



The Stock
Catalyst
Report



Uranium

A New Bull Market is Dawning



March 2017

We believe a near decade-long bear market for uranium miners has ended. The Uranium market is on the cusp of a supply/demand imbalance whereby inadequate supplies will not be able to meet rising global demand.

Investors who own the equities of select uranium miners stand to reap dramatic profits.

PREMISE

We are Very Bullish on Uranium and the Equities of Select Miners.

- **Uranium Market Bottom:** After an over 80% decline in the price of uranium and even more of a decline of the stock prices of most uranium miners, we think the uranium market has bottomed and the equities of certain uranium miners are dramatically mispriced.
- **Rising Demand:** Nuclear power (low enriched uranium is the fuel) is a large scale, 24/7, carbon free and safe source of electricity viewed as a vital tool to help achieve climate initiatives. Uranium demand could grow by over 48% to as high as 266.8 million pounds of uranium (U3O8) by 2030 from an estimated 179.3 million pounds of U3O8 in 2015.
- **Reduced Production:** Mining at today's prices is uneconomical. Uranium miners are under water as extraction costs exceed spot pricing – by a large amount. This has led to reduced capital spending by miners on exploration as well as cuts in production. There is not enough production to meet future demand.
- **Market Disrupter Displaying Discipline:** In January, Kazatomprom, Kazakhstan's state owned uranium producer and the leading global uranium producer, announced a 10% production cut. This will take more than 3% of production off the market.
- **Legacy Contracts are Expiring:** Many nuclear power utilities locked into long-term contracts for uranium at the peak of the prior bull market six years - ago. Those contracts are entering a roll-off phase. Uranium miners will not be incented to enter contracts with utilities at current prices. The price will need to rise for utilities to secure their fuel source. 40% of utility demand is uncovered in 2020 and over 80% by 2025.
- **Favorable Backdrop Emerging for Some U.S Miners:** US energy security is at risk given 20% of its electricity is derived from nuclear power yet it only produces about 3% of its own uranium to fuel the nuclear reactors. Russia and Russian friendly countries control nearly 65% of global uranium production. And that's a potential major problem for the U.S We expect U.S miners to benefit from a pro-nuclear power friendly Trump Administration.
- **Equity Shortage:** At the peak of the last bull market in uranium there were over 500 uranium miners. Today, we estimate there are only about 40 contenders for investor capital.

OVERVIEW

The cash costs to produce uranium are about \$25 - \$30 per pound, the all-in sustaining cost, when you add sustaining and exploratory capital expenditures, royalties etc., for even the “lower cost” uranium explorers or near term producers is near \$50-\$60 per pound.

Uranium trades around \$24 on the spot market and around \$40 for long-term contracts. Those prices are not sustainable for producers – many miners are responding to the low prices by shutting in production.

We expect its price to at least triple from its current \$24 level over the next few years.

These shut-ins will lead to a uranium supply shortages just as we are on the cusp of dramatic demand increases from the more than 60 nuclear power plants set to come on line in next few years.

The worldwide demand for uranium is assured because of its electricity generation efficiency, its zero carbon emissions and its low percentage of fuel costs versus other sources of fuel supplies.

The last bull market in uranium stocks generated so much wealth, that those who made a lot of money then will be extremely aggressive this rise. And we expect the stocks to start discounting that move in the near-term.

Uranium Market Background

1950s

Uranium’s first bull market was driven primarily by the nuclear arms race between the US and the Soviet Union. Uranium exploration companies then were trading on small regional stock exchanges. Uranium investors enjoyed spectacular returns.

1970s

Uranium price increased over ten times during this bull market... from \$3 to \$43. Some uranium stocks returned over 100 times. Greater nuclear power use was the main driver. It was a cheap alternative to high-priced oil. Disastrous power plant failures ended this bull market—first Three Mile Island and then Chernobyl. New production also came online and flooded the market just as demand was decreasing. The bear market lasted for 20 years.

2001–2011

From the late 1970’s until 2001 the uranium price decreased over 70%. It bottomed at \$8 per pound in 2001.

For most companies, the cost of producing uranium was significantly higher than the \$8 spot price. Miners had little incentive to increase or maintain production. Miners stopped producing and production capacity plummeted.

The supply destruction was significant while demand was increasing. The spot price far exceeded the equilibrium price. After bottoming at \$8 per pound in 2001, it soared to \$138 in 2007.

Some uranium equities, including Paladin Energy and Cameco, to name a few, saw their stock prices increase in the thousands of percent.

Fukushima, Japan Nuclear Disaster - March 2011

Fukushima precipitated a rapid deceleration in the already declining price of uranium already declining uranium market.

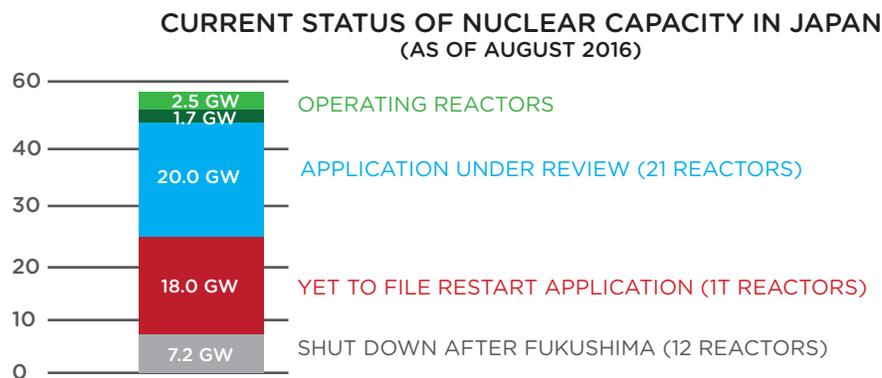
In 2011, a tsunami caused a nuclear meltdown at the Fukushima power plant in Japan. Afterward, Japan took all 54 of its nuclear power plants offline and switched to importing liquefied natural gas.

Since, five reactors have received approval to restart operations under the new safety standards imposed by Japan's Nuclear Regulation Authority (NRA). Only three of those reactors are currently operating. Two more are scheduled to come online soon.

Applications for the restart of 21 other reactors, including 1 under construction, are under review by the NRA. Some reactors that meet the new NRA safety standards and have been approved to restart continue to face legal or political opposition that may delay or forestall their restart.

Twelve reactors totaling 7.2 gigawatts (GW) were permanently closed. Restart applications for 20 previously operating reactors (totaling 19.5 GW) and 1 new reactor under construction (the 1.4 GW Oma Nuclear Power Station) have been filed with the NRA.

The remaining 17 reactors (16 GW) have yet to submit restart applications.



There is still uncertainty about whether some of these reactors can meet the new NRA safety regulations, particularly regulations regarding the ability to withstand severe earthquakes.

In addition to NRA approval, the restart of Japan's nuclear reactors requires the approval of the central government and the consent of local governments or prefectures where the power plants are located.

Current plans by the Japanese government are to have 19 reactors running by the end of 2018.

Per the latest update from the World Nuclear Association, the country's 54 main reactors had provided close to 30% of the country's electricity. Pre-Fukushima, this was expected to increase to at least 40% by 2017. Debate continues about where that share will settle in a Post-Fukushima world. Japan has stated 20%-22% is its new target.

After Fukushima, the shut-down of Japan's nuclear power industry eliminated 13% from global uranium demand.

Japan will have little choice but to restart its reactors. There's just no way to store five years' worth of liquefied natural gas or coal. It takes too much space. There are probably tens of different facilities in Japan that could store five years' supply of enriched uranium.

But for now, the uranium market has been plagued with excess supply in-part because of the Fukushima incident. The uranium price slid from \$73 to around \$18 per pound, before rising to its current \$24.

The Current Uranium Market

Uranium prices are at 10-year lows.

Most investors find it hard to muster up the courage to own the stocks knowing that uranium spot prices have fallen over 85% from previous highs.

Sentiment on the uranium sector is extremely negative. And the stock prices of many uranium miners are down well more than 80% from their prior peaks.



