RFC Ambrian

The Alchemist

Issue 30:

Uranium

This issue of the The Alchemist *examines the current uranium market in light of the recent rise in the spot price and whether the strong performance of uranium equities this year is justified by the longer-term fundamentals of the nuclear industry*

Uranium — Is this a Turnaround or has the Moment Gone?

INTRODUCTION

In January 2017 we finally saw a significant pick-up in spot market uranium prices. This commodity has been on a downward trend since a 2007 peak of US$136.22/lb; the current price sits at US$25.50/lb, a fall of 81%. Increasing supply, the devastating Japanese tsunami of March 2011 and advances in alternative energy supply continue to plague the industry. This issue of *The Alchemist* looks at these concerns and whether the recent spike in uranium interest is signalling the bottom of the market by providing an update on the current supply and demand dynamics, counterbalanced by market perceptions and a look into investor activity.

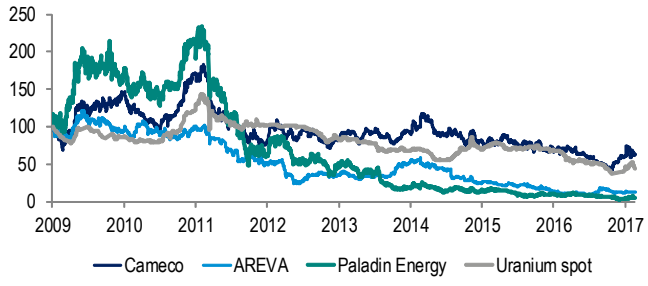
A TURBULENT HISTORY

Uranium spot pricing reached a new nadir in November 2016 — a 12-year low of US$17.80/lb. Since then a 50% revival led to a high of US$26.81/lb in February 2017, from where it has since come off.

The sharp move in the spot market was partially the result of an announcement in January 2017 by Kazakhstan's state-owned KazAtomProm that it would reduce its production for 2017 by 10%. In relative terms, this accounts for some 3% of world production, or 5.2Mlb of uranium. As this is the world's largest producer, the announcement had significant implications for the sustainability of supply at the prevailing low prices. The spot market represents only 10-15% of product sold, with the remainder being under long-term contracts. As a result, uranium is an opaque market where price volatility is exaggerated relative to its importance to overall sales. Some market analysts have viewed the response to KazAtomProm's decision as possibly being an inflection point in the market.

While markets have short memories, incidents at Three Mile Island, Chernobyl and (more recently) at Fukushima continue to inform public debate and anxiety about the consequences of nuclear power. Additionally, geopolitical concerns, ranging from North Korea's apparent determination to increase its nuclear capability, Iran's ambitions and almost any new President Trump policy, add to the negative picture. In short, nuclear power faces public acceptance issues and a hardening policy environment in many countries despite uranium being seen as a cleaner source of energy relative to its direct base load competitor — fossil fuels. In light of statutory moves in Europe towards an emissions mitigating power portfolio, questions are being raised over the role of nuclear power and whether alternatives can be found. That being said, activity in non-OECD countries pursuing nuclear energy has never been more feverish.

Figure 1: Industry & Company Price Movement Index (2009 = 100)



Source: Bloomberg

Following Fukushima and the closure of 54 reactors (approximately 11.7% of the world's uranium demand), only two Japanese nuclear plants are operating today in an increasingly challenging regulatory environment. Several nations responded to the disaster by terminating programmes and changing focus away from nuclear energy. Given lower utility demand, longer-term contractual production at higher prices and continuing secondary supply, global inventories have risen.

The bull case for uranium is largely driven by the growing global energy requirement and increasing environmental concerns about the impact of fossil fuels. China is spearheading this drive, with 23GWe from 20 reactors under construction in the medium term (World Nuclear Association, 2017).

THE DEMAND OUTLOOK

Global energy demand continues to be driven by economic growth and is set to develop across a changing energy landscape. Major transformations in energy supply are set to take place as the world responds to the considerable investment required to meet the 30% rise in energy consumption expected by 2040. The developing economies of China, India, Southeast Asia and the Middle East all exhibit accelerated growth, industrialisation and urbanisation, with non-OECD demand for energy expected to rise 71% from 2012 to 2040. Some 75% of all nuclear construction is currently taking place in these countries. In contrast, more mature energy-consuming OECD economies are only expected to see an 18% increase in demand over the same period (World Energy Outlook, 2016). Aggressive nuclear construction (predominantly in Asia) will probably lead to emerging economies overtaking Western Europe and the US as the main providers of nuclear power by 2030. The re-orientation of these developing economies and strong predicted growth will be the key drivers for uranium demand in the future.

