INDUSTRY/STRATEGY //URANIUM

STORMCROW

The Renaissance is Upon Us

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- **Hope Springs Eternal** – We've been hearing about how uranium prices are about to soar for years. In spite of a few false-starts, not much has happened, nor should it have. It is now changing, and on a long-term basis.

- **The Dawn of a New Era** – Some national governments are moving to implement serious new nuclear programs. They recognize that nuclear power is safe, affordable and necessary, especially if the world is to be weaned off fossil fuels such as coal.

- **We Need Baseload Power** - That this requires explanation is disheartening. Wind and solar are simply too unreliable to be used as primary sources of electrical power in our present grid. Unless we are willing to spend vast sums to augment the grid, requiring not only huge amounts of capital for unproven solutions but also time that we do not have to complete CO_2 emission reductions, nuclear is a necessary alternative.

- **Shortfall** – The uranium market has been in supply shortfall for several years. Users have been drawing down stockpiles that exist in various nations around the world to maintain supply to both new and existing reactors. With the reactor fleet that is now in place and under construction, that shortfall will mount. And there is a nuance, unappreciated by most, that will see prices jump much faster than a cursory analysis would suggest, providing the incentive to bring new, higher-cost supplies into the market. Investors should be preparing for a once-in-a-lifetime opportunity in this sector.

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Summary

We believe that nuclear power is an essential part of a de-carbonized future. It’s wonderful to speculate about a world containing nothing but wind turbines and solar panels that feed their generated electricity into inexpensive batteries which can supply us all with cheap power that is renewably generated. But in the context of western governments that owe their existence to votes from citizens that spend less time deciding what policies to back than what food to order at a restaurant, it is time to call this speculation what it is: a hopeless fantasy.

That doesn’t mean that climate change cannot be overcome. Greenhouse gas emissions can be seriously reduced, quickly enough to stave off the most serious effects of climate change and we can do this without crippling our economies. But we need to be realistic about the path to be followed.

Nuclear power is reliable, safe and inexpensive. While it is not 100% carbon free up and down its supply chain, neither is any other option that can be deployed over a time frame that mitigates the most harmful impacts of soaring atmospheric greenhouse gas levels. We need to stop making ‘perfect’ the enemy of ‘better’ and start acting in ways that make real differences. We know that nations such as China, Russia and India are adding substantial numbers of nuclear reactors to their generating fleets, at least some of the generated electricity off-setting output from fossil fuel-fired generating stations. But, in many cases, more rapid nuclear conversion is constrained by the likely future shortages of uranium fuel.

We wish we could say that those hypothetical fuel shortages are not a concern. Unfortunately, we have examined the demand for and supply of uranium through to 2030. Demand for uranium is one of the surest things in the resource sector; once a company has spent billions of dollars to construct a new nuclear reactor, the last thing that company wishes to do is leave it unfueled and unproductive. We know how much fuel is needed and, given the operating environment, how much fuel must be replaced each year. Supply is slightly less certain, given the vagaries and uncertainties around mining, but uranium mining is serious enough that there is less variability here than with many other commodities.

However, there is a nuance in the supply of uranium that is overlooked by some. Secondary supply is a significant component of overall uranium production per year. The sources of secondary supply include dilution of higher grade uranium (known as “downblending”), the reprocessing of spent nuclear fuel for both plutonium and useful uranium (in which case the supply is described in uranium-equivalent terms), the processing of tailings (if surplus inexpensive separation capacity exists, then the tailings from earlier enrichment efforts can be subject to additional processing to create more fuel) and the processing of natural uranium to extract even more of the useful

uranium isotope from it (again, if the surplus inexpensive separation capacity exists, a process known as “underfeeding”).

As the supply of natural uranium to meet demand grows, the amount of excess enrichment capacity will drop. So one extra tonne of natural uranium today will mean the equivalent amount of fuel-grade uranium available to be used. The additional amount of processed fuel available from one extra tonne of mined uranium in 2027, however, will be less, as separation capacity will be diverted from processing tailings or continuing to process natural uranium to leave less of the useful isotope behind. It takes less work to enrich a higher-grade feed, so it remains net positive to overall supply to process natural uranium instead of tailings, but the resulting increase in low-enriched uranium for fuel is not necessarily intuitive.

We derive market prices for uranium in the future by using a Dutch auction methodology; we look at the amount of excess supply required to keep estimated stockpiles at roughly equivalent levels, in the face of increasing demand, mine production that is unable to keep pace and declining secondary production. The cost of the marginal supplier needed to make the required amount is then multiplied by a factor we evaluate through analysis of historical data to give us an estimate of the spot price for a given future year.

What our analysis suggests is that the spot price will increase rapidly, in spite of capacity being brought back online or even expanded by the lowest-cost supplies in the space, Kazatomprom of Kazakhstan and Cameco of Canada. The industry will need new, more expensive suppliers to meet demand. We believe this is going to lead to much higher prices over a time-frame that is advanced compared to what a cursory analysis might suggest.

We believe the uranium market is one of the most interesting critical materials markets we have examined, since, perhaps, the lithium market circa 2014 or 2015. We expect spot prices for uranium to nearly double from 2020 levels by 2026, with contract prices moving even higher. There is a potential for any disruptions to cause temporary material shortages that could lead to price shocks which might be alleviated, somewhat, if stockpiles were allowed to be drawn down more quickly. However, a dangerous wildcard for the industry is the arrival of investment vehicles that make physical uranium purchases something that the average retail investor can take part in. The uranium market of 2030 won’t look much like the uranium market of 2020.

Natural uranium occurs in a number of different types of deposits and as a number of different minerals, but one constant is that natural uranium is composed of just three isotopes. Stepping back even further, an element is defined by the number of protons in its nucleus, which matches the number of electrons orbiting that nucleus. But an element might be composed of several isotopes, that is of nuclei with the same number of protons but different numbers of neutrons. It's a gross oversimplification but think of neutrons as something like the 'glue' that holds the like-charged protons in the nucleus together. So, isotopes, while having extremely similar chemical properties, can and do have extremely different nuclear properties.