Uranium Demand-Strong Growth

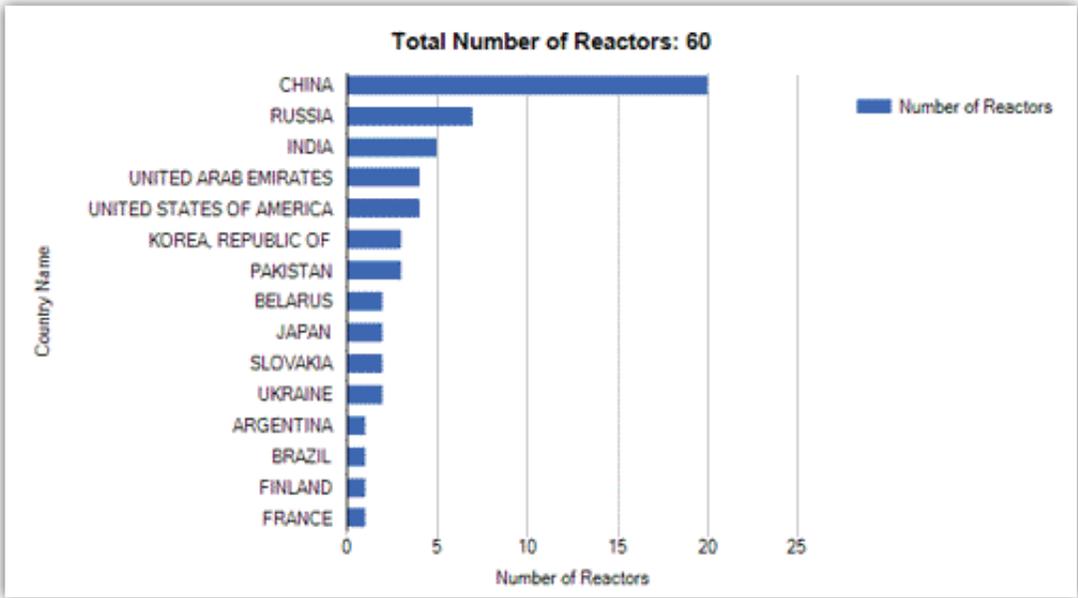
	2016	2004
Spot Price	\$20	\$20
Reactors Under Construction	60	23
Asian Reactors Under Construction	26	16
U.S Reactors Under Construction	4	0
Reactors Operating	448	440
Large Mines in Development		Macarthur River, Olympic Dam, Cigar Lake = 42.8mm lb/yr.

Today there are significantly more reactors operating and in the pipeline (meaning under construction, planned, or proposed) than there were during the last uranium market bottom in 2004.

The World Nuclear Association reports that there are 450 nuclear reactors operable in 30 countries as of January, 2016. These reactors can generate 382.5 gigawatts of electricity and supply about 12% of the world's electrical requirements.

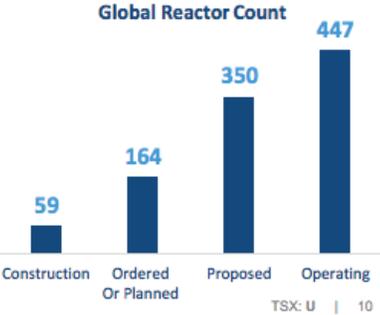
Per IAEA, there are 60 nuclear reactors under construction in 15 countries. The principal drivers of this expansion being China (20 reactors under construction), Russia (8), India (5), the United States (4), South Korea (3) and UAE (4).

Per the WNA, there are a total of 168 reactors that are either under construction, or ordered around the world. An additional 345 reactors that are proposed, with the potential to be operating by 2030.



2015 & 2016: Highest annual growth in nuclear power in 25 years

- **China:**
 - Plans to build 108 reactors by 2030
 - Government investment of over USD\$100Bn
- **India:**
 - 25% nuclear energy powered by 2050
- **South Korea:**
 - 25 reactors provide 1/3 of South Korea’s power
 - Plans to increase nuclear capacity 70% by 2029
- **Russia:**
 - 7 reactors under construction
 - 11 more to be constructed before 2030
- **Saudi Arabia:**
 - Plans to build 16 reactors by 2030
 - First reactor to come online in 2022



Source: UxC, World Nuclear Association (“WNA”), InstituteFor Energy Research

China has made a significant commitment to nuclear power as it plans to build 110 reactors by 2030.

China's 13th 5-Year Plan

Uranium Participation Corporation 

- **Massive Chinese Nuclear Buildout**
 - 36 reactors in operation
 - 21 under construction, +58%
 - 40 planned, +169%
 - 139 proposed, +556%

200 total reactors on the horizon
- **6-8 reactors to be approved each year**
 - 33 Gwe currently
 - 46 Gwe by 2020-21
 - 75 Gwe by 2025
 - 113 Gwe by 2030 (+242%!)
- **In 2015, China's CO2 emissions from energy use declined by 0.1%, the first decline in emissions since 1998**
 - Nuclear power grew by 28.9%, more than doubling the 10-year average of 12.4%

Source: WNA, BP China Energy Market Statistical Review



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Per UxC, in its "Uranium Market Outlook - Q4 2015" (the "Q4 Outlook"), global nuclear power capacities are projected to increase by 44%, from 376.6 gigawatts in 2015 to 540.6 gigawatts in 2030.

The outlook also estimates that uranium demand could grow by over 48% to as high as 266.8 million pounds U3O8 by 2030 from an estimated 179.3 million pounds of U3O8 in 2015.

Nuclear energy plays a key role in global initiatives to reduce carbon emissions and improve air quality around the world. At the 2015 COP21 conference, also known as the 2015 Paris Climate Conference, for the first time in over 20 years of UN negotiations, a legally binding and universal agreement on climate was reached - with the specific aim of keeping global warming below 2°C.

Because nuclear power is a large scale and carbon / emission free source of energy, it is viewed as a vital tool to help achieve climate initiatives. In response to the relationship between clean air and nuclear power, the World Nuclear Association is developing The Harmony Project, an initiative to grow nuclear power to produce 25% of global electricity by 2050.

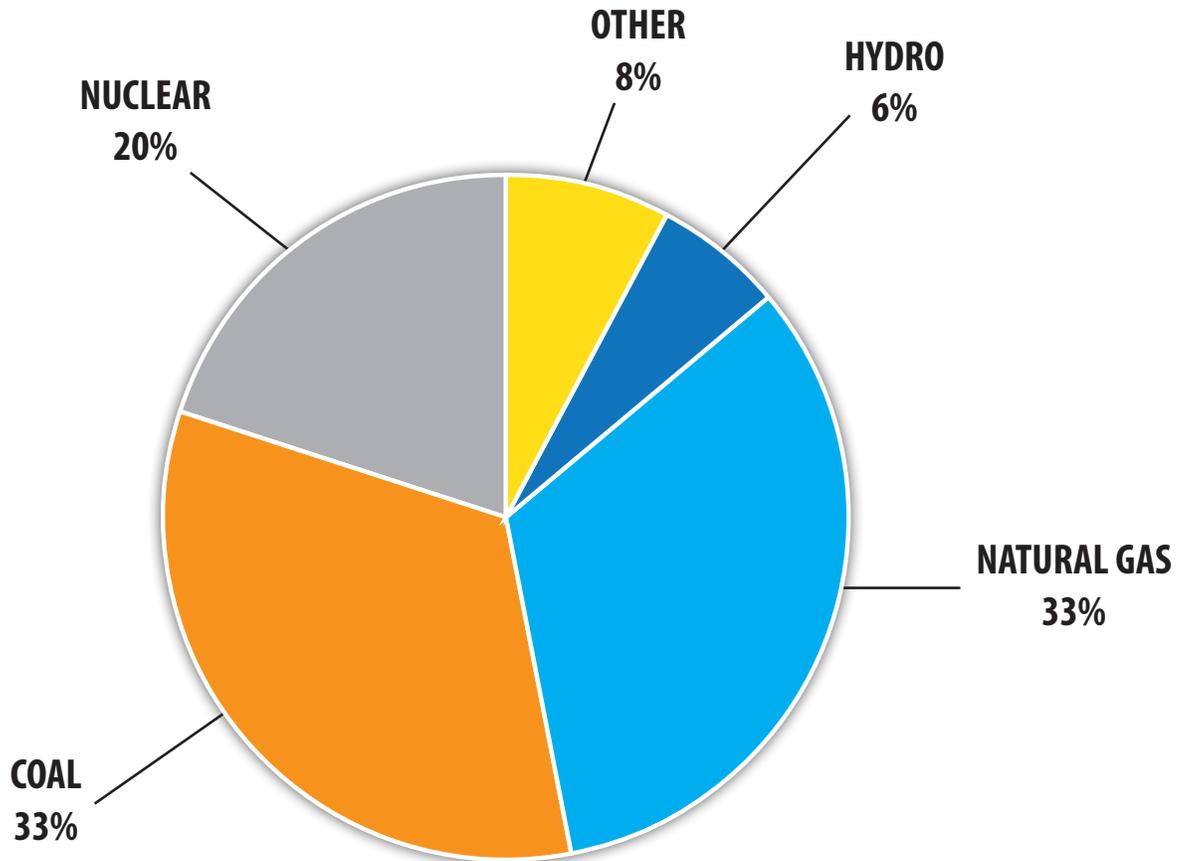
The current market share that uranium has in the world's baseload capacity is not insignificant. Globally, it is nearly 12% of baseload capacity.