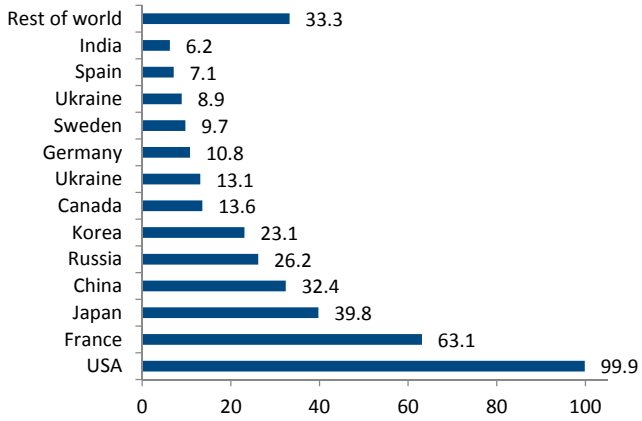
Asia

Asia (particularly China) continues to be fundamental to the uranium market. China is bringing its nuclear programme online with rapid, large-scale construction nationwide. As of 1 March 2017, there were 60 reactors under construction globally, with 20 of these in China (IAEA, 2017). As the only country with significant nuclear expansion plans, the Chinese fleet is set to play a key role in the development of China's future energy security, as outlined in its most recent *Five Year Plan.* The plan, which limits coal to 1.1TWe by 2020, is part of a long-term drive to have 20% of China's power generation produced by non-fossil fuel means by 2030. By 2030 it is projected that China will be drawing between 8-10% of its power from nuclear, up from 2% in 2012 (World Nuclear Report, 2016). The changing energy mix is the nation's answer to developing a diverse, clean, sustainable and profitable energy economy.

The average construction time for a reactor in the Chinese fleet is 5.7 years, the fastest in the world. Step changes in uranium demand will occur as many of the reactors under construction come online, leading to a hefty jump in consumption. In the shorter term, a Chinese nuclear power target of 58GWe by 2021 sees the addition of over 20GWe, equivalent to additional demand for approximately 1,390tpa U (14,450t U_3O_8), not including the uranium required to start up a reactor (World Nuclear Association (WNA), 2017). A ravenous China has its long-term sights on a nuclear generation target of over 120-150GWe by 2030, requiring the construction (on average) of 8-10 new units pa over the next 15 years.

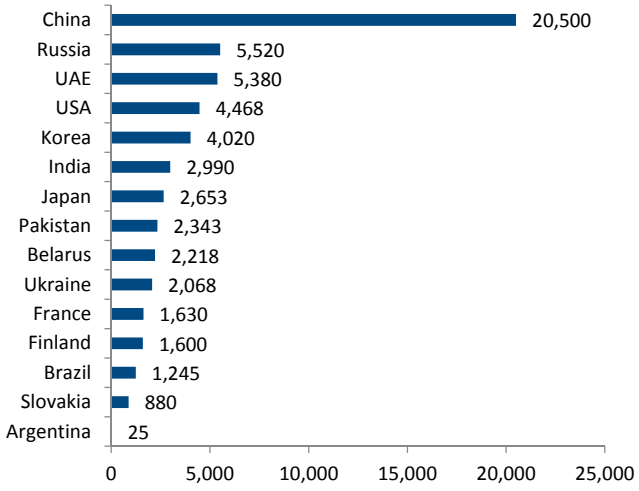
To meet the challenge of its medium-to-long-term uranium demand, the Central Government has employed a strategy of sourcing uranium from both domestic supply and the global markets to ensure stable and reasonably priced U_3O_8.

