

INDUSTRIAL MINERALS

Uranium prevails

Development of new mines continues in the uranium sector despite current low prices for the commodity, reports Roger Murray

The uranium mining and development sector is locked into survival mode, with cuts to mine production, development delays and exploration spending freezes as companies struggle to balance the books and cope with the drop in the uranium spot price to an 11-year low of US\$24/lb for uranium oxide (U₃O₈) as of September.

The principal cause of supplier woes is continued weak demand. Western utilities remain well-stocked with inventory, although it is anticipated that some at least will resume buying activity in the next two years.

So far, only a few of the 54 reac-

tors closed (six permanently) – after Japan's March 2011 earthquake/tsunami seriously damaged the Fukushima nuclear plant – have restarted; as more come back into operation, this will provide another upward impetus to demand.

However, it is China's purchase of nuclear fuel for its expanding nuclear-plant network (an average six new reactors are due on line each year until 2020) that provides the main upside. Analysts see China's continued inventory accumulation as the leading factor likely to spark a recovery in uranium in the next two years.

On the supply side, Kazakhstan has provided some stability by this year pledging not to raise production above the 28,000t of U₃O₈, representing 39% of global uranium output, that it produced last year.

SALAMANCA SHINES

One mining development proceeding is Salamanca in west-central Spain, where Berkeley Energia has already begun initial site infrastructure works, with mine start-up currently scheduled for 2018.

Salamanca's location in a first-world jurisdiction with well-established infrastructure nearby is

Bannerman Resources' heap-leach uranium demonstration plant on its Etango project in Namibia



seen as a key advantage by Berkeley. The initial development stage is fully funded; Berkeley had A\$11 million (\$8.4 million) in cash and no debt as of end-June 2016, and to fund the estimated US\$96 million up-front capital cost the firm is seeking a minority equity investment from a strategic partner for a price reflecting Salamanca's US\$532 million post-tax net present value (NPV).

MDM Technical Africa, a wholly owned subsidiary of the AMEC Foster Wheeler group, has been appointed to undertake the front-end engineering design (FEED) based on the definitive feasibility study (DFS) that AMEC completed in July 2016.

Measured and indicated resources for the DFS were 60Mlb (27,215t) of contained uranium grading an average 516ppm (0.05%) U_3O_8 , with a 30Mlb (13,608t) inferred resource not taken into account, and further

upside potential from the higher-grade Zona 7 deposit.

The DFS confirmed that the Salamanca project will be a low-cost producer capable of generating strong after-tax cash flow through the current low point in the uranium price cycle. Over an initial 10 years, annual steady-state output would be 4.4Mlb (1,996t)/y U_3O_8 at a US\$13.30/lb cash cost, below even the currently depressed spot-market price. Over the 14-year life of mine (LoM), output would be 3.5Mlb (1,588t)/y at a 15.06/lb cash cost. Salamanca is projected to generate an average annual net profit after tax of US\$116 million during steady-state operation.

Mining will start at Retortillo, one of three shallow Salamanca deposits and where a central processing plant is to be located, using a continuous mine-rehabilitation process involving progressive lining and backfilling

with waste and treated ore to minimise land disturbance.

Processing will comprise heap leaching/solvent extraction with no on-site sulphuric acid needed as supplies are available from regional smelters. Managing director Paul Atherley says that inclusion of Zona 7, the most recently discovered deposit, has "transformed the economics of the Salamanca project and provided the basis for us to commence development".

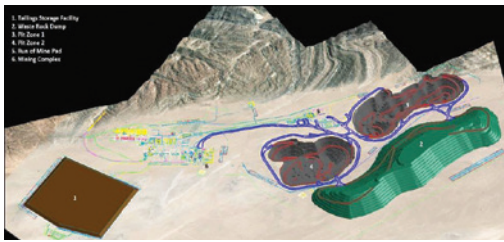
Zona 7 currently accounts for just over 40% of Salamanca's measured and indicated resource at a higher grade of 0.7-0.8% U_3O_8 , with an extensive drill programme targeting Zona 7 extensions and similar deposits under way.