Uranium is the densest form of energy in the world. For Japan, Taiwan, South Korea etc., and you need energy security, there's nothing like uranium. It is possible to store in a fairly-small warehouse enough raw material to keep the economy going for five years. Five barrels of uranium could power as much as 220 thousand barrels of oil. Think about that.

And the price of the fuel, relative to the value of the power, is small. The fuel cost makes up less than 5% of the operating budget of an old small plant.

A Major Source of US Electricity Generation

U.S Electricity Generation in 2015. Total 4,069,381 gigawatthours



In the U.S., about 20% of electricity generated is from nuclear reactors.

That means that in the near term, the US has no choice but to continue it.

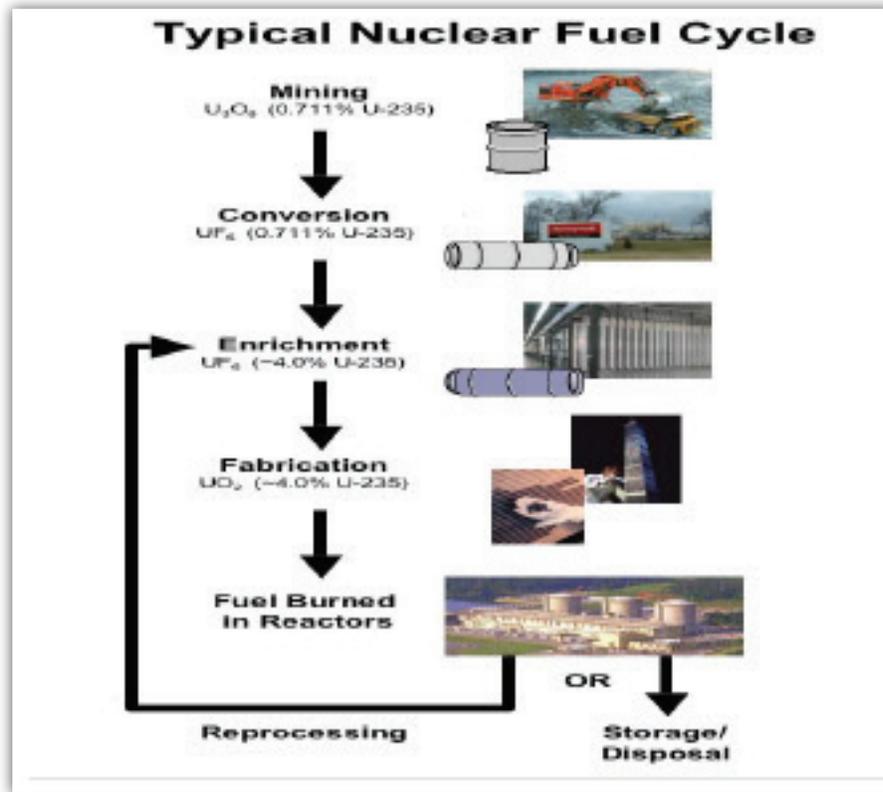
On a system-wide basis, 2% to 3% involuntary dips in power generating capacity are a threat to the grid; they could shut it down.

Imagine the effect on the economy of a 20% drop in power generation. Nuclear reactors need fuel and uranium is the source of that fuel.

**Demand is growing, utilities have significant uncovered needs,
and they are facing a supply shock.**

For nuclear power plants, running out of fuel is not an option, Utilities can't just put uranium from a mine into their reactors – there are a lot of steps in between. The nuclear fuel cycle can extend 18 -24 months. To provide a buffer, operators often cover their uranium needs at least three years ahead of need – and sometimes as much as a decade out.

The Nuclear Fuel Cycle:

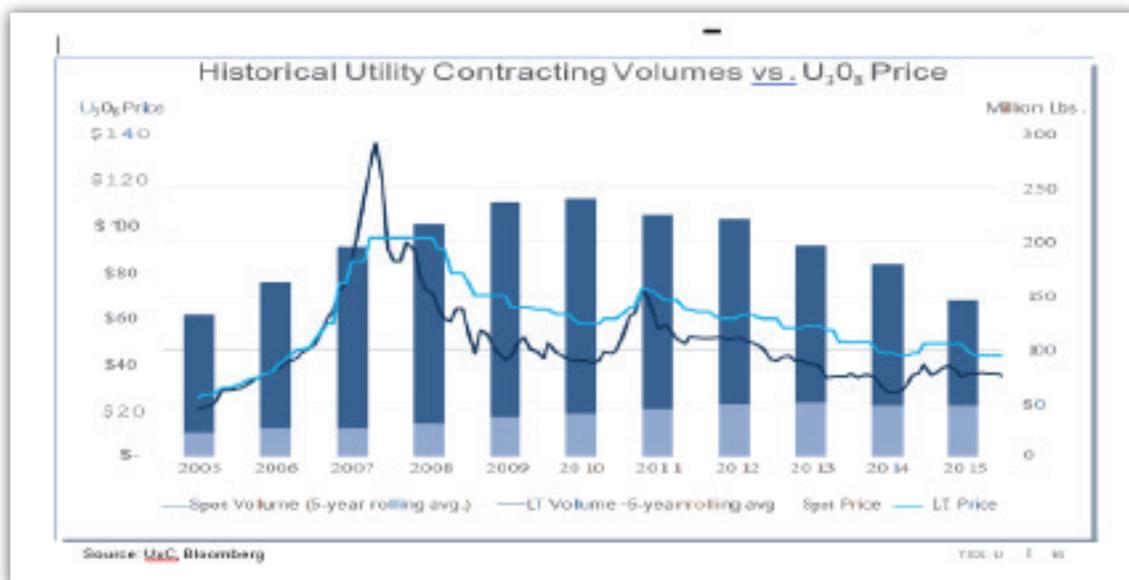


Nuclear fuel buyers are playing it close to the edge before ordering. They are taking advantage of low spot prices. Usually about 77% or so of contracts are long-term. In 2015, that number was closer to 60%.

But we think their time is running out - and very soon.

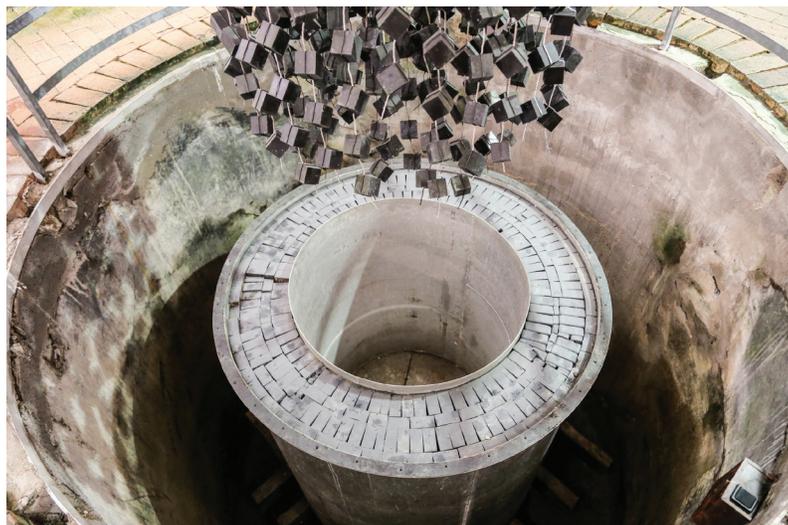
In the last three and a half years, the world has consumed over 600 million pounds of uranium under term contract, fuel buyers have only replaced about 200 million of that through term contracting.

Most global utility contracts roll off by 2020-2022.



When the spot price of Uranium spiked to \$138 per pound in 2007 nuclear power operators raced to sign supply deals out of fear prices would stay sky high. They got that wrong; prices quickly reversed. Nevertheless, those deals were binding – and many of them were ten-year terms.

That means that a significant number of supply contracts will begin to run out next year.



Nuclear operators are uncomfortably uncovered three years out. They haven't signed new contracts to replace those about to expire because they could pick up cheap uranium on the spot market for years.

Operators are looking at supply and demand data, at contract timelines and price predictions, and they know the market is set to tighten – time is running out for them to secure new supply.

New long-term contracts are more likely than not around the corner. And those new contracts will support higher prices because producers will demand it.

Why? Because they need higher prices to increase exploration, build new mines and increase production.

The point is that almost no new production can be built economically at current prices.