Figure 2: Total Net Electrical Capacity 2017 (GWe)



Source: IEAE-PRIS

Figure 3: Nuclear Generation Currently Under Construction (MWe)



Source: IEAE-PRIS

In contrast, nearly six years on from Fukushima, Japan continues to have almost all its nuclear fleet idled. Nuclear energy generation has dropped to 9.4TWh in 2015, down from 288TWh in 2010 (IEA, 2016). Public opposition to nuclear power has grown during the period. The short- and long-term implications this has for both Japanese and global energy security are still evolving. Total primary energy supply from fossil fuels has increased from 80.7% (2010) to 93.7% in 2015 (IEA, 2016). The new Japanese Government of 2014 formulated a new *Strategic Energy Plan* that reinstated the importance of nuclear power as an energy source and led to the introduction of stringent new regulations. The Nuclear Regulatory Authority is reviewing the applications for conformity assessments of reactors and fuel cycle facilities into the regime: 24 reactors are currently in this process of restart approval.

The *Energy Outlook of Japan Through to 2017* (IEEJ, December 2016) stated an objective of seven nuclear power plants being restarted in the current fiscal year (to 31 March 2017) and a further 19 in the following year; however, the pace of these restarts has been slower-than-expected. A decision on Kansai Electric Power Co's lawsuit is likely to attract substantial attention and will affect future nuclear reactor restarts.

Additionally, the termination of C$1.3bn in uranium contracts with Cameco by TEPCO early this year, Toshiba's US$6.3bn write-down on its nuclear reactor construction business and the announcement of the additional closure of five reactors (leaving the fleet eligible for restarts at 43) means 2017 has started poorly. The role nuclear plays in Japan's evolving energy mix will face considerable challenges from growing safety concerns and their associated costs, and from the cheaper energy sources of natural gas and renewables. However, it is the loss of public trust that may prove the most difficult issue to overcome.

The West

While Asia continues to generate growth, expectations for nuclear power expansion in the West have come to almost a complete standstill. Future reactor construction threatens to be outstripped by those being retired, with crashing natural gas prices and the accelerated market penetration of renewable energy leading to a drop in wholesale electricity prices in some countries.

The average US reactor age is 36 years, with the 100+ fleet containing 15-20 plants at risk of shutting down within the next 5-10 years as 40-year operational licences expire. Under the latest administration in the US, a focus has been placed back on generating power using shale, natural gas and coal. While it is unknown how this will play out in the medium and long term, such a move would engage base load competition to nuclear power in a country that is expecting to see a large number of its nuclear reactors go into retirement.

In Europe, nuclear power faces both public acceptance issues and a negative policy environment. Well intentioned policy makers have created renewable-rich energy policies with generous subsidies that have simply highlighted the need for reliable base load generation. European policy is driving power supply change, with a renewables target for 2030 of 46-50% of electricity (from just 27% in 2015), implying displacement of part of the remaining breakdown — 27% nuclear, 27% coal, 17% gas and 2% oil (World Nuclear Organisation, 2017).

Foratom, a European body for the nuclear industry, believes that EU energy policy should be built upon the three pillars of sustainability, competitiveness and security of supply, in which nuclear is favoured given its clean base load ability, while a large number of bodies and think tanks, such as Agora Energiwende, say that there will no longer be any base load demand by 2030, and the grid infrastructure will be used principally to back up renewables. The plants that fit this scenario are those that can ramp up and down rapidly, and load-follow normally. This is not a favourable scenario for high-capex and inflexible nuclear power.

Over the next decade phase-out programmes will continue to reduce nuclear generation capacity in Spain, Germany, Switzerland and Belgium. By 2025, eight of the UK's reactors are scheduled to retire, taking almost 5.1GWe with them, while the implications of Brexit and, thus, the UK's departure from the European Atomic Energy Community (Eurotom) remain unclear. The approved construction of Hinkley Point C (3.2MWe) is the sole exception to this. While there are 14 new reactors planned to come online in the coming decade across greater Europe, additional generation capacity is outstripped by a shutdown ratio of almost 5:2.

Additionally, the nature of nuclear construction dictates that there are almost always significant delays, with much of this due not just to the physical construction, but also licensing procedures, finance negotiations and site preparation being deferred. Flamanville in France continues to be plagued by these problems, with an onsite explosion in early February drawing attention to construction being many years behind schedule and over budget. Furthermore, the nuclear industry has drawn controversy over carbon aggregation safety concerns related to the weakening of steel in reactor vessel heads and pressurisers due to the accumulation of carbon. The expected delays in proposed nuclear power station start-ups demonstrate a lack of confidence in their future, particularly under post-Fukushima regulations.