Berkeley aims to conclude long-term uranium offtake contracts from now until Salamanca starts up and, in September, signed its first such agreement with European

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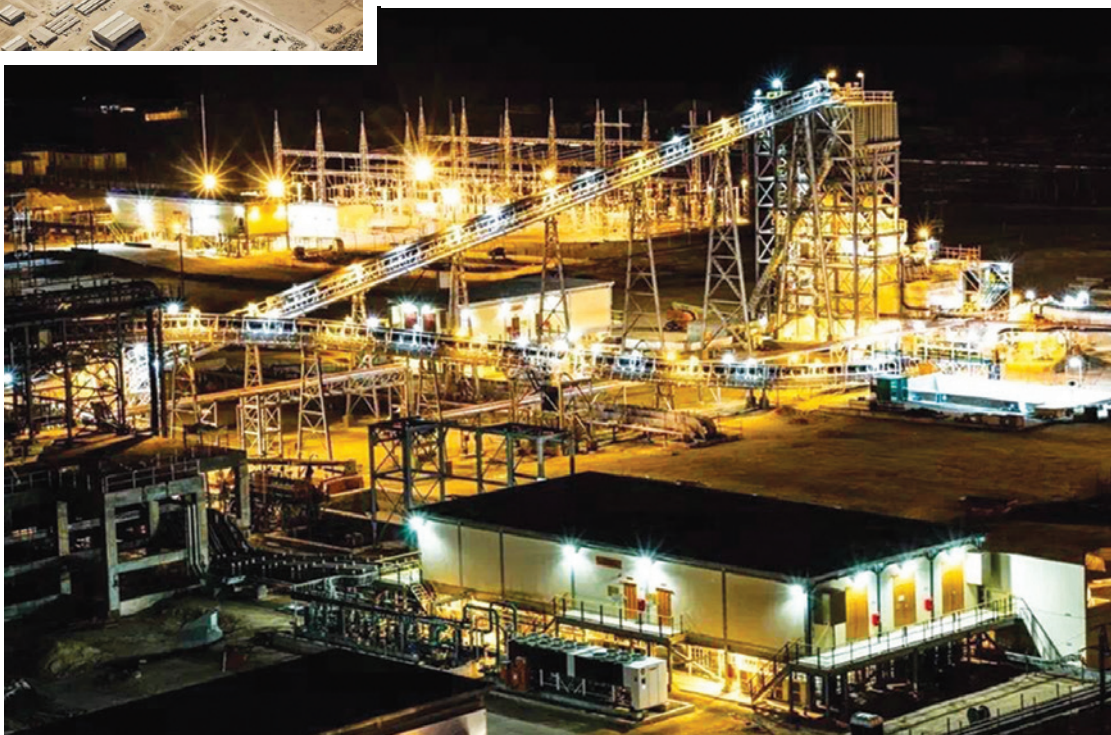
Husab in Namibia is the largest single open-cast mine built in the past two decades. Near right: 3-D layout plan



Above: aerial view of Husab plant

Above right: covered ore stockpile at Husab

Right: Husab site at night



“At full capacity, Husab is projected to increase Namibia’s GDP by some 7%”

► commodities trader Interloys Trading. An initial letter of intent should be finalised into an offtake contract by the end of 2016; both parties “contemplate” an average price of US\$41/lb U_3O_8 – well above the current spot-market price. The firm intends to use a combination of fixed and market-related pricing to ensure positive operating margins in the initial years of production.

Berkeley’s view of the market is that while prices may stay flat in the near term, from 2018, when Salamanca is expected to start up, demand will be increased by US utilities looking to re-contract coupled with Chinese new reactor demand

for nuclear fuel, which may lead to higher spot-market and long-term contract prices.

HUSAB MEGA MINE

But before Salamanca kicks in as Europe’s first new uranium mine, the much larger Husab mine in Namibia’s central Namib Desert will be producing, predominantly to supply Chinese nuclear power plants.

Husab is the largest single open-cast mine (two pits) built in the past two decades or more and has also been the biggest 21st century mine-construction project in southern Africa. At full capacity, Husab is projected to increase Namibia’s GDP –

NS\$147 billion (US\$11.5 billion) in 2015 – by some 7% and expand export earnings (US\$4 billion) by about US\$0.5 billion.

Despite the unfavourable market, construction of the US\$2.2 billion mine, processing plant and associated infrastructure, has been unaffected and works completed to schedule by the Husab Project Joint Venture (HPJV), the engineering, procurement and construction management (EPCM) joint venture of AMEC and Tenova Bateman. Most Husab product will be sold to a guaranteed market in China with only some 10-15% expected to be sold on the open market. ►

*View of
Bannerman's
Etango
demonstration
plant from the
entrance*

Originally known as Rössing South due to its proximity to Rio Tinto's long-established Rössing mine just to the north, Husab has been developed in just over 10 years since the deposit was first discovered in early 2008 by Australia's Extract Resources. Husab has huge, relatively high-grade reserves in two main resource areas, Zones 1 and 2. Proven and probable reserves total 320Mlb (145,150t) of contained yellowcake, grading 0.6% U_3O_8 proven and 0.5% probable.