So it is for uranium. The three isotopes of uranium, each of which contain 92 protons, are ^{234}U (with 142 neutrons, but occurring only in very small amounts as it is a product of a nuclear decay), ^{235}U (with 143 neutrons, at a level of 0.7% in natural uranium) and ^{238}U (with 146 neutrons, at a level of 99.3% in natural uranium). From the point of view of the nuclear industry, the interesting isotope is ^{235}U. It was discovered long ago that ^{235}U could be made to break into smaller nuclei, or fission, if its nucleus absorbed a slow-moving neutron. That fission reaction releases energy and additional neutrons. Put enough ^{235}U in a small enough space and, after some other engineering matters are dealt with, the uranium will heat up sufficiently to boil water, which is the basic principle for generating electricity from nuclear energy.

To be used in most modern nuclear power plants, types known as pressurized water reactors or boiling water reactors (PWRs or BWRs) the uranium fuel is converted to a ceramic, UO_2, that can withstand the high temperatures within the reactor without melting. The fuel is typically formed into small cylindrical "pellets" that are inserted into a (usually zirconium) metal tube known as cladding. The cladding serves to help ensure that uranium oxide doesn't dissolve into the working water around the uranium fuel. In the PWR, the entire working vessel is kept sealed and at high pressure, much as a pressure cooker being heated from the inside. The working fluid passes through a heat exchanger, to help keep radioactive elements where they should be kept, inside the reactor, and then the very hot water from the heat exchanger is flashed to steam that is used to turn a turbine and attached generator.

The fuel in these reactors must be enriched to levels of 3-5% ^{235}U. This is done by converting another uranium oxide, U_3O_8 or "yellowcake", to UF_6. Fluorine has only one isotope, so any mass difference between atoms of UF_6 is due to differences in uranium mass. The UF_6 is then processed using gaseous diffusion (an older technology) or centrifuges to separate, in stages, the lighter and interesting ^{235}U from the less interesting ^{238}U. The tails from this process are known as "depleted uranium", and the enriched UF_6 is finally converted to UO_2 form for processing into fuel.

Starting at the natural 0.7% level of ^{235}U, the more work that is done to the feed, the more ^{235}U can be recovered for use and the less is left in the depleted tailings. The industry refers to a standardized amount of conversion work as a Separation Work Unit or SWU. The enrichment process is non-linear. For example, if you wanted to take a tonne equivalent of uranium metal and process it to make 4% low-enriched uranium (LEU) with tailings containing only 0.25% ^{235}U, the result would be 122 kg of 4% ^{235}U LEU, 873 kg of tailings containing 0.25% ^{235}U and some loss. It would require 726 SWU to get the job done, at a cost for separation alone of about USD$40,000. However, if you wanted to use this same fuel in a research reactor of some kind that needs 20% high-assay enriched uranium as fuel, that same tonne equivalent of uranium metal would yield 23 kg of uranium enriched to 20% ^{235}U, about 971 kg of tailings at 0.25% ^{235}U plus some losses, but would require only 982 SWU at a cost of USD$53,000 to get the job done. This is why governments are worried about proliferation; the hard and expensive part of enriching nuclear material is the first bit.

There are, of course, reactor designs that can use uranium at natural abundances of ^{235}U as fuel, including the pressurized heavy water reactor (PHWR) models known as Canadian Deuterium-Uranium (CANDU) reactors. Most designs, however, require enriched fuel because they lose too many neutrons within the reactor to maintain the fission process unless they pack more ^{235}U nuclei into the same small space.

The industry gets most of its uranium from mining. This mining can look like a conventional open pit operation, as in Australia, an underground project conducted mostly with remotely operated equipment to help ensure miner safety, as in Canada, or something that doesn't look much like "real" mining at all, as in the *in situ* leaching of uranium in Kazakhstan. Whatever the type of mining, the net result is to produce tonnes of uranium. Throughout this report, unless otherwise noted, we will be referencing tonnes of uranium in metal form.

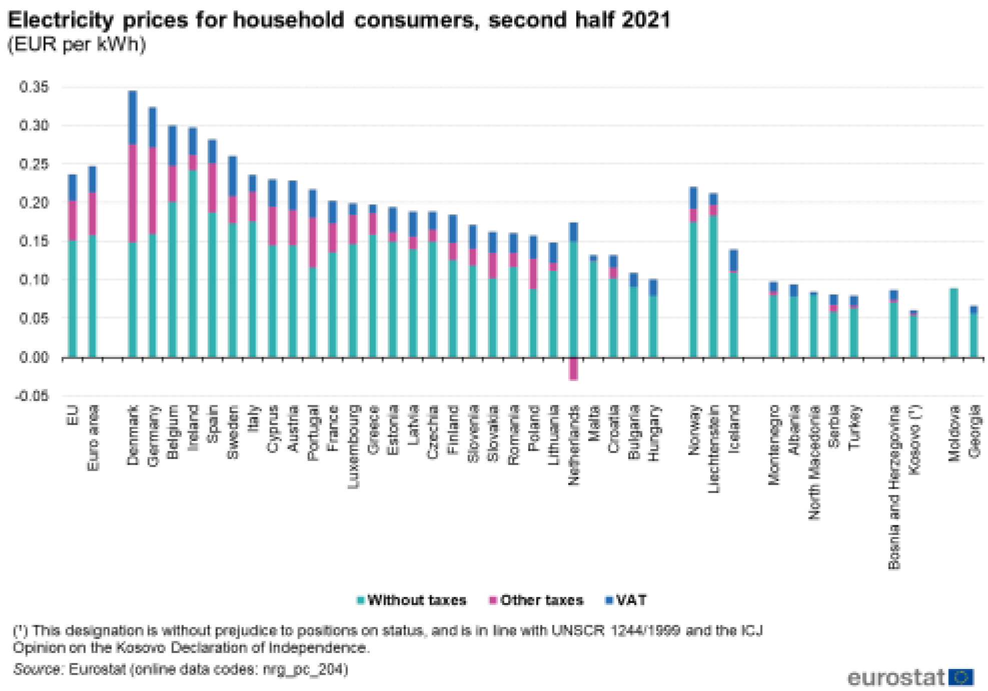
At Least No One Wears Uranium Jewelry

Unlike many other critical materials, there is really only one use for uranium. The facetious title of this section aside, having only one end-use makes modeling its future price much simpler (or, at least, it did). In this case, uranium is (almost completely) turned into fuel for use in nuclear reactors.