Producers know a supply gap is coming. They want to start building projects now, to be ready to pour new supply into that gap. The only thing they need are higher prices – and utilities will agree to higher prices, because (1) they know new production is needed and (2) uranium represents a very small part of their operating cost (less than 5%) so higher prices are not that significant to them.

That means we could expect the prices to rise soon, based on contract timing, lack of new supply, and rising demand.

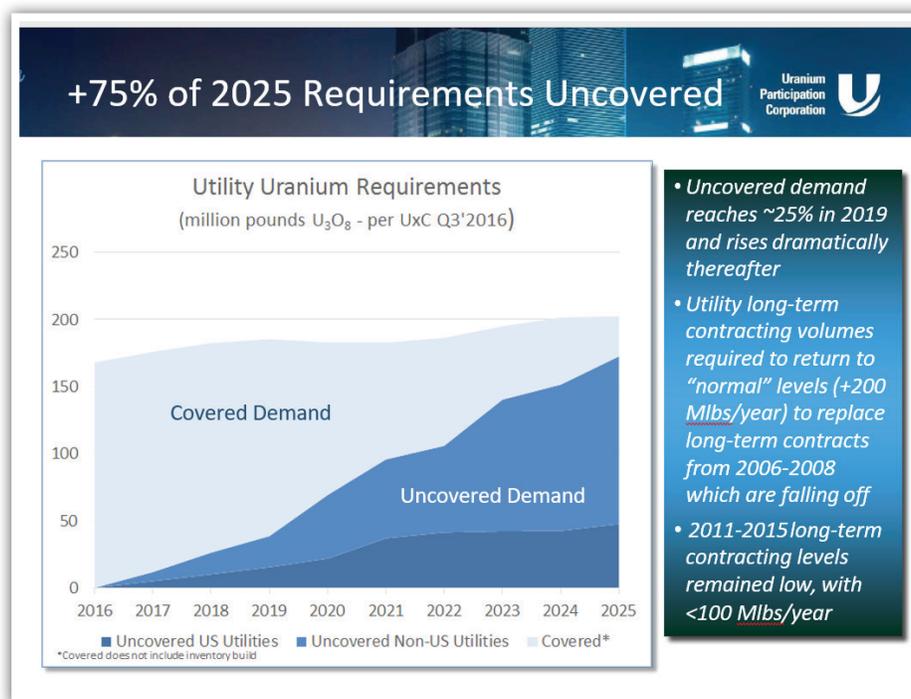
There are two key challenges to primary supply: 1) timeliness and 2) cost. The long-lead nature of uranium mine development means that the industry is unable to respond quickly to sudden increases in demand or significant supply interruptions – bringing on new production can take between seven and 10 years.

And now with recent lower uranium prices, there are delays and cancellations as new projects become uneconomic.

2016 U.S. uranium concentrate production totaled about 2.9 million pounds of U3O8. Down from roughly 4 million pounds in 2015.

The assurance of that steady stream of uranium to process into nuclear fuel isn't there however at \$24 spot uranium. Producers who mine it for \$60 and sell it for \$24, losing \$36 per pound, can't make up those losses on volume.

Over 80% of 2025 nuclear power plant uranium requirements are uncovered by utilities.



There are no major new mines in development that could meet the demand of uranium over the next decade. It takes ten years just to go through the permitting and building process of a new mine. Should utilities shutter mines, it could take a couple of years to restart them.

The current spot price reflects short term oversupply with the largest factor being the growth in Kazakhstan spot production.

The long-term demand that enters the market is affected in a large part by utilities' uncovered requirements. In 2016, UxC estimated that uncovered demand was only about 7.4 million pounds U₃O₈ or just 4% of projected demand. Uncovered demand, however, is projected by UxC to increase significantly over the period of 2016 to 2019, such that up to 75.1 million pounds remains uncovered for 2020, representing roughly 39% of projected demand in that year. Uncovered demand rises rapidly for years after 2020 to over 175 million pounds per year (or roughly 83% of projected total demand) for 2025.

At 175 million pounds, the uncovered demand in 2025 is estimated to be nearly as much as total demand estimated for 2015 and approximately 6 million pounds U₃O₈ greater than the total production expected from new and existing mine production in 2025 - some of which is already committed to the covered portion of the demand projected in 2025.

To address the rising portion of demand that is uncovered, utilities will need to return to the market and secure long-term contracts.

From 2006 to 2010, on average, 39 million pounds U₃O₈ equivalent were purchased on the spot market per year and roughly 200 million pounds U₃O₈ equivalent were contracted in the long-term market each year.

By comparison, from 2011 to 2015, on average, 47 million pounds U₃O₈ equivalent have been purchased on the spot market per year, while less than 100 million pounds U₃O₈ equivalent were contracted in the long-term market each year.

In 2014 and 2015, long term contracting volumes were roughly 77 million pounds U3O8 per year. With low contract volumes in recent years and increasing uncovered requirements, we expect that long term contracting activity will need to increase soon as utilities look to secure supply and move U3O8 through the nuclear fuel cycle to fuel the world's growing fleet of nuclear reactors.

**To the year 2025, over 80% of utilities requirements are uncovered.
We think this is about to end.**

This may create a short squeeze situation as nuclear power generating utilities have increasingly relied on spot purchases to supplant contracts signed in the rush of the last uranium bull market.

This resembles the supply dynamics of the early 2000s, when the spot market was oversupplied by de-enriched former weapons grade uranium made available by the 'Megatons to Megawatts' program.

The unexpected flooding of Cigar Lake in 2006 triggered a significant price reversal as utilities rushed to get their hands-on supply, contracting volumes of material at higher prices that still form a large portion of their current supply agreements.

Nuclear power utilities now have put themselves in a position with very little bargaining leverage.

This may be critical at a time that KazAtomprom, the state-owned Kazakhstan uranium supplier and global market share leader at well north of 40%, rethinks its marketing strategy, has announced a major production cut of 10% and nearly all major producers are unwilling to long term contract at price levels below \$40/lb.

Uranium Supply

We estimate there exists an excess total supply in the market of about 17 million pounds annually.

Primary Supply		
Mil Lbs.	Demand	Production
2015	179	151
2025	210	169
Source: 3Q16 Ux Consulting		
Secondary Supply * (Mil Lbs.) * estimates The Stock Catalyst Report		
2016		
Japan	15	
Underfeeding		
Russian	15	
Western	8	
U.S Dept. of Energy	7	
Total Secondary Supply	45	
* Very opaque market, best efforts estimate		
Surplus		
Primary Production		151
Secondary Supply		45
Total Supply		196
Demand		179
Surplus		17

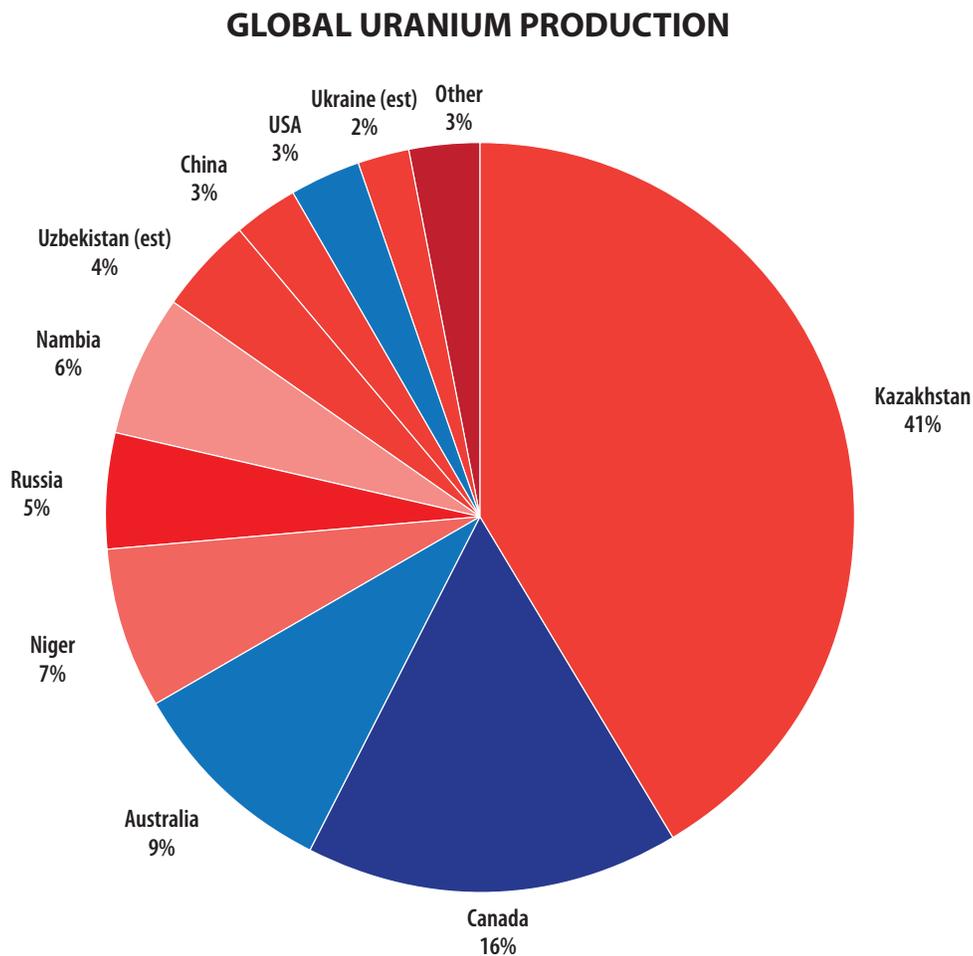
The uranium market is comprised of **Primary supply**, the supply that comes from miners, and **Secondary supply**.