Commissioning was due to have been completed during October, with ramp-up to full capacity of 15Mlb (6,800t)/y of U_3O_8 expected during 2017. Swakop Uranium's CEO, Zheng Keping, confirmed at the September annual symposium of the World Nuclear Association (WNA) in London. Swakop U is 90%-owned by Taurus Mineral, a subsidiary of China General Nuclear Power Corp and China-Africa Development Fund; Namibian state-owned Epan-gelo Mining Co has a 10% free-carried interest.

Mining and load haul of ore from Husab's two open pits began in 2014 to build up a stockpile ready for immediate processing once the plant becomes operational, with an average 50Mt/y of ore due to be treated by conventional acid-tank leaching/solvent extraction.

So far, Husab has deployed a large mining fleet of 26 Komatsu 960E-2KT AC haul trucks, six Caterpillar hydraulic face and rope shovels and six drill rigs.

Two innovative designs, installed to maximise environmental protection and minimise wind-blown dust, are a covered ore stockpile with a large over-all triangular roof and a fully lined tailings storage facility (TSF). An onsite acid plant will produce 1,500t/d, while Swakop U has also built a US\$2.5 million onsite laboratory to analyse 70,000 ore samples per month.

Infrastructure includes a 22km permanent surfaced road through the surrounding mountains to connect with the main B2 tarred highway, and a 65km water pipeline from the coastal town of Swakopmund where it connects to the AREVA-owned desalination plant to the north.

On the staffing side, Husab is employing 1,600 permanent workers and 400 contractors, with a strong focus on training and development. Last year, 350 mining and process operators were trained. Some 93%



of the workforce is Namibian and the proportion is due to reach the 95% target by the year-end.

ETANGO DEMO PLANT

Also in Namibia, Australia's Bannerman Resources has successfully completed five stages at the heap-leach demonstration plant on its 100%-owned Etango project near to Husab, and in October announced that it would proceed with an additional sixth phase.

The plant was commissioned in September 2015 with the purpose of demonstrating the potential for achieving substantial capital and operational cost savings compared with a 2012 Etango DFS. This is part of the firm's strategy to leverage Etango to take advantage of a rising uranium price environment at which point a development decision would be taken.

Based on the DFS, annual production is planned to be 7-9Mlb (3,175-4,082t) U_3O_8 for the first five years and 6-8Mlb (2,722-3,629t) thereafter over a 16-year minimum LoM. Etango would be potentially Namibia's second-biggest uranium mine. Ore reserves total 280Mt grading an average 194ppm (0.19%) U_3O_8 for 119Mlb (53,977t) of contained uranium.

The five demo-plant work phases completed since commissioning in

March 2015 have demonstrated or simulated the heap leaching and solution recycling aspects of the processing route, validating DFS assumptions.

Phase 5 aimed to optimise the process parameters and showed that processing more coarsely ground material at reduced acid consumption could contribute to further reductions in capital and operating costs.

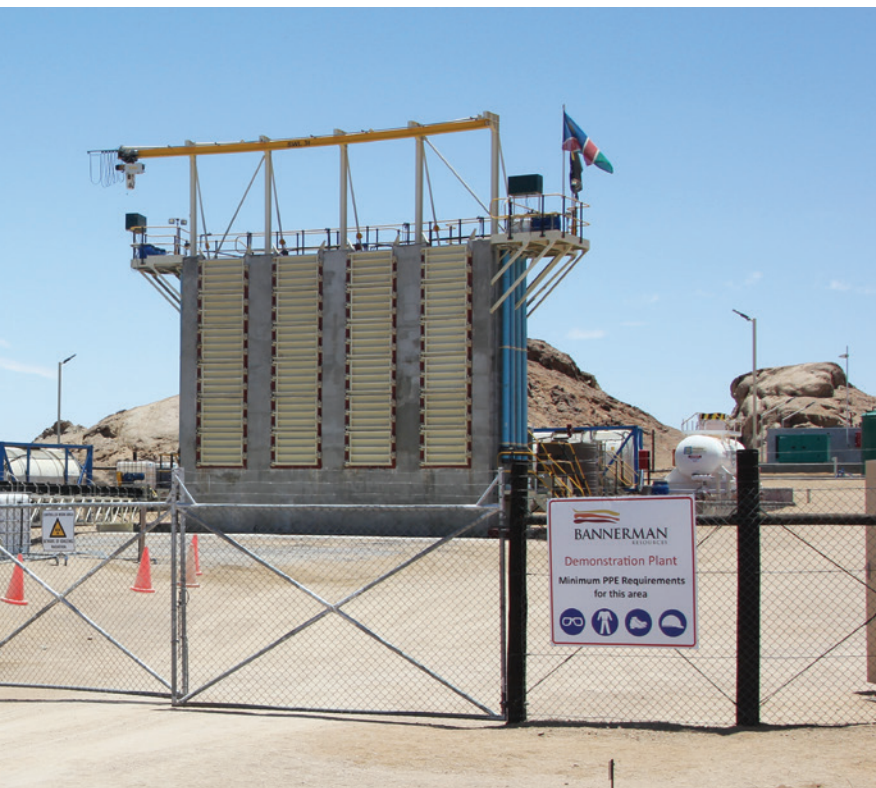
CEO Brandon Munro comments that the two-year programme has provided a "superb" return on investment and "has now been extended into a sixth phase, such is the extent of the positive impact on capital and operating costs we expect to attain".