There is a very large nuclear reactor fleet under construction. While all the news stories from Europe are about how Germany is phasing out nuclear power and will replace it with cheap solar and wind, few news stories point out that Germany now has some of the most expensive electricity in the

European Union and that, if it weren't for French nuclear power, most Germans would be left in the dark at night, trying to read by candlelight:

Figure 1 – EU Retail Electricity Prices (H2 2021)



Source: Eurostat

Unfortunately, it is not Europe or North America that is leading the nuclear charge, but China and Russia along with India. Per capita greenhouse gas emissions from China are well below those of North American nations, but with their sizeable population China emits more man-made greenhouse gases than any other country. However, they are also doing more through the construction of new reactors to reduce future greenhouse gas emissions than any other nation. China is clearly making rational environmental improvement a priority.

Figure 2 – Current and Building Reactors, by Nation

	NUCLEAR ELECTRICITY GENERATION 2021		REACTORS OPERABLE Aug-22		REACTORS UNDER CONSTRUCTION Aug-22		REACTORS PLANNED Aug-22		REACTORS PROPOSED Aug-22		URANIUM REQUIRED 2021
	TWh	% e	No.	MWe net	No.	MWe gross	No.	MWe gross	No.	MWe gross	tonnes U
Argentina	10.2	7.2	3	1641	1	29	1	1150	2	1350	167
Armenia	1.9	25.3	1	448	0	0	0	0	1	1060	50
Bangladesh	0	0	0	0	2	2400	0	0	2	2400	0
Belarus	5.4	14.1	1	1110	1	1194	0	0	2	2400	179
Belgium	48	50.8	7	5942	0	0	0	0	0	0	790
Brazil †	13.9	2.4	2	1884	1	1405	0	0	4	4000	340
Bulgaria	15.8	34.6	2	2006	0	0	1	1000	2	2000	322
Canada	86.8	14.3	19	13,624	0	0	0	0	2	1500	1492
China	383.2	5	54	52,150	21	23,511	31	34,410	168	196,860	9563
Czech Republic	29	36.6	6	3934	0	0	1	1200	3	3600	706
Egypt	0	0	0	0	1	1200	3	3600	0	0	0
Finland	22.6	32.8	5	4394	0	0	1	1170	0	0	421
France	363.4	69	56	61,370	1	1650	0	0	0	0	8233
Germany	65.4	11.9	3	4055	0	0	0	0	0	0	521
Hungary	15.1	46.8	4	1916	0	0	2	2400	0	0	320
India	39.8	3.2	22	6795	8	6700	12	8400	28	32,000	977
Iran	3.2	1	1	915	1	1057	1	1057	5	2760	153
Japan †	61.3	7.2	33	31,679	2	2756	1	1385	8	11,562	1396
Jordan	0	0	0	0	0	0	0	0	1	100	0
Kazakhstan	0	0	0	0	0	0	0	0	2	600	0
Korea RO (South)	150.5	28	25	24,431	3	4200	0	0	2	2800	4270
Lithuania	0	0	0	0	0	0	0	0	2	2700	0
Mexico	11.6	5.3	2	1552	0	0	0	0	3	3000	226
Netherlands	3.6	3.1	1	482	0	0	0	0	2	2000	69
Pakistan	15.8	10.6	6	3256	0	0	1	1170	0	0	787
Poland	0	0	0	0	0	0	0	0	6	6000	0
Romania	10.4	18.5	2	1300	0	0	2	1440	1	720	185
Russia ‡	208.4	20	37	27,727	3	2810	25	23,525	21	20,100	5925
Saudi Arabia	0	0	0	0	0	0	0	0	16	17,000	0
Slovakia	14.6	52.3	4	1868	2	942	0	0	1	1200	359
Slovenia	5.4	36.9	1	688	0	0	0	0	1	1000	127
South Africa	12.2	6	2	1854	0	0	0	0	8	9600	277
Spain	54.2	20.8	7	7123	0	0	0	0	0	0	1221
Sweden	51.4	30.8	6	6885	0	0	0	0	0	0	914
Switzerland	18.6	28.8	4	2973	0	0	0	0	0	0	412
Thailand	0	0	0	0	0	0	0	0	2	2000	0
Turkey	0	0	0	0	4	4800	0	0	8	9500	0
Ukraine †	81.1	55	15	13,107	2	1900	0	0	7	8750	1876
UAE	10.1	7	2	2690	2	2800	0	0	0	0	907
United Kingdom	41.8	14.8	9	5883	2	3440	2	3340	10	17,000	1259
USA	771.6	19.6	92	94,718	2	2500	3	2550	18	8000	17,587
Uzbekistan	0	0	0	0	0	0	2	2400	2	2400	0
WORLD*	**2653 TWh**	**c 10.3** % e**	**437 No.**	**393,259 MWe**	**59 No.**	65,294 **MWe**	**89 No.**	**90,197 MWe**	**340 No.**	**375,962 MWe**	**62,496 tonnes U**

Source: World Nuclear Association (WNA, August 2022)

We have a good idea of how much uranium is required to refuel a reactor per year, depending on size, reactor type, reactor design and regional capacity utilization. We also accurately know how much uranium is required to initially fuel a reactor prior to startup. Through work done by the World Nuclear Association and others, we can break down uranium demand in the past, in this table back to 2010, and see that uranium demand has been on something of a roller coaster ride:

Figure 3 – Historical Uranium Demand, by Year and Nation (in tonnes uranium metal, tU)