World Inventory

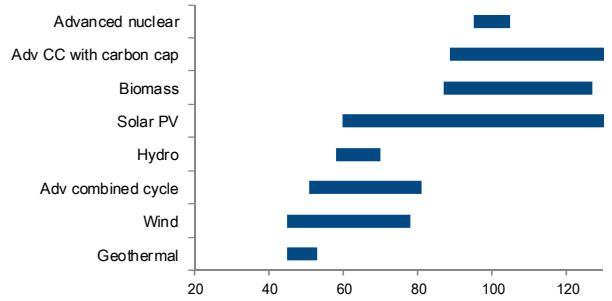
Masked by commercial confidentiality requirements and national strategic interest clauses, the amount of uranium held in stockpiles worldwide remains opaque. Data is not publicly released by many countries, with estimates generally calculated from import/export, domestic production and consumption data. Estimates show a large variance in numbers, but it is universally agreed that utilities, suppliers and traders are all sitting on high levels of inventory relative to historic levels and demand requirements. Post-Fukushima prices have allowed uranium players to boost their inventories, and as a result there may be little incentive or ability to commit to long-term contracts to meet medium-to-long-term requirements. It is believed that there may be more than 1Blb of inventory globally, or enough to supply the world's current fleet for five years. The 2014 estimates compiled by the World Nuclear Association, Bloomberg and Ux Consulting put US and European supplies at two years, with Japan maintaining at least six years at full production and China stockpiles somewhere around twelve.

The successfully completed *Megatons to Megawatts* programme (M2M) is an example of the contribution of over 13,500t U from the reprocessing of weapons-grade material. This agreement between Russia and the US met ~13-19% of total raw uranium demand at the termination of the M2M contract in 2013 (WNA, 2017). The US Department of Energy has continued to supply to domestic and international markets as it clears its inventories to finance the rehabilitation of reactor sites. With an agreement signed in 2016, Global Laser Enrichment is to produce 100,000t of 'natural-grade' uranium over 40 years, or 2,500tpa (DOE, 2017).

Changing Power Supply Dynamics

Uranium is unusual as the actual cost of the raw material accounts for a very small part of the cost of generating nuclear power. The cyclical movement of the commodity has little impact on the margin of nuclear generators, with profitability driven by power prices rather than fuel costs. For nuclear energy it accounts for only 2-4% of the levelised cost of electricity (LCOE); for fossil fuels it can be up to 80%. LCOE compares generation options as it accounts for a system's lifetime costs divided by the system's lifetime expected power output. For nuclear power, high capex, low power prices and competition from renewables are discouraging expansion. Renewables have become increasingly competitive, with rising levels of investment resulting in further technological and (subsequent) economic improvements. Energy storage systems with significant potential have begun to be rolled out to the market, such as the Tesla Powerwall products that offer end-user solutions to the peaked nature of renewables. In the US, estimated LCOE for those generation resources entering service in 2022 illustrates this shifting environment. Given additional licensing and regulatory approvals and increasing energy storage potential, peak generation sources are expected to edge out nuclear in the years to come.

Figure 4: LCOE of New Generation Sources Added to the Grid in the US (2022)



Source: US Energy Information Administration 2016

SUPPLY

Three countries account for approximately 75% of the uranium market: Kazakhstan (39.8%), Canada (23.4%) and Australia (11.8%). The poor sentiment and pricing in the market has resulted in considerable operational changes.

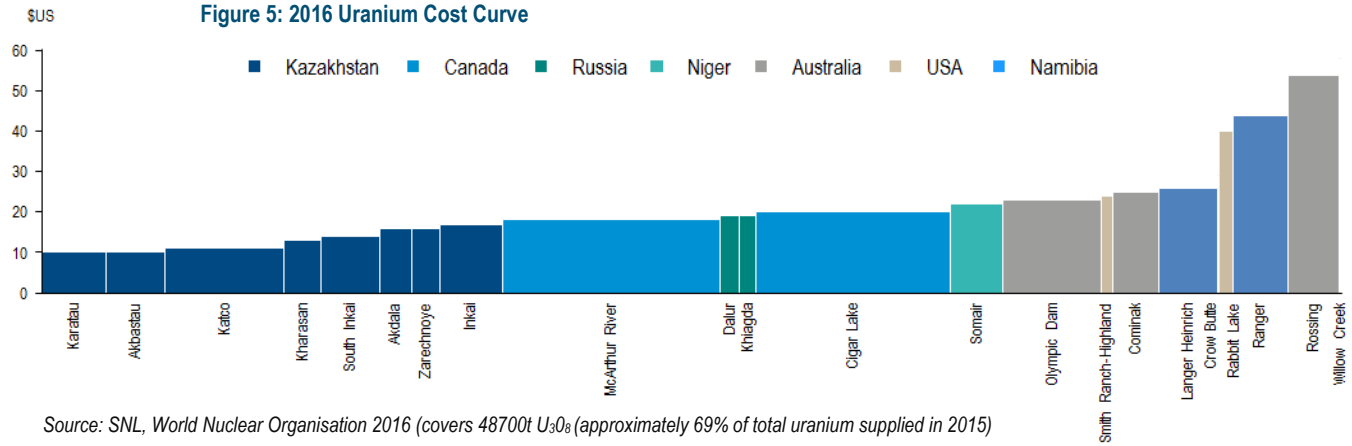
The announcement in January that KazAtomProm would reduce production by 10% for the coming year was derived from a strategic review of the current oversupplied market, opting for a 'pounds in the ground' policy until markets improve. The reduction will be 2,000t U_3O_8, roughly equivalent to 3% of total global uranium production based on 2015 figures (World Nuclear News, 2017). KazAtomProm has major strategic links with Russia, Japan and China, and has stated that no existing customer contractual commitments will be affected. Although the reduction of the exact production levels for each of its 17 operations is yet to be approved, the cutbacks will have significant implications for the volume available on the spot market.

Cameco, the world's dominant non-governmental producer, reported a net loss of C$62m for 2016. While it maintains a number of Tier 1 assets, it has incurred significant impairment and decommissioning costs on its other operations as it moves to reduce overheads. The Kintrye Project took a further US$238m in write-downs as the current spot price fell far below the indicated US$67/lb for it to be operationally viable. All operations at Rabbit Lake were placed on care and maintenance at a US$124m impairment cost and the loss of 530 of its workforce. Smith Ranch-Highland and Crow Butte in the US faced a similar fate, incurring US$257m in decommissioning costs as production stalled until prices improve. To increase the challenge faced by Cameco, a C$1.3bn claim of *force majeure* by TEPCO on its contracts will mean approximately 9.3Mlb of uranium deliveries through to 2028 are under question (Cameco, 2016).

In Australia, Olympic Dam produced 4,363t U_3O_8 in 2016, up 39% on the previous year (BHP Billiton, 2016). As a uranium source that is not economically supply-driven, it will continue to feed the market as a by-product of the copper and gold operations.

In contrast, Energy Resources of Australia's licence at its Ranger Mine operations is set to expire in 2021 with little chance of renewal. It recently announced that it would cease mining and maximise generation of cash from the processing of stockpiles, which it can potentially sustain until late 2020. There is a reported 8,080t U_3O_8 at its Ranger No 3 stockpiles. ERA expects sales in 2017 to be within the range of 2,000-2,400t U_3O_8 (ERA, 2016).

Figure 5: 2016 Uranium Cost Curve



Source: SNL, World Nuclear Organisation 2016 (covers 48700t U_3O_8 (approximately 69% of total uranium supplied in 2015)

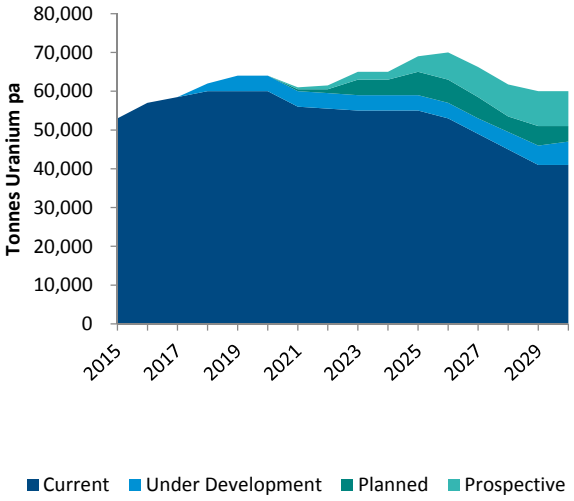
The long-awaited Husab Uranium Project (Namibia) started pre-production over the New Year, signifying a milestone in the China Nuclear Generation Power Group's (CGN) fuel security strategy. The US$2.2bn mine is one of the largest uranium deposits in the world and is expected to ramp up to a production target of 6,800tpa U_3O_8. This would make it the second largest uranium operation in the world.

As a driver for demand in the future, China has looked to secure supply through the acquisition of equity stakes in multiple foreign operations. China is now active across Kazakhstan, Canada, Australia, Namibia, Niger and Uzbekistan.

For China, heavy investment has developed a secured supply of some 130,000t U_3O_8 through to 2025. As these contracts terminate there will be a need to secure future supply, which may result in long-term contract activity once again. On the domestic front, supply has been emphasised with intensified uranium prospecting and exploration in China. As of April 2015, Chinese reserves are reported to be over 2Mt U_3O_8 (Mining.com, 2015). In what way the combination of these supply channels will meet its increasing thirst for nuclear fuel remains unclear; however, it seems unlikely that it will have an effect on the uranium market of the same magnitude as in 2007 when speculation about Chinese demand saw the spot market reach US$136/lb.

Nevertheless, production shutdown and closure decisions by major producers shed light on the greater supply picture and illustrate the longer-term unsustainability of current uranium prices. The supply dominance of a handful of players poses a risk to supply as individual operational issues can have direct effects on the overall supply picture. Between KazAtomProm and Cameco, production forecasts estimate a reduction of 5Mlb for 2017 as even some of the lowest-cost producers in the industry look to adapt.

Figure 6: Supply Needs for Forecast Market Requirements[1]



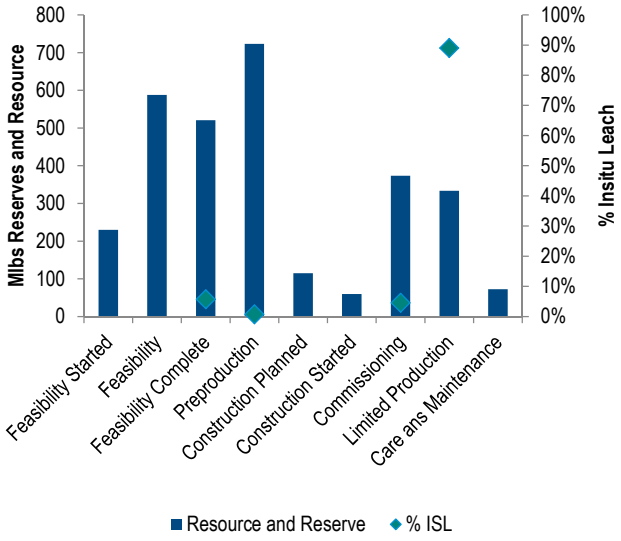
Source: World Nuclear Organisation
[1]Includes the restarting of Japanese reactors and China's growth plan

Waiting for markets to improve, there are an increasing number of operations sitting online ready to ramp up production. In comparison to those in the development phase, these operations do not require the US$70-90/lb often cited as necessary for new projects to progress. Additionally, *in situ* leach operations, a high percentage of which have recently constrained production, are also easily able to adjust production to market pricing.

Curtailed production at Smith Highland-Ranch and Crow Butte operations offer Cameco potential production responses to the return of higher prices. They operate at cash costs of US$24.23/lb and US$28.57/lb respectively.

New uranium mine developments continue to increase the growing gap between uranium produced and consumed. Recent low prices and long lead times (up to seven years) have made it economically challenging to bring on new production. Future production targets for new sites illustrate that a number of operations can economically operate under the current conditions, but given the capital required and the ability for current operations to ramp back up, the immediate-to-medium-term future looks unfavourable.

Figure 7: Uranium Development Runway

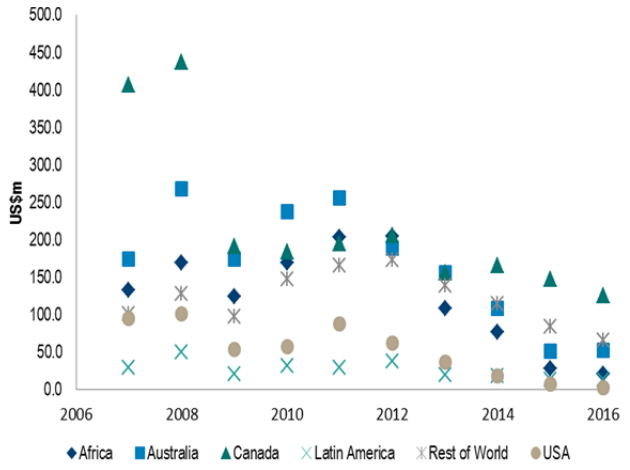


Source: SNL

Exploration

Market oversupply has significantly affected exploration activity, with its volume in steady decline (see Figure 8). A corporate survival instinct has slashed or completely curtailed exploration budgets. The highs of 2007 and 2008 are a distant memory, with an increase of just 0.1% in identified uranium resources in 2016. This has the potential to constrict long-term supply in the future, but for the moment it seems that today's consumption can be resolved through the increased production capacity of existing operations (approximately 4,700tpa) and 'ready to develop' operations rather than new properties.

Figure 8: Exploration Budget Trends for the Last Decade

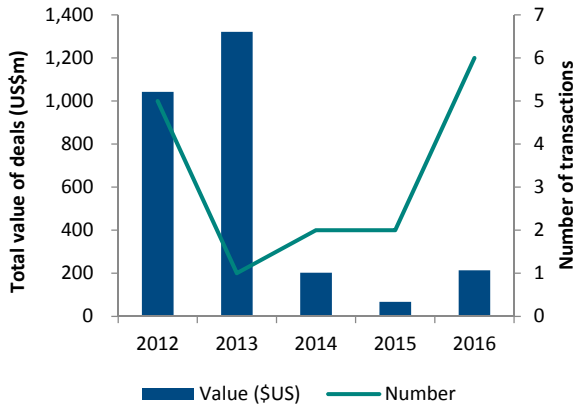


Source: SNL Mining Data

INVESTMENT MARKET

The market for uranium has seen a significant decline in M&A transactions since 2012, brought on by uncertainty about the industry and its future. There are many companies that are currently in a holding pattern, waiting for an industry revival. As the sector come back, a significant increase in M&A activity — as firms with excess cash invest in firms that have been burning reserves during the downturn — is likely. Operations that can consistently supply uranium and abide by long-term contracts will afford significantly higher premiums relative to their competitors.

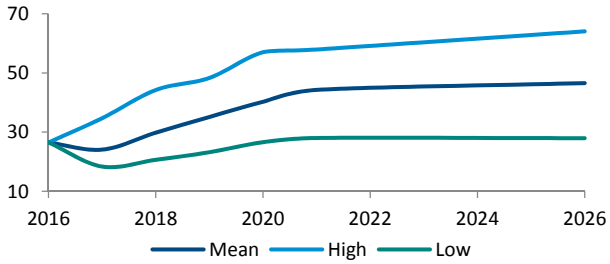
Figure 9: Transactions Greater than US$5m post-Fukushima for U_3O_8 Operations



Source: SNL

Looking to market consensus, many financial institutions choose not to predict the future price of uranium due to the many unknowns with the industry. Of the firms that do, the uncertainty about the market shows clearly as forecasts show a wide range of prices and a mean toward the centre of the range.

Figure 10: Expected U_3O_8 Price Range from Financial Institutions (US$/t)



Source: Consensus Economics

CONCLUSIONS

The question this issue tries to answer is whether the positive uranium price rebound in January 2017 is the bottom of the market or whether it was just a short-term reaction to an announcement. Additionally, is there promise in the future of uranium?

Nuclear energy still provides the best solution for non-polluting 24/7 base load power, particularly at a time when renewable energy (coupled with storage or fossil fuel back-up) is yet to prove itself. In the short-to-medium term, it is China's *Five Year Plan* to secure energy, be a net exporter of power and have nuclear power production generate between 120-150GWe by 2030 that is driving positive sentiment towards the market. The plan to bring back 48 Japanese reactors online completes a positive Asian uranium story. This is supplemented by near-term *ad hoc* opportunities for the renewal of long-term supply contracts.

This planned recovery is countered by anti-uranium sentiment driving policy, large stockpiles, a strong focus on renewable development and the removal of uranium power generation from Europe. Looking to the long term, the cost competitiveness of uranium power production, coupled with the effects of medium-term factors, raises a large question mark over uranium's future.

The spot price rise in January was a reaction to a low-cost operating company choosing to keep pounds in the ground rather than continuing to oversupply the market and may very well not be sustained. Investment in uranium should be approached via a 'preparation for growth' strategy; as and when interest returns to the market due to higher demand, transactions are likely to attract significant premiums for good assets.

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