being developed by OmegaCorp before it was acquired by Denison in 2007, and GoviEx in 2016.

Denison and GoviEx merged their respective African uranium assets in June 2016 to create the world's largest undeveloped uranium resource base. Under the terms of a C$5-million all-scrip deal, GoviEx acquired Denison subsidiary Rockgate Capital, which held Denison's Africa-based uranium interests, in exchange for GoviEx shares.

One of the largest uranium resource bases

GoviEx's new combined asset portfolio now includes two permitted uranium development projects – the Madaouela project, in Niger, and the Mutanga project, in Zambia. It also includes the Falea project, an advanced exploration-stage project in Mali, and the exploration-stage Dome project, in Namibia.

GoviEx has advised that it now controls one of the largest uranium resource bases among publicly listed companies, with combined National Instrument 43-101-compliant measured and indicated resources of 124.29-million pounds uranium oxide (U_3O_8), as well as inferred resources of 73.11-million pounds U_3O_8.

Source: Mining Weekly

Further expanding its Zambian footprint, GoviEx finalised its acquisition of African Energy Resources' uranium interests in the country in October 2017. GoviEx now owns the Chirundu project and the Kiraba Valley tenements, which both neighbour the Mutanga project.

Combined, these projects comprise contiguous tenements of about 140 km in strike length parallel with the Zimbabwe border. They comprise three mine licences containing combined mineral resources of 5 800 t of uranium in measured and indicated resources, and 17 400 t of inferred resources.

Combined, Mutanga, Chirundu and Kiraba Valley significantly improve GoviEx's potential economies of scale, according to executive chairperson Govind Friedland.

African Energy Resources is still developing the Northern Luangwa Valley project, in northern Zambia.

Meanwhile, Barrick Gold-owned Australian developer Equinox Minerals operates the $762-million Lumwana copper mine, which contains about 7 492 t of uranium in 11.20-million tonnes of ore. As Lumwana is a copper mine, Equinox extracts uranium as a by-product, though this is being stockpiled and not processed, for now, until the uranium market improves.

A bankable feasibility study on uranium recovery at Lumwana has indicated that the mine contains 3 800 t of indicated resources at 0.80% uranium, and 2 570 t in inferred resources.

According to the company, Lumwana's uranium/copper stockpile could be treated at a later date, if and when Equinox decides to build a uranium plant. Until then, uranium is being classified as "waste".

Zambia Mining Magazine reported in 2014 that Barrick Gold had accumulated a stockpile of more than five-million tons of uranium at Lumwana. Equinox completed a uranium feasibility study in 2008, showing that output of two-million pounds a year of U_3O_8 and 15 000 t of copper could be mined simultaneously from the discrete uranium-enriched zones.

Following detailed consultation with the IAEA, Zambia's mining legislation has been upgraded to take uranium into account. It started issuing uranium mining licences in 2008 and, in 2017, has been revising its regulations regarding uranium exploration and mining.

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