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Nation											
Argentina	123	208	124	212	213	215	215	195	206		198
Armenia	55	63	64	86	87	88	88	77	77		77
Bangladesh	-	-	-	-	-		-	-	-		-
Belarus	-	-	-	-	-		-	-	-		701
Belgium	1,052	995	995	1,017	1,017	1,017	1,015	987	898		999
Brazil	311	318	321	321	325	326	329	321	358		325
Bulgaria	272	309	313	317	321	324	327	327	334		331
Canada	1,675	1,845	1,694	1,764	1,784	1,784	1,630	1,592	1,616		1,538
China	3,738	4,889	7,841	7,943	7,545	9,133	6,121	9,796	9,452		10,507
Czech Republic	678	591	583	574	563	566	565	649	686		665
Finland	1,149	1,152	471	1,127	480	751	1,126	494	1,066		765
France	10,153	9,254	9,254	9,320	9,927	9,230	9,211	9,502	8,739		8,936
Germany	3,453	1,934	1,934	1,889	1,889	1,889	1,689	1,480	1,381		1,264
Hungary	295	331	331	357	357	357	356	349	360		352
India	908	1,305	937	1,326	913	1,579	997	843	2,334		967
Iran	148	168	170	172	174	176	178	157	161		157
Japan	8,003	2,805	4,636	366	2,119	2,549	680	662	1,336		2,000
South Korea	3,804	4,029	3,967	4,218	5,022	5,022	5,013	4,730	4,592		4,903
Mexico	253	285	279	270	277	270	282	248	236		251
Netherlands	107	102	102	103	103	103	102	82	74		83
Pakistan	68	113	117	117	99	101	270	217	219		196
Romania	175	175	177	177	179	179	179	183	187		185
Russia	4,135	4,912	5,488	5,090	5,456	4,206	6,264	5,380	5,616		4,834
Slovakia	269	299	307	675	392	466	917	651	591		515
Slovenia	145	137	137	137	137	137	137	141	141		141
South Africa	321	304	304	305	305	305	304	279	294		283
Spain	1,458	1,379	1,355	1,357	1,274	1,274	1,271	1,275	1,217		1,290
Sweden	1,537	1,366	1,394	1,505	1,516	1,516	1,471	1,188	1,236		962
Switzerland	557	527	527	521	521	521	521	497	502		390
Turkey	-	-	-	-	-	-	-	-	-		-
Ukraine	2,031	2,288	2,348	2,352	2,359	2,366	2,251	1,944	1,890		1,893
UAE	-	-	-	-	-	-	-	-	485		966
United Kingdom	2,235	2,093	2,096	1,828	1,738	1,738	1,734	1,772	1,796		1,820
USA	19,538	18,376	19,724	19,622	18,816	18,692	18,161	18,996	19,164		19,746
Uzbekistan	-	-	-	-	-	-	-	-	-		-
Totals	68,646	62,552	67,990	65,068	65,908	66,880	63,404	65,014	67,244	67,595	68,240

Source: WNA, various

It is easy to see the impact of the German abandonment of nuclear power, general European ambivalence toward it and Chinese adoption over the span of 10 years. China has almost single-handedly dragged uranium demand back to its historical peak.

And with respect to future demand, we are able to utilize metrics for individual reactors under construction, the capacity factor demanded from similar reactors at the same or nearby sites and other metrics to determine, at least through 2030, where demand for uranium is likely to go. Simply, demand will, through to 2030, reach levels that have never been seen before:

Figure 4 - Future Uranium Demand, by Year and Nation (in tU)

Nation	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Argentina		206	206	206	206	206	206	206	206	206	206
Armenia		77	77	77	77	77	77	77	77	77	77
Bangladesh		-	-	1,200	1,500	600	600	600	600	600	600
Belarus		146	299	1,724	597	597	597	597	597	597	597
Belgium		898	898	490	-	-	-	-	-	-	-
Brazil		358	358	358	358	358	358	358	358	358	358
Bulgaria		334	334	334	334	334	334	334	334	334	334
Canada		1,409	1,142	957	1,042	840	1,025	926	920	1,005	923
China		10,814	14,293	12,172	14,415	15,006	18,236	18,952	17,523	15,648	15,648
Czech Republic		694	694	694	694	694	694	694	694	694	694
Finland		2,478	1,188	1,188	1,188	1,188	1,188	1,188	1,188	2,358	1,481
France		8,701	8,701	10,351	8,990	8,990	8,990	8,990	8,990	8,990	8,990
Germany		587	100	-	-	-	-	-	-	-	-
Hungary		360	360	360	360	360	1,560	1,800	840	840	840
India		1,080	1,780	3,920	1,760	1,760	1,760	2,760	1,960	1,960	1,960
Iran		161	161	161	1,218	347	347	347	347	347	347
Japan		2,344	2,579	3,189	3,189	5,231	6,571	6,841	6,841	6,841	6,841
South Korea		5,121	6,521	8,231	7,450	6,360	6,360	6,360	6,360	6,360	6,360
Mexico		239	239	239	239	239	239	239	239	239	239
Netherlands		74	74	74	74	74	74	74	-	-	-
Pakistan		636	636	636	636	636	636	636	636	636	636
Romania		187	187	187	187	187	187	187	187	187	187
Russia		6,227	6,222	6,014	5,805	5,595	5,895	6,814	7,977	9,582	11,693
Slovakia		428	428	899	538	538	1,738	817	817	817	817
Slovenia		141	141	141	141	141	141	141	141	141	141
South Africa		294	294	294	294	294	294	294	294	294	294
Spain		1,217	1,217	1,217	1,217	1,217	1,217	1,217	1,217	1,217	1,217
Sweden		985	985	985	985	985	985	985	985	985	985
Switzerland		446	446	446	446	446	446	446	446	446	446
Turkey		-	-	1,200	1,440	1,680	1,920	960	960	960	960
Ukraine		1,879	1,879	1,879	1,879	1,879	1,879	1,879	1,879	1,879	1,879
UAE		877	1,660	1,940	2,220	1,100	1,100	1,100	1,100	1,100	1,100
United Kingdom		1,820	1,422	1,422	964	964	2,684	3,035	1,666	1,666	1,168
USA		18,295	19,795	18,795	18,795	18,795	18,795	20,045	20,285	19,275	19,275
Uzbekistan		-	-	-	-	-	-	-	1,205	1,447	1,689
Totals		69,513	75,316	81,980	79,239	77,718	87,132	89,898	87,868	88,087	88,982

Source: Stormcrow, WNA Data

This tells us a substantial part of the story, that there is a prospective shortage in uranium that will come to pass if current production cannot keep pace with growing demand. What we are about to show is that the shortage is already upon us.

Primary Production – Just Not Enough

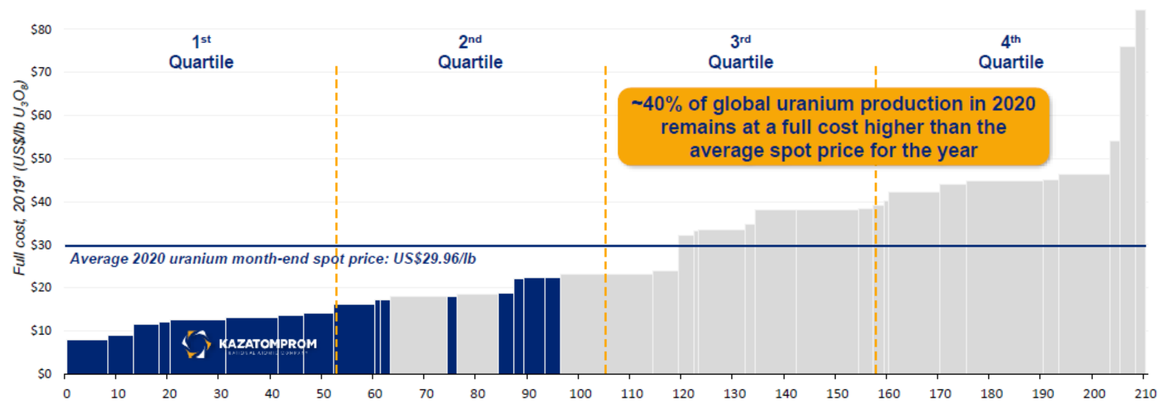
Over the last few years, the major producer in the world has been Kazatomprom. This is because the nation of Kazakhstan is home to most of the best deposits for uranium in the world (with similar but smaller deposits in nearby nations). These underground, sedimentary bodies are porous and contain relatively low-grade uranium. However, they are amenable to deploying a technology called *in situ* recovery (ISR). By drilling down to the top and bottom of these sedimentary layers, it is possible to pump in a lixiviant that will dissolve uranium as it percolates through the host rock and then cycle this fluid back to the top of the deposit until the lixiviant is saturated in uranium. The working fluid is then pumped back to the surface and processed to yield pure uranium chemicals.

By Kazatomprom's own regulatory filings, their all-in costs of production are among the lowest in the industry, approximately USD$10 per pound in the case of their best mines. The company has taken an approach of partnering with other interested parties to expand their technical capabilities and increase Kazatomprom's share of wallet within the industry. For example, Cameco is a partner in one mine and brought Kazatomprom the technologies to convert yellowcake to uranium hexafluoride for enrichment and then efficiently convert that UF_6 back to UO_2 for use as nuclear fuel. A partnership with Rosatom yielded enrichment technology. A partnership with Chinese companies has given Kazatomprom direct knowledge regarding fuel processing and fuel rod assembly. The meteoric rise of market share, directly and indirectly belonging to Kazatomprom, is impressive. And this market share has largely been gained without crushing the market price for uranium over the same period.

Cameco is the second-largest miner in the uranium world, and essentially the only other major producer with an all-in cost of production that is at levels of roughly USD$20 per pound. Cameco takes advantage of the very high-grade unconformity deposits in Saskatchewan, mining ore from underground and leaching it to create a very rich feed for purification and production of yellowcake. Most of Cameco's underground mining utilizes remote mining equipment in order to protect workers from excessive radiation exposure. Indeed, Cameco has become an industry leader in remote mining, as a result.

Beyond these two firms, the effective cost of production rises quickly. From Kazatomprom's financial disclosures:

Figure 5 – All-In Cost of Production of Uranium Mines, by Production (in millions of pounds)



Source: Kazatomprom Presentation (2020)

What is clear from the above chart is that once maximum production from Kazatomprom and Cameco (along with a select few other low-cost mines) are exceeded, and both have curtailed production in recent years to support the market price, spot price must rise dramatically to bring enough production into the market to avoid disastrous shortages. Note that in recent years, global mined uranium production has not been particularly good at meeting demand:

Figure 6 – Historical Primary Uranium Production, by Year and Nation (in tU)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Argentina	-	-	-	-	-	-	-	-	-	-	-
Australia	5,900	5,983	6,991	6,350	5,001	5,654	6,315	5,882	6,517	6,613	6,505
Brazil	148	265	326	192	55	40	44	-	-	-	25
Canada	9,783	9,145	8,999	9,331	9,134	13,325	14,039	13,116	7,001	6,938	8,282
China	827	885	1,500	1,500	1,500	1,616	1,616	1,885	1,885	1,885	1,921
Czech Republic	254	229	228	215	193	155	138	-	-	-	2
Finland	-	-	-	-	-	-	-	-	-	-	-
France	7	6	3	5	3	2	-	-	-	-	-
Germany	8	51	50	27	33	-	-	-	-	-	-
India	400	400	385	385	385	385	385	421	423	308	323
Iran	-	-	-	-	-	38	-	40	71	71	73
Kazakhstan	17,803	19,451	21,317	22,451	23,127	23,607	24,586	23,321	21,705	22,808	23,507
Malawi	670	846	1,101	1,132	369	-	-	-	-	-	-
Mongolia	-	-	-	-	-	-	-	-	-	-	-
Namibia	4,496	3,258	4,495	4,323	3,255	2,993	3,654	4,224	5,525	5,476	5,730
Niger	4,198	4,351	4,667	4,518	4,057	4,116	3,479	3,449	2,911	2,983	2,986
Pakistan	45	45	45	45	45	45	45	45	45	45	45
Romania	77	77	90	77	77	77	50	-	-	-	-
Russia	3,562	2,993	2,872	3,135	2,990	3,055	3,004	2,917	2,904	2,911	2,959
South Africa	583	582	465	531	573	393	490	308	346	346	355
Ukraine	850	890	960	922	926	1,200	1,005	550	1,180	801	834
USA	1,660	1,537	1,596	1,792	1,919	1,256	1,125	940	582	67	139
Uzbekistan	2,400	2,500	2,400	2,400	2,400	2,385	2,404	2,404	2,404	3,500	3,500
Totals	53,671	53,494	58,490	59,331	56,042	60,342	62,379	59,502	53,499	54,752	57,185
% World Demand	84%	87%	94%	91%	85%	98%	96%	93%	80%	81%	

Source: WNA

While demand has risen, production from both Kazatomprom and Cameco has been curtailed to support the market price. The extra uranium needed for use in reactors has been made up by some secondary production as well as drawing down stockpiles.

The interesting thing about primary uranium supplies is that, even with Cameco and Kazatomprom producing at their maximum rates, primary supply is currently, and increasingly, insufficient. Nations such as the United States and China established uranium stockpiles to provide for supply in the event of disruption, not to keep prices low. It is difficult to understand how prices will not rise given the likely projections regarding mine output through to 2030:

Figure 7 – Projected Primary Uranium Supply, by Year and Nation (in tonnes uranium metal, tU)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Argentina	-	-	-	-	-	-	-	-	-	-
Australia	6,397	6,289	6,181	6,073	5,965	5,974	5,983	5,991	6,000	6,009
Brazil	50	75	100	125	150	180	210	240	270	300
Canada	9,625	10,969	12,313	13,656	15,000	15,770	16,540	17,310	18,080	18,850
China	1,957	1,993	2,028	2,064	2,100	2,100	2,100	2,100	2,100	2,100
Czech Republic	3	5	7	8	10	12	14	16	18	20
Finland	-	-	-	-	-	50	100	150	200	250
France	-	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-	-	-	-
India	339	354	369	385	400	520	640	760	880	1,000
Iran	74	76	77	79	80	80	80	80	80	80
Kazakhstan	24,205	24,904	25,603	26,301	27,000	26,200	25,400	24,600	23,800	23,000
Malawi	-	-	-	-	-	-	-	-	-	-
Mongolia	-	-	-	-	-	30	60	90	120	150
Namibia	5,984	6,238	6,492	6,746	7,000	7,040	7,080	7,120	7,160	7,200
Niger	2,989	2,992	2,994	2,997	3,000	3,200	3,400	3,600	3,800	4,000
Pakistan	45	45	45	45	45	45	45	45	45	45
Romania	-	-	-	-	-	-	-	-	-	-
Russia	3,007	3,056	3,104	3,152	3,200	3,220	3,240	3,260	3,280	3,300
South Africa	364	373	382	391	400	420	440	460	480	500
Ukraine	867	901	934	967	1,000	1,100	1,200	1,300	1,400	1,500
USA	211	284	356	428	500	600	700	800	900	1,000
Uzbekistan	3,500	3,500	3,500	3,500	3,500	3,400	3,300	3,200	3,100	3,000
Totals	59,618	62,051	64,484	66,917	69,350	69,941	70,532	71,122	71,713	72,304

Source: WNA, Stormcrow

We must still evaluate the supply of secondary sources of uranium (or its equivalent) to the market. However, there is a subtlety to this market that is likely unappreciated by many. And the result is a more rapid development of the gap between supply and demand than might otherwise be expected.

Secondary Production – Robbing Peter to Pay Paul

There are three major sources of secondary production of nuclear fuel, material that can be considered as a uranium equivalent if not actual uranium. These will behave very differently as the market evolves.

In the past, "downblending" was a source of fuel. High-enriched uranium (HEU), that was either used as the core of a nuclear weapon or stockpiled for eventual use as such, was re-purposed and blended with purified natural uranium to make LEU. However, the programs conducted by Russia and the United States to shrink their nuclear arsenals have come to an end, and the amount of LEU from these downblending programs has essentially dropped to zero.

An ongoing source for secondary uranium or its equivalent is the reprocessing of spent fuel. LEU that has spent time in a reactor has undergone intense neutron bombardment, and the level of ^{235}U in the fuel has been reduced sufficiently that the fuel must (eventually) be replaced. However, there are still substantial amounts of ^{235}U in the "spent" fuel, as well as useful isotopes created by its presence in a reactor such as ^{239}Pu (created by neutron absorption and subsequent decay of ^{238}U, which makes up the bulk of LEU). Both useful uranium and plutonium can be extracted from spent fuel, processed and reused as part of new fuel for a reactor.

The other two sources of secondary production are related and slightly more complicated. Both relate to the availability of enrichment capacity and feedstock. With the curtailment of production but a substantial excess of enrichment capacity in some areas of the world, if that enrichment capacity is inexpensive enough then more LEU can be produced from some sources than would be expected.

LEU can be made by continuing to process the tailings from an initial enrichment effort. Natural uranium is about 0.7% ^{235}U. The economically optimal end-point for processing uranium is dictated by prices and costs, but has historically resulted in tailings of 0.2% to 0.4% ^{235}U. If a processor is unable to obtain additional natural uranium because, say, the two largest miners in the world have limited their production of natural uranium, and that processor still has available enrichment capacity then they might choose to take low-grade tailings and continue to process that waste to create an even lower-grade waste plus some additional LEU for sale.

The second possibility is to simply continue applying more enrichment cycles to the natural uranium in the plant. This results in, essentially, the same thing as the processing of tailings, above. That is to say, for a given amount of natural uranium fed into the plant, more LEU is produced than would be economically optimal and the tailings leaving the plant are lower in ^{235}U than would normally be expected. This practice is known as "underfeeding",

feeding in less natural uranium than would be economically optimal to produce a given amount of LEU.

And this leads us to an issue. Production of uranium-equivalent from spent fuel is not likely to change markedly through to 2030. Those doing this sort of reprocessing have dedicated chemical equipment to make it happen, and higher prices owing to higher demand and constrained supply of uranium will make the production of a uranium-equivalent from spent fuel more viable, not less. Unfortunately, at least for a time, there won't be any wildly larger amount of spent fuel to reprocess. So, the problem really becomes one of robbing Peter to pay Paul, when we consider either the processing of tailings or underfeeding.

As uranium demand rises, Cameco, Kazatomprom and other miners will increase their production. It is more lucrative for a fuel processor to enrich natural uranium at 0.7% ^{235}U than to process tailings containing 0.25% ^{235}U. As those SWUs are applied to processing natural uranium, we make more LEU. But we lose the amount that was being produced by those same SWUs that were previously applied to the processing of tailings or underfeeding. The result will be, barring these firms adding substantial enrichment capacity, that more mine production will result in more LEU being available to the nuclear uranium industry but not nearly as much LEU as might be expected if one simply looks at current primary uranium production and the output of LEU today.

As a concrete example, let's say 5,000 tonnes of 4% LEU are produced by the processing of 0.3% tailings, reducing the resulting tailings to 0.2%. This would require 64,394,767 SWU to complete. But if we had enough natural uranium, we can make 11,959 t of 4% LEU using the same number of SWU by processing the natural material down to 0.3% tailings. This is because, again, the higher the grade of the feed, the easier the enrichment is to complete. So, we do gain in the total amount of LEU available for sale, but by 6,959 tU, not the full 11,959 tU.

The Wildcard – Uranium as an Investment Metal

One of our deepest concerns for the uranium market, and it will be a very significant driver of spot prices as well as how quickly national stockpiles are depleted, is the transition we are seeing to uranium as an investment metal. In the past, we've joked that at least no one wears uranium jewelry. Unlike other industrial metals like platinum or silver, uranium has a single use. Unfortunately, like other materials such as the rare earths and lithium, there has been a concerted push to turn these metals and their volatile pricing into a source of investment profit.

Indeed, this would not be a first for uranium either. It's well documented that the price peaks reached by uranium prices in 2007, roughly USD$137 per pound, were achieved for a variety of reasons. Among those reasons was the realization by groups of investors that, as long as the uranium was stored in appropriately licensed facilities, just about anyone can buy some physical uranium. Fortunately, these buyers were investors in a simple profit-making trade, so when uranium prices looked to peak, the investors sold the material they held, realizing their profit and bringing prices back inline.

The current situation may be different. Retail investors have started to decide that they should be able to cash in on critical material volatility. But Cameco, for example, is not going to sell and hold 100 pounds of uranium for a retail investor, and a retail investor is not going to take the time and expense to not only verify the provenance and authenticity of some yellowcake but also find and rent an appropriate licensed and insured facility to store it.

Enter the physical uranium trust. While an institutional investor might buy physical uranium and sell it when they achieve a target return or when they need to make repayments to their source of capital, the physical trusts are being supplied with surplus capital from institutional and retail investors. There is no repayment schedule to be concerned with and, in the case of retail investors, nothing but greed driving their sales.

A physical trust is obligated to hold some fraction of their assets under management in the form of a commodity. In many cases, they effectively hold 100% in the commodity form. If $50 comes in from a retail investor and uranium costs $50/lb., the trust buys another pound and puts it in storage, issuing a certificate for one pound (or some number of 'units', or whatever else) to the investor. If uranium reaches $100/lb., that investor can redeem their pound/units/whatever for $100 when the trust sells a pound of material (less fees and the like). The point of all this being that, once the pound is purchased by the trust before or during a long bull market price run for uranium, it is very unlikely to leave. And it doesn't matter if a power company, crying for a couple of tonnes of uranium to help refuel their reactor, shows up and makes the physical trust a crazy offer for physical material. A traditional trust CANNOT sell their pounds into the market without a unit holder being willing to liquidate their holding.

In fact, it's likely worse than we've described. A power company absolutely requiring material will likely need to make higher and higher bids in the spot market and, as is the mechanism of investment metals, encourage even more retail buyers to enter the trust as uranium prices continue to soar. It's Bitcoin in its heyday, except that uranium is actually required by our society to produce reliable and inexpensive electricity. Without it, we will be left burning coal or natural gas and making even higher levels of carbon dioxide.

Let's look at the Sprott Physical Uranium Trust as just one example, albeit presently the largest. Sprott acquired what was Uranium Participation Corp. (UPC) in May of 2021. At that time, UPC held 16,269,658 pounds of U_3O_8 and another 300,000 kg (in uranium metal terms) in the form of UF_6. By December 31, 2021, Sprott Physical Uranium Trust held 41,280,707 pounds of U_3O_8. As of 3 August, 2022, the Trust holds 57,269,000 pounds of U_3O_8. In roughly 14 months, the Sprott Physical Uranium Trust purchased 40,219,000 pounds of U_3O_8, or 15,470 tonnes U metal. At an annualized rate of buying of 13,260 tonnes U metal, Sprott is the third largest buyer in the world behind only the nations of the United States of America and (barely) the People's Republic of China.

Investment vehicles such as physical uranium trusts ARE that feared "uranium as jewelry" investment path. These sorts of investment vehicles already represent a significant uranium demand, one that is likely to increase over the next few years and accelerate even more as prices rise. And this is likely to be a very significant source of spot price increases for uranium, if not volatility, as well.

The Balance – Stockpiles Will Fall, How Low Will They Go?

Without further ado, we believe the appropriate (recent, post the conclusion of the "Megatons to Megawatts" program involving Russia and the USA) historical data regarding demand and both primary and secondary production are:

<u>Figure 8</u> – Historical and Projected Balance (all figures in tU)

Year	**2018**	**2019**	**2020**	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Mine Production	53,499	54,752	57,185	59,618	62,051	64,484	66,917	69,350	69,941	70,532	71,122	71,713	72,304
Reactor Consumption	67,244	67,595	68,240	69,513	75,316	81,980	79,239	77,718	87,132	89,898	87,868	88,087	88,982
Est. Investment Consumption	4,000	6,000	8,000	10,000	13,000	19,000	9,000	18,000	22,000	20,000	15,000	15,000	25,000
Reprocessed Fuel (tU equiv.)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Re-Enriched Depleted Uranium	2,000	2,000	2,000	1,800	1,599	1,399	1,198	998	949	901	852	804	755
Underfeeding	7,000	7,000	6,000	5,399	4,798	4,197	3,595	2,994	2,848	2,702	2,557	2,411	2,265
Total Global Stocks	279,000	271,157	262,102	251,405	233,538	204,638	190,110	169,735	136,342	102,578	76,241	50,081	13,423

Source: WNA, IAEA, Stormcrow

Through last year, it has been possible, through a combination of primary and secondary supply, to maintain global stockpiles at roughly constant levels. As of this year, however, stockpiles begin to meaningfully decline. It is possible that global authorities will allow those stockpiles to deplete even more quickly, restricting price increases, but we would argue that this would be counterproductive. If national authorities move to subsidize the uranium price by delivering from stockpile, lower prices will cause an even slower supply response and stockpiles could be drawn down to critical levels.

In broad terms, what we see is that, in 2021, the overall market is in rough balance, assuming that physical stockpiling such as that being done by Sprott and potentially others does not continue to exacerbate an already tight supply situation. Demand exceeds the combination of primary and secondary supplies by only about 700 tU. But by 2030, in spite of primary mine production increasing by nearly 13,000 tU per year compared to 2021, demand will exceed all supply by nearly 12,000 tU. This is driven by higher demand and augmented by a drop in secondary production from 9,199 tU in 2021 to only 5,020 tU in 2030.

Put another way, in spite of mine production likely increasing by 12,686 tU between 2021 and 2030, the actual supply of LEU in tU will only increase by the equivalent of 8,507 tU. Yes, the supply of LEU increased significantly, but not nearly as much as pure mining output would suggest. That additional 4,179 tU shortfall results in more aggressive movement in price.

Now, what is very difficult to project is whether firms enriching uranium will choose to add substantial amounts of enrichment capacity if prices rise, to continue underfeeding and tailings processing. We believe this will not occur immediately. First, it has been a generation since the nuclear industry was in a position of essentially unbridled growth in demand, so companies are out of practice in terms of thinking about spending on enrichment capacity. Second, the growth in demand for LEU is being driven in China, and western firms must come to terms with whether or not that demand for processing capacity will be satisfied by Chinese firms that will import non-Chinese feed, as is true for many other commodities, or whether it will be satisfied by non-Chinese LEU imports, or a combination of both. This will not be a decision made in haste.

Price Forecasting – Remember, the Cure for Low Prices is Low Prices (Unless You Can't Make More)

Low prices in a mining sector result in diminished exploration and delayed development. That has certainly happened in uranium. If demand eventually picks up, the result could be a rapid, borderline catastrophic, increase in pricing. In many of the other industries that Stormcrow studies, junior companies and some participants in the space dream about shortages and high prices. Many of these markets resemble the uranium market, in that the market is relatively small and relatively concentrated among just a few suppliers. But the difference between most of these markets compared to uranium is that very few have such an extreme cost of production disparity between the best producing mines in the sector and others. And few other sectors can weather spikes in prices.

For example, the lithium sector has seen boom and bust and boom, again. There is no shortage of lithium in the world. The best producer in the lithium industry might have a cost of $3,000 a tonne to produce, the worst will be no more than $6,000 a tonne, for material that sells for many times the highest costs in the industry, at least during a boom. There is no doubt for lithium that, given enough time, the supply side will react to high prices.

The uranium industry is different. The best producer in the space, Kazatomprom, is somewhat unique in that it operates out of a set of mines that are geological oddities with the ability to apply *in-situ* recovery, allowing very low all-in production costs of roughly USD$10 per pound of produced uranium. The second-best producer, Cameco, also operates out of mines that are geological oddities with an extremely high grade, allowing for all-in production costs of roughly USD$20 per pound. Beyond a sprinkling of by-product production and other geological oddities that also come with similarly low all-in cost, the costs of uranium from other mines rapidly rises through USD$40 per pound (see Figure 4, above).

It is often noted how low spot prices are compared to the global production cost, but it should also be noted that, in 2020, data from the US Energy Information Administration tells us that only 24% of the uranium purchased in the US was on a spot basis, the remaining 76% came through longer-term contracts. Uranium producers are not fools, they are not selling huge quantities of material below their production cost, and reactor owners and operators are not fools, either, they won't risk having to restrict the output from their reactors because they forgot to order fuel.

It is very important to note that the price of raw uranium, of itself, is not the defining factor in the price of electricity generated by a nuclear reactor. Of course, everyone prefers to receive their raw materials for free, but whether the price of uranium is USD$45.50 a pound or USD$100 a pound is not a deal-breaker for the operators of nuclear reactors:

<u>Figure 9</u> – The Breakdown of the Fuel Cost for Running a Nuclear Plant

Cost of Fuel...	...assumed to be USD$45.50/lb.		...asssumed to be USD$100/lb.	
	Nominal	Future	Nominal	Future
Natural Uranium	$ 12,894,000	$ 2,834,000	$ 28,338,000	$ 2,834,000
Conversion	$ 1,962,000	$ -	$ 1,962,000	$ -
Enrichment	$ 3,423,000	$ 1,424,000	$ 3,423,000	$ 1,424,000
Fuel Fabrication	$ 6,151,000	$ -	$ 6,151,000	$ -
Spent Fuel Management	$ -	$ 11,233,000	$ -	$ 11,233,000
Totals	$ 24,430,000	$ 15,491,000	$ 39,874,000	$ 15,491,000
Grand Total		$ 39,921,000		$ 55,365,000

Source: WISE Nuclear Fuel Cost Calculator

The WISE Nuclear Fuel Cost Calculator tells us that the difference in refueling a reactor requiring 109 tonnes of LEU per year is only USD$15.4 million more per year, even if uranium prices more than double from recent levels. Of course, what would be a deal-breaker is not being able to get uranium, at all, at any price.

So, on to our price projections. First, a brief description of our methodology for predicting uranium price. We hoped that, like all other commodities, we could simply find a formula based on several modeled factors, like the level of demand and the gap between demand and supply. This approach works well for various markets like lithium chemicals or fertilizers, but it fails miserably for uranium.

This failure is likely because there is so much external manipulation in the markets. When Cameco decides