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The Impact of Global Nuclear Fuel Inventories on Forward Uranium Production

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INTRODUCTION

The March 2011 Fukushima accident has not only led to a significant reduction in global uranium demand, but it has resulted in the enormous growth of nuclear fuel inventories. Uranium producers have been unable to compete with the current situation of large and growing nuclear fuel inventories and have recently begun to curtail primary production as these low-cost inventories have pushed uranium prices to levels below the production cost of many uranium projects, making these projects uneconomic in the near- and medium-term.

DESCRIPTION

Global nuclear fuel inventories are held by numerous entities, including:
• End-user nuclear power utilities and their relevant nuclear fuel procurement/management subsidiaries,
• Suppliers throughout the supply chain, including uranium producers, converters, enrichers, fabricators, and even reprocessors and mixed-oxide (MOX) fuel fabricators,
• Investors, traders, and financial institutions, as well as other non-end users, and
• Governments that have historically been involved in the production of nuclear fuel for both civilian and military applications.
Among global utility inventories, UxC data shows that the desired level for 2017 was 392 Mlb U3O8e (150,769 tU), with actual inventories amounting to 759 million pounds U3O8e (291,923 tU), or an excess of 367 million pounds U3O8e (141,154 tU) [1]. The U.S. Energy Information Administration (EIA) reported in its 2016 Uranium Marketing Annual Report that U.S. utility inventories held nearly 129 million pounds U3O8e (49,615 tU) at the end of 2016, up 43% from 90 million pounds U3O8e (34,615 tU) in 2011 and 182% higher than the historical low of 46 million pounds U3O8e (17,692 tU) in 2003 [2]. The Euratom Supply Agency (ESA) shows that European Union (EU) utility inventories increased from 123 million pounds U3O8e (47,308 tU) in 2011 to a peak of 142 million pounds U3O8e (54,615 tU) in 2013, but have since decreased slightly to 134 million pounds U3O8e (51,538 tU) [3]. Interestingly, given numerous reactor closures since 2011, EU utilities now hold more inventories per reactor than just a few years ago. Given the highly uncertain situation regarding the future of reactor restarts in Japan, the question of the country's utility inventories has become even more important to the uranium market. UxC estimates that Japanese utility inventories total 126 million pounds U3O8e (48,462 tU), with very little consumed since 2011, and enough fuel to last most Japanese utilities through most of the next decade and some utilities even beyond 2030. UxC's Base Case reactor restart/operations forecast for Japan assumes that only 21 of 40 operable units will eventually restart [4].
China's three main utilities –China National Nuclear Corporation (CNNC), China General Nuclear Power Corp. (CGN), and State Power Investment Corp. (SPI) –are estimated to hold 450 million pounds U3O8e (173,077 tU) at the end of 2017, an increase of 151% compared to an estimated 179 million pounds U3O8e (68,846 tU) in 2011. Starting in 2010, the import of uranium supply tripled, and net uranium imports have surpassed domestic uranium demand by a huge margin in every year since.
Supplier inventories have also built up inadvertently to the extent that global uranium demand has dropped off and utilities cancel out of previously contracted commitments. Traders hold inventories as well, although they do not produce or consume uranium. Since traders facilitate the flow of supply in the market, in some cases with offtake agreements, they end up holding inventories. After Fukushima, traders also became heavily involved in mid-term contracting wherein they purchased low-priced spot uranium to hold in inventory for

future delivery.

Another recent development stemming from the Fukushima accident and subsequent reactor shutdowns has been the use of excess SWU capacity to underfeed enrichment plants and/or re-enrich depleted tails to natural uranium. This underfeeding of enrichment plants has caused the need for newly produced uranium to decline even further. Thus, enrichers have been "creating"or accumulating uranium inventories and have turned around and sold this excess uranium into the market. Additionally, depending on how enrichers elect to use their excess capacity, they can choose to build inventories in the form of enriched uranium product (EUP).