Phase 6 (results due by due by end-November 2016) is focused on using a conventional tertiary crushing circuit, coarser particle size distribution of material going into the heap and a reduction in binder addition without compromising heap stability.

U-PGRADE TUMAS DEAL

Still in Namibia, Australia's Deep Yellow and Marenica Energy have executed a binding technology licence agreement for use of the latter's proprietary U-graduate process at Deep Yellow's Tumas project (See MM September 2014).

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The firms announced in September that U-pgrade would be used at Tumas is in return for a long term licence fee (over the life of the project) equating to 25% of Tumas' estimated NPV under a range of "possible development scenarios".

Deep Yellow noted that the agreement follows the recent conclusion of a successful test work programme on Tumas ore and has been structured to share the economic benefits of the resource/technology combination under "various conditions". The agreement initially comprises a series of lump-sum payments and then ongoing fees once an U-pgrade pilot plant has met specific performance indicators.

The test work demonstrated that processing Tumas ore using U-pgrade can reject up to 98% of the mass while recovering over 82% of the uranium content, which could substantially reduce both capital and operating costs, so enabling development at a lower uranium incentive price.

Deep Yellow's managing director, Greg Cochran, said: "We have been carefully managing numerous parallel elements in regard to the Tumas project and have long been confident that those efforts would soon be rewarded."

Deep Yellow will fund all project-development expenditure including costs associated with a pilot plant and further test work.

The Tumas palaeochannel straddles Deep Yellow's two wholly owned licence areas and comprises three zones. The current resource is 14.8Mt grading 366ppm (0.4%) U_3O_8 for 11.9Mlb (5,398 t) of contained yellowcake.

A Zone 1 infill drilling programme completed at the end of 2014 and a subsequent geophysical modelling exercise have provided additional confidence in the resource.

In emailed comments, Cochran notes that the licence agreement "means that we can move forward very rapidly with a pre-feasibility study (PFS), resource extension drilling and further metallurgical test work, which (funding permitting) could be completed by the middle of next year with a DFS completed just a year later".

He added: "The process offers substantial benefits over conventional processing routes and will see a dramatic reduction in both capital and operating costs, which will move the Tumas project forward in the industry's development cycle. I'd see us in commissioning just when the market is due to really take off late in 2019."

GREEN LIGHT FOR LETLHAKANE

In Botswana, Australia's A-Cap Resources has been granted a mining licence for its Letlhakane project, located near Francistown in the northeast. Formal confirmation was received in early September from the department of mines and the licence is valid for 22 years.

A-Cap obtained final environmental approvals and land-board project surface rights in mid-2016. It is sufficiently funded to continue project optimisation works and a PFS, and intends to seek a listing on the Hong Kong stock exchange and raise development capital for Botswana's first uranium mine in early 2018. Its largest investor is Chinese private firm Jiangsu Chixiang Precision Gear Co, which raised its equity interest to a 41.7% shareholding in September.

The total resource (Gojwane/Serule deposits), covering a 14km x 11km area, totals 269Mt grading an average 0.03% U_3O_8 for 190Mlb (86,182t) at a 200ppm cut-off according to an October 2015 resource upgrade using a localised uniform condition. This takes account of mining and grade-control selectivity.

A heap-leach process is under consideration, using two-stage acid leaching, solvent extraction and ion exchange. The most recent drilling programmes have targeted the early optimised shells. This typically represent the earliest production potential; these are the Kraken, Gorgon South and Serule West prospect areas. ♥

The Husab tailings storage facility