The most obvious source of secondary supply is civil stockpiles held by utilities and governments.

Re-enrichment of depleted uranium (DU, enrichment tails) is another secondary source.

Underfeeding at enrichment plants is a significant source of secondary supply, especially since the Fukushima accident reduced enrichment demand for several years. This is where the operational tails assay is lower than the contracted/transactional assay, and the enricher sets aside some surplus natural uranium, which it is free to sell (either as natural uranium or as enriched uranium product) on its own account.

Primary Supply



Per Ux Consulting, a leading uranium consulting firm, the outlook for production is:

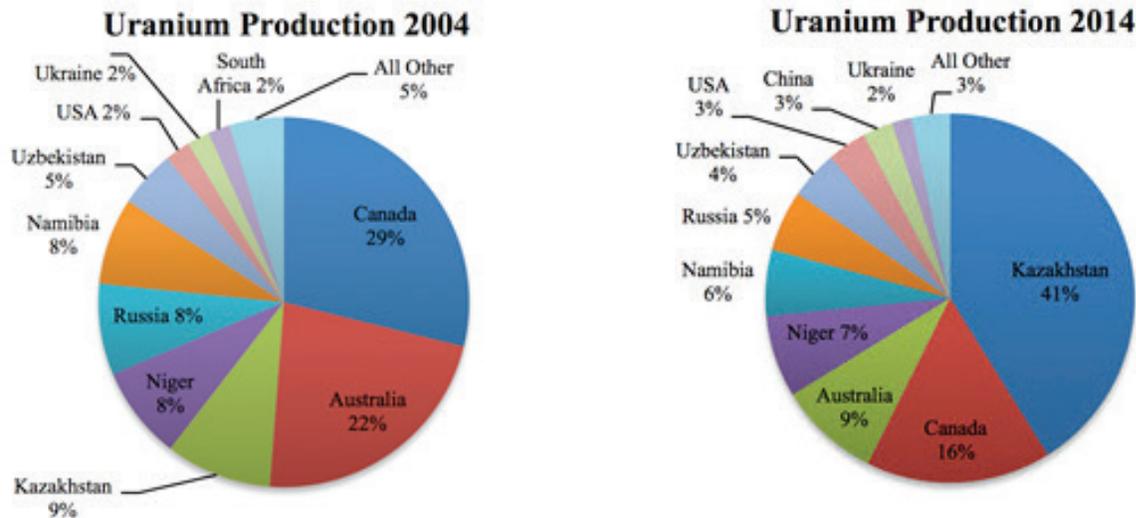
	Demand	Production
2015:	179M lbs.	151M lbs.
2025:	210M lbs.	169M lbs.

Secondary supply has filled the recent gap.

We estimate 45 million pounds of secondary supply on the market – leading to excess annual supply of 17 million pounds.

Kazakhstan has surged to the global uranium production lead - prices be damned

Kazakhstan has grown from the number three uranium supplier in 2004, with 9% market share, to the largest producer in the world and constituted 41% of global mine production in 2014. We believe it is possible its market share nearing the end of 2016 is approaching the mid-40% range.



Finally - A price cut! A signal Kazakhstan is exerting its influence in a positive way. This is Big!!

In January, KazAtomProm (the Kazakh state owned uranium company and largest global uranium miner) announced a 10% production cut. Think about that. The number one supplier in the world, just cut production 10%. Imagine the impact on the oil market if the Saudi's, had cut oil 10%. Oil would go through the roof.

Uranium spot price has increased from around \$20 to \$24 per pound since the announcement. We suspect the Kazakh's might cut again later in the year as their cost of production is in the low-\$20ish range. Barely enough to make any margin at current prices.



This new pricing discipline is signaling a shift in the global uranium markets as the Kazakh's begin to move away from policies that enabled KazAtomProm to seize a significant amount of market share. The Kazakh's market share grab had unintended (or maybe not) consequences on uranium prices.

Inventory Management via the establishment of Swiss Marketing Arm.

Beginning in October 2015, KazAtomProm announced, and has subsequently reiterated its intention to establish a marketing company, based in Switzerland, to centrally coordinate the sale of uranium.

This marketing arm will have numerous implications for KazAtomProm's uranium marketing which would have a meaningful impact on the uranium spot price and supply/demand dynamics:

Inventory Discipline and Management: Most of KazAtomProm's supply contracts are done through asset JVs or direct supply agreements earmarking specific mine production for a specific utility customer throughout the nuclear fuel supply chain.

A more effective inventory management tool would include the production from all mines into an inventory pool with sales drawn from the pool for delivery.

Using a pooled method would enable the group to incorporate an inventory policy and act as a swing producer or seller, using inventory and production levels to influence the uranium price.

Transfer Pricing: Kazakhstan has comprehensive transfer pricing laws which restrict the sale of commodities to publicly verifiable prices where available.

The purpose of the law is to restrict tax avoidance enabled by the shifting of profits out of country through subsidiary transfer pricing.

The consequence is KazAtomprom has only been able to sell in the spot market.

Given the current spot price of \$24/lb. is well below the long-term uranium contract price of \$38-\$40 negotiated between utilities and uranium suppliers, this has had a depressing effect on the market.

The lower spot prices have enabled utilities to put off signing new supply contracts and rely more on a 'just-in-time' sourcing model.

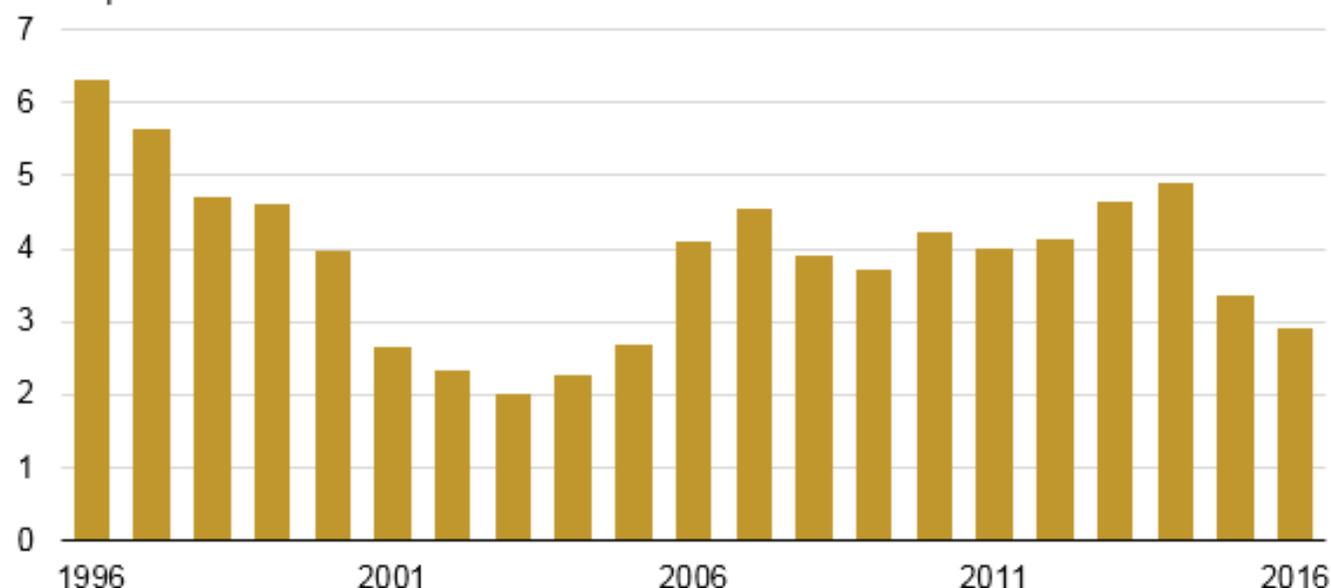
The new Swiss marketing company would enable KazAtomprom to sell uranium at spot to its Swiss marketing subsidiary and subsequently market uranium at higher prices abroad.

KazAtomprom will now be able to contract at higher than spot price should it choose to. Which recent public statements by its leadership suggest will occur. It is also publicly suggesting that it will halt production growth as it is happy with current production and market share levels

KazAtomprom is unlikely to sell at spot for much longer. Its initial strategy of rapid production increases and spot sales enabled the company to make tremendous market share gains. We expect to see a sharper focus on price discipline and margins while maintaining its market share.

U.S Energy Security at Risk -Washington, Come-in, We Got a Problem

U.S. uranium concentrate production (1996-2016)
million pounds U3O8



The US consumes around 50 million pounds of uranium per year to fuel our nuclear power reactors.

Nuclear power accounts for about 20% of our nation's power consumption.

The U.S produces less than 3 million pounds of uranium per year.

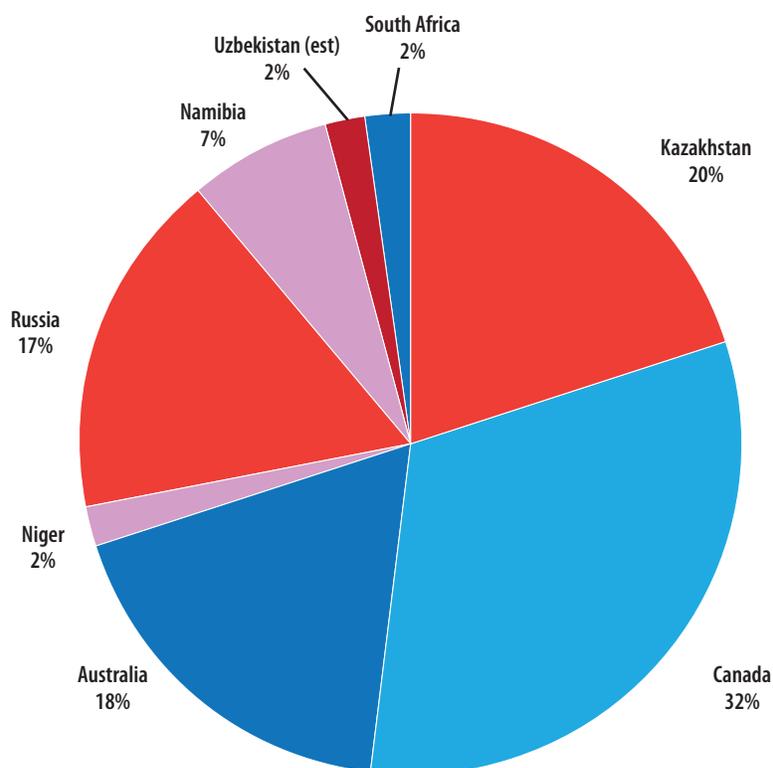
We'll repeat that. The U.S consumes around 50 million pounds of uranium per year, yet produces less than 3 million pounds per year.

Now get this. In a controversial deal in 2013, the Russian's took private Uranium One, which controls 365,000 acres in Wyoming accounting for 20% of America's own uranium supply.

Right in its own backyard, the Russian's control 20% of U.S uranium. AND THAT'S A HUGE PROBLEM FOR THE U.S.

Given the U.S imports over 95% of its uranium to fuel its nuclear reactors, which power 20% of the nation's energy, one would hope that the uranium supply is secure. We don't think it is.

US URANIUM IMPORTS 2015



The Russian Circle of Influence

(Russian speaking/ Russian friendly) outside the US controls nearly 65% of world uranium supply.

The U.S purchased 45% of its Uranium supplies from Russian friendly countries.

And the U.S cannot rely on Canadian and Australian imported uranium to meet its demand. Neither country can supply enough Uranium to meet U.S demand. Furthermore, both of those countries have long-term supply agreements with India and China.

Russia's Enrichment Influence: Another concern for the U.S should be enrichment capacity. Without enrichment, uranium for nuclear fuel is useless. Russia controls nearly half of the world's enrichment capacity. And any U.S friendly capacity is already full.

THE U.S IMPORTS APPROXIMATELY 45% OF ITS URANIUM FROM RUSSIAN FRIENDLY SOURCES AND THE RUSSIANS OWN 20% OF U.S URANIUM PRODUCTION.



Think about that. The Russian's have tremendous influence over the uranium market.

We wonder What President Trump; the DOE and Congress will do about that.

Inventories - A Critical Discussion Point

Ux Consulting estimates there are about 1.4 billion lbs. of above ground uranium stocks. That might sound like a lot in a market that consumes 179 million pounds.

Now let's wrap some context around these numbers. Since 1985, uranium demand has been met by supplementing historical under-production by the mines with inventories built up before 1985.

Total inventories were near today's levels when uranium prices peaked at over \$130/lb in 2007, and again in 2011 when uranium was \$70/lb.

Per the OECD, current total inventories are about half the level of their peak in 1991.

Utility Inventories

Most uranium inventories are at the global utilities, the biggest consumer of uranium. Their existing inventories, combined with their long-term contracts, means most of their existing needs are being met.

Globally, utilities are reportedly holding about 770 million pounds of uranium, compared to current annual demand of 179 million pounds. This equates to 4.4 years of demand.

However, China is estimated to hold approximately 40% of this inventory. China is building its inventory, given that the country plans to grow its nuclear energy generation from the current 30 giga-watts of electric capacity to 130 GWe by 2030 and 240 GWe by 2050.

Ex-China from the inventory position and the rest of the nuclear world is currently holding about 2.9 years of demand.

Historically utilities have sought to hold between 2 and 3 years in inventory. So, current inventory levels are high, but within the historical range.

As we said, context of the inventories is important.

Utilities consume enriched uranium in their reactors. The cycle time for mining uranium out of the ground, shipping it to enrichment facilities, enriching it and then creating fuel rods from the enriched uranium could be 18 – 24 months, or longer. The current stockpiles at utilities are not excessive given the enrichment cycle.

Secondary Supply – Pressuring the Market

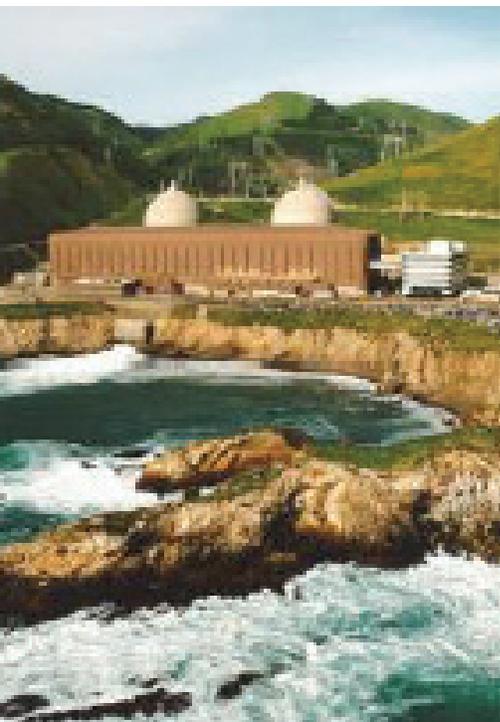
There already exists a shortfall between the uranium consumed by reactors and the uranium produced from the world's mines, about 25 - 30 million pounds. That gap has been bridged by secondary supplies – uranium in various forms that is already out of the ground and sitting in stockpiles around the world. It is estimated the U.S government holds 260 million lbs. and Russia has about 135 million pounds. Not all of that is useable however.

Japan Inventories. As previously discussed, with just three reactors on-line, this has created excess supply of about 15-20 million pounds per year.

Enrichment Underfeeding: As previously discussed, Fukushima led to a 13% reduction in uranium demand. It also reduced demand for enrichment services, leaving enrichers with excess capacity in their capital-intensive plants. We estimate about 23 million pounds underfeeding supply annually is on the market.

Side-Note Uranium Primer - Uranium as Nuclear Fuel

Uranium in its naturally occurring form consists primarily of two “isotopes” with the same chemical characteristics, but different atomic weights due to the differing number of neutrons in their nuclei. Let's call one heavy and one lighter for simplicity sake.



The lighter isotope, U-235, comprises only 0.7% of natural uranium, but it is the only isotope that can undergo fission and, thus, produce energy. This is what nuclear power reactors use.

The other isotope, the heavy one, U-238, comprises the remaining 99.3% of natural uranium. To be useful as fuel in the most prevalent nuclear power technologies, the percentage of U-235 must be increased to the level of 2-5% U-235, a process called “enrichment.”

Apologies, this is a bit technically dense – but a key to understanding secondary supply from Underfeeding.

Enrichment is a technically difficult process, the essence of which is highly secret because it is the same process used to produce some nuclear weapons material. (Nuclear weapons can be made from uranium of approximately 90% U-235.)

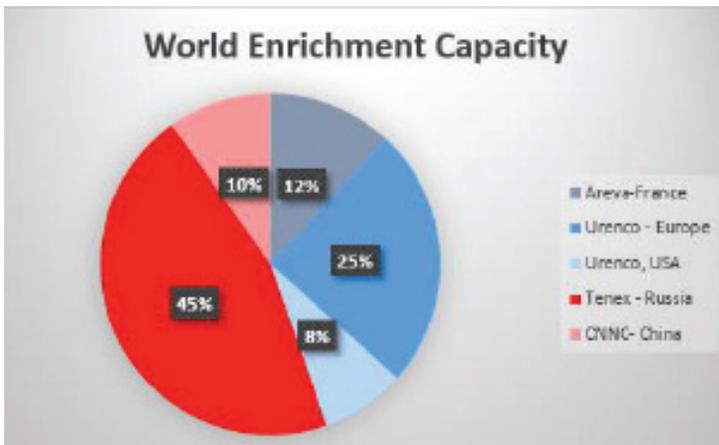
The enrichment process uses centrifuges to separate the lighter molecules from the heavier molecules.

Building enrichment capacity is expensive. Once built, the process is inflexible (the centrifuges cannot just be turned on and off).

The utilities which buy uranium from the mines need a fixed quantity of enriched uranium to fabricate the fuel to be loaded into their reactors.

The quantity of uranium they must supply to the enrichment company is determined by the enrichment level required and amount of fissile uranium in waste stream after enrichment (tails assay).

Underfeeding – Stay with us, this is important! The enricher, however, has some flexibility in respect to the operational tails assay at the plant. If the operational tails assay is lower than the contracted/transactional assay, the enricher can set aside some surplus natural uranium, which it is free to sell (either as natural uranium or as EUP) on its own account. This is known as underfeeding.



The opposite situation, where the operational tails assay is higher, requires the enricher to supplement the natural uranium supplied by the utility with some of its own – this is called overfeeding.

In respect to underfeeding, the enricher will base its decision on the plant economics together with uranium and energy prices.

With reduced demand for enriched uranium following the Fukushima accident, enrichment plants have continued running, since it is costly to shut down and re-start centrifuges.

The surplus SWU output can be sold, or the plants can be underfed so that the enricher ends up with excess uranium for sale, or with enriched product for its own inventory and later sale.

We estimate today that underfeeding is adding about 23 million pounds of uranium into the market. That's a lot.

However, the inertia of the enrichment process thus exacerbates over-supply in the uranium market and depresses SWU prices (from \$160/SWU in 2010, the spot price at February 27th, 2017 was \$47). With forecast overcapacity, it is likely that some older cascades will be retired.

Per the WNA, estimated currently total enrichment production capacity is about 58.7 million SWU (seperative work units), well above the 47 million SWU of annual demand.

As centrifuges spin or shut permanently, the excess capacity maximizes U-235 recovery (underfeeding), therefore reducing the demand for U3O8, and resulting in the build-up of Enriched Uranium Product ("EUP") inventories.

The long-term SWU price for most long-term (10 year) contracts set in 2009-2012 was in the \$148 to \$164 range. These contracts are due to expire in the near-term.

As enrichers have minimal operational cost related to underfeeding, they tend to be price-takers and are happy to sell on the spot market for whatever price they can get.

Therefore, while enrichers can continue to deliver against their high-priced legacy contracts, they can still afford to sell excess material into what is an increasing lower spot price. Their average price received still likely to be high enough cover their costs.

These actions have placed downward pressure on the SWU price and the uranium price.

Many long-term contracts for enrichers end around 2019 to 2021.



It is reasonable to think some excess enrichment capacity will be removed, reducing underfeeding and EUP stocks.

The US/Russian Megatons to Megawatts program, which converted The US/Russian Megatons to Megawatts program, which converted 2013.



In February 1993, the Russian Federation and the United States signed a 20-year, government-to-government agreement for the conversion of 500 metric tons of Russian highly enriched uranium from nuclear warheads to low-enriched uranium to fuel U.S. nuclear reactors. The agreement became known as the megatons to Megawatts program.

Over the life of the program, the low-enriched uranium produced under the agreement provided about one-third of the enrichment services needed to fabricate fuel for U.S. nuclear reactors. The program ended December 2013.

Under the agreement, the United States formed the United States Enrichment Corporation (USEC), a government-owned corporation (privatized in 1998), and the Russian Federation designated Tenex to implement the program. The terms of the agreement required that Russian highly enriched uranium be diluted, known as down blending, to become low-enriched uranium in Russia and then shipped to the United States.

Low-enriched uranium is used to fabricate fuel for U.S. reactors. Once the United States receives the low-enriched uranium, Russia was paid for the work that was required to dilute or down blend the highly-enriched uranium to low-enriched uranium, which is measured in separative work units (SWU). Russia also received an equal amount of natural (unenriched) uranium.

The first shipment of low-enriched uranium under the Megatons to Megawatts program was made in 1995. Almost all U.S. reactors have used some fuel originating from this program. The program converted 475.2 metric tons of highly enriched uranium into 13,723 metric tons of low-enriched uranium.

However, the impact of the excess supply on the market from the cessation of this program has been delayed.

A Change in DOE Guidelines in 2013.

In 2013, The Obama Administration changed two historical Department of Energy guidelines that restricted uranium sales from the Department of Energy's own reserves.

Historically the DOE had two guidelines regarding uranium sales; 1) DOE sales would not exceed 10% of the total annual fuel requirements of all US nuclear plants and 2) The DOE sales of uranium to the nuclear utilities would not occur at a price below that of a domestic uranium producers cost of production.

The DOE is now selling uranium and conversion inventories via barter transactions to fund decontamination and decommissioning operations for defunct enrichment facilities, which previously supplied defense and later utility enrichment services.

The barter transactions are contributing to extreme downward pressure on uranium and conversion market prices by effectively dumping the excess uranium material inventory into the market at prices below production costs. The amount of uranium from barter transactions is well more than current domestic production levels.

With the May, 2014 Secretarial Determination, the DOE began to transfer 2,705 Metric Tons of Uranium, about 6 million pounds, into the market annually, an amount greater than 10% of the total annual fuel requirements of domestic U.S. reactors. And at prices much lower than a U.S. miners cost of production.

So, the DOE has been selling the reserves into an already over supplied market - thereby pressuring the market. The

unintended consequence of the Administration's policy change has been a declining spot market price. This has hurt uranium producers worldwide as well, including American producers.

A recently introduced U.S Senate Bill, 512, introduced by Wyoming Republican Senator John Barrasso, is intended to streamline regulation and address excess inventories sold into the market. The bill wants a cap of 2,100 metric tonnes (4.6 million pounds). It's a start. We believe newly appointed Secretary of Energy Rick Perry is pro-nuclear power. We wouldn't be surprised to see the sales of US inventories halted altogether or dramatically reduced. It is believed the spot price impact from US sales is \$3-\$5 per pound.

Secondary supply pressures should begin to ease in the near-term.

As Japan begins to come back on line and enrichment underfeeding begins to dissipate as their long-term contracts roll off, we expect a more level playing field to unfold in the supply/demand equation. But only for a while.

This means that more primary production will be needed from uranium mines. And there is simply a shortage of new mine production coming on line.

Mine closures and production shut-ins could lead to a high single-digit, low double digit percentage shortage of uranium requirements needed to fuel the world's nuclear power fleet.

We estimate approximately 10% of total supply required over the next decade will need to come from new mines that are not yet in development. And it takes that long to get a mine going from permitting to production.



Bear Case

The other side of the equation, the downside: Worldwide economic growth is very slow and doesn't seem to be making any upturns.

Secondly, one consequence of high energy prices of all types in the last decade has been that there is increasing efficiency in energy production and in energy use in a lot of energy-intensive industries. This has reduced demand for uranium.

The third issue revolves around the whole political and social concern, which is the fact that uranium is a pariah. And increasingly, the places that can afford to [avoid nuclear energy] won't make the decision based on technology or economics. Rather, they'll make the decision based on politics and social preference.

Cheaper alternatives. The primary suggestion here is that other forms of alternative energy, wind and solar specifically, will back nuclear out of the equation.

Another risk to nuclear is how much cheaper natural gas and coal are than they used to be. And how much more energy-efficient big industrial users of electricity are. LNG has fallen by 60% in nominal terms and more in real terms.

They understand in the Emirates and in Saudi Arabia that reducing the domestic demand for natural gas for power generation allows them to use that same natural gas for exports as LNG, or as feed-stock for fertilizer or chemical production.

In other words, the highest and best use of natural gas, ironically, in areas where they have a lot of it, isn't to generate electricity but to substitute nuclear power and use that natural gas for higher and better uses.

Underfeeding – as discussed above. The reduced demand for enrichment services has left enrichers with excess capacity in their capital-intensive plants. Low incremental production costs and technical considerations incentivized the enrichers to separate more of U235 isotope out of the natural uranium (underfeed), effectively providing another increase in uranium supply.

APPENDIX

Background Information on Uranium Pricing

Uranium Pricing 101 - Focus on the Long-Term Price

Spot Price vs. Long-Term Price

Unlike other many other commodities, uranium does not trade on an open market. Buyers and sellers negotiate contracts privately. To aid in determining contract prices, these market participants refer to prices that are published by independent industry consultants including The Ux Consulting Company LLC (“UxC”) and TradeTech LLC.

Depending on the conditions of the transaction, contracts will typically be priced or quoted in reference to either the “spot price” or the “long-term” price.

Spot Price is the price of uranium oxide in concentrates (“U3O8”) that is available for purchase and delivery today, or sometime in the immediate to near future.

Sellers of spot priced material are often industry traders or uranium producers looking to offload minimal amounts of otherwise uncommitted production.

In most cases, uranium producers will have long-term supply contracts or off-take agreements, with utilities to supply the utility with uranium for up to 7-10 years in most cases.

If the producer at any given time produces more uranium than required by its contractual agreements, the producer may opt to sell the excess uranium into the spot market.

Buyers in the spot market also consist of industry traders and electric utility companies that operate nuclear power plants.





Utilities primarily purchase material in the long-term market but will enter the spot market to cushion or maintain inventory levels when necessary or to be opportunistic when prices are low.

Long-Term Price, in general terms, describes the price for uranium under a long-term supply contract that involves the delivery of significant quantities of material over a multi-year period at various pre-determined dates in the future.

Future deliveries typically occur over several years (7-10 years) and often begin 2-3 years from the date of the agreement.

Electric utilities use these long-term contracts to secure a long-term supply of fuel that is necessary to operate their nuclear power plants into the future.

These contracts can be complex and often have variable elements, as well as price ceilings and price floors.

Sellers in the long-term market primarily consist of uranium mining companies that operate or have an interest in one or several uranium mines and benefit from having a degree of price certainty for the long-term economics of their mining operation(s).

Buyers of long-term priced material consist of electric utilities that operate nuclear power plants, and various global government entities that may wish to build strategic uranium inventories to ensure a long-term supply of fuel for nuclear power plants operated as part of a nationalized power grid.

Historically, the long-term price has normally been quoted at a higher price than the spot price. This is because buyers, electric utilities, are willing to pay a premium for the security of future supply.

The premium pricing also considers the time value of money. Between the years of 2006 and 2016, the spot priced averaged a 17% discount to the long-term price.

The exception to this norm is when long-term contracting buys up much of the uranium supply in the market. In this circumstance, the uranium available in the spot-market may be priced at a premium (see 2006-2007) to reflect the scarcity of the material and the importance of securing the material (at any cost) to the electric utility companies that are short of long-term supplies.

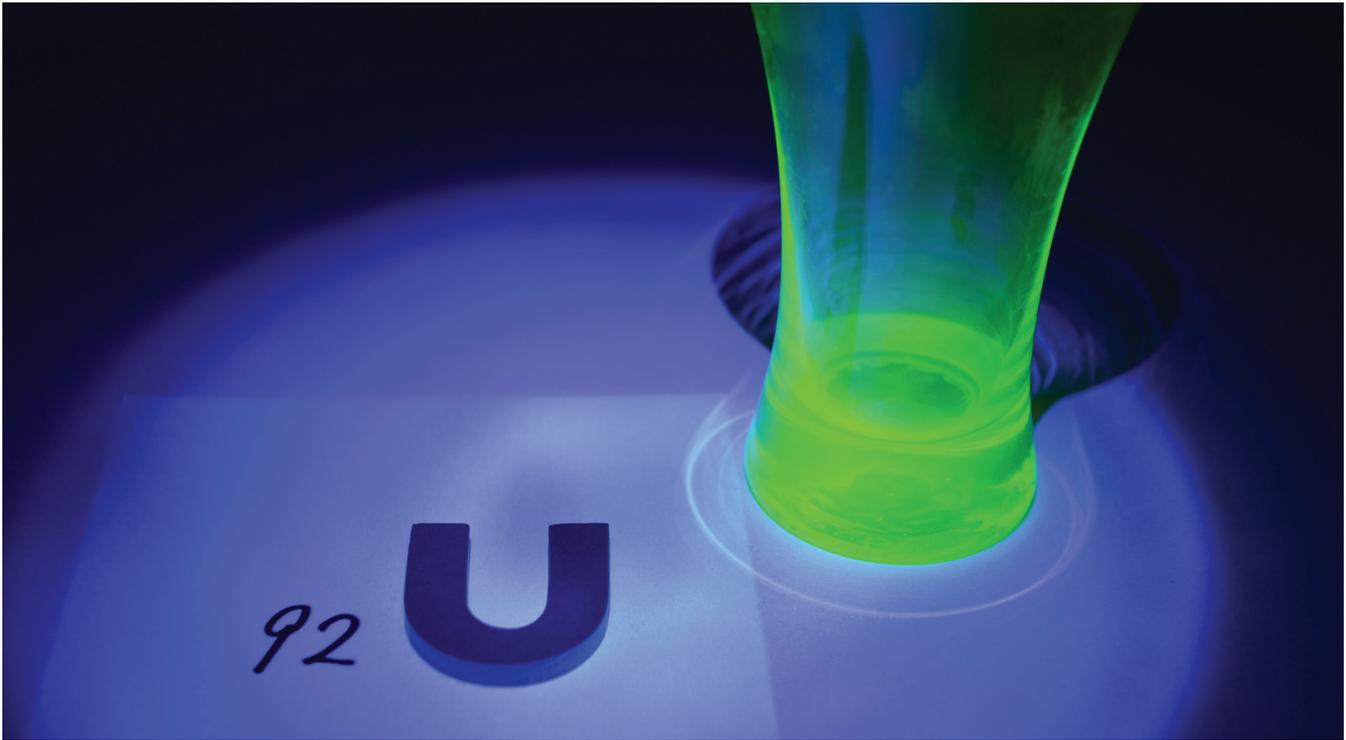
“Real” price of Uranium- the Long-Term Market

Having a spot price and long-term price quoted at the same time is somewhat unique to uranium, and often investors will ask “how do I know what the ‘real’ price of uranium is when there is such a difference between the spot and long term price?”

Arguably, the most relevant price of uranium is the long-term price, for two important reasons:

1. The volume of material bought and sold in the uranium market is considerably higher in the long-term market than the short-term market.

If we look at 2015, UxC reported that there were 80 million lbs. uranium transacted on the long-term market, as opposed to 49 million lbs. Uranium transacted on the spot market.



Looking back over the last ten years 2005 - 2015, 1.48 billion pounds were transacted in the long-term market (148 million lbs. uranium on average per year) versus 434 million pounds in the spot market (43 million lbs. uranium on average per year). Meaning, volumes normalize at around 77% in the long-term market and 23% in the spot market.

If you were to compute a volume weighted average based on these measures, the long-term price would weigh over 3 times as much as the spot price in arriving at the weighted average price of uranium.

2. The supply of uranium from primary sources of production (miners), even into the spot market, relies on the long-term price. Because uranium producers primarily sell their uranium into long-term contracts using the long-term price, the spot price can (at times) become irrelevant to production revenues and/or production decisions.

Investors also wonder why the demand from utilities is so much larger in the long-term market compared to the spot market.

For utilities, the security of a long-term supply of uranium is often their top priority.

Without uranium, utilities would not be able to power their multibillion dollar fleets of nuclear power plants.

To secure supplies for many years into the future, utilities typically purchase their uranium using long-term contracts, rather than sporadically purchase spot material that may or may not be available in the market in future years.

With utilities often competing for sources of reliable long-term supply, the long-term market is arguably the market where true price discovery occurs, and the spot market is where discretionary buying takes place.

This suggests the importance of the long-term price when trying to determine the “real” price of uranium.

Taken together, while the spot price of uranium is often what investors and the media will look to first, the long-term price of uranium is often what drives the decisions of the uranium market and the current uranium producers.

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