UxC estimates that inventories from all the world's suppliers, traders, and investor-related entities totaled ~231 million pounds U3O8e (88,846 tU) at the end of 2017, with this group holding 53 million pounds U3O8e (20,385 tU) more than it did in 2015.

Governments, including the U.S. and Russia, continue to hold uranium inventories for military purposes. Much of the uranium is held in the form of highly-enriched uranium (HEU) contained in nuclear warheads and strategic stockpiles, which can enter the market if it is considered excess to national security interests. U.S. Government inventories, declared as excess or commercial, total ~145 million pounds U3O8e (55,769 tU), but its disposition of natural UF6 and HEU inventories are expected to be largely completed by the end of this decade. The true wildcard going forward is the success of the U.S. Department of Energy's proposed tails re-enrichment program.

The Russian government is the holder of an estimated 368 million pounds U3O8e, (141,538 tU) although most of its material must undergo some type of processing to be utilized. A large portion of the inventory consists of depleted uranium. Furthermore, tails that are deemed to be suitable for re-enrichment have low assays, but with Russia's large excess enrichment capacity, the volume of re-enriched tails has increased since the Fukushima accident. Two other major components of Russia's inventory are slightly irradiated uranium and reprocessed uranium. Among the country's inventory that does not require further processing is primarily natural UF6 stemming from the monitored inventory that became available following the end of the HEU Agreement.

DISCUSSION AND CONCLUSION

Although current inventory accumulation has taken several years to take shape, it has clearly become a major concern for market participants in the post-Fukushima environment. There is clearly no single opinion about the inventory situation, but most market participants agree that dealing with the growing level of inventories is crucial to rebalancing supply and demand fundamentals and creating a more sustainable future.

In early 2017, the world's largest producer Kazatomprom stated that it would reduce planned 2017 production in Kazakhstan by ~10%, noting that its decision "was based on the current glut of the uranium market [5]." And in late 2017, Kazatomprom announced its intention to further reduce Kazakh planned uranium production by 20% under Subsoil Use Contracts of Company enterprises for the 2018 through 2020 period, "in order to better align its output with demand [6]."More importantly, the cuts come to a country with the majority of its production in the lowest cost tier, with UxC showing a weighted average full cost of ~$15 per pound U3O8 across Kazakh operating uranium projects in 2016 [7].

Other producers have not been immune to the impact of inventories on the market. In November 2017, Cameco Corp. elected to suspend production from its low-cost McArthur River mine for a period of at least 10 months starting in January 2018 [8]. A primary driver in cutting production by ~16 million pounds U3O8 (6,154 tU) in 2018 was the fact that Cameco's inventory position had ballooned up to ~28 million pounds U3O8 (10,769 tU), which is nearly twice the level of its preferred 6-month inventory position. More than a year earlier, in April 2016, Cameco suspended production at its Rabbit Lake mine in Saskatchewan and began curtailing production at U.S. in-situ recovery (ISR) operations, resulting in the aggregate decline of ~6 million pounds U3O8 (2,308 tU) per year [9].

In Africa, AREVA has reduced production from its two operating projects, SOMAIR and COMINAK, in Niger by 25% since 2015, citing difficult market conditions. Meanwhile, Paladin Energy made an adjustment to its Langer Heinrich mine plan in August 2016, choosing to process stockpiled low and medium grade ores through 2019 and effectively shift higher-grade ore processing into later years when uranium prices may be higher [10]. As a result of the change, Langer Heinrich production was about 1.6 million pounds U3O8 (615 tU) lower over the last year.

Going forward, the mostly likely scenario entails additional inventory growth in the near-term, followed by the gradual disposition of utility, supplier, and trader inventories, which cumulatively will be greater than any additional buying on the part of utilities or other market players in the post-2020 period. Inventories will displace primary uranium production on a larger basis, especially after 2020, and as such, they will continue to have a price suppressive effect on the uranium market as existing supply outweighs new demand for inventories. However, this situation should slowly dissipate by the late 2020s, especially with significant uranium resource depletion projected in the mid-2020s. Accordingly, any new production decisions within the next several years will likely be premature unless market fundamentals change significantly in that timeframe.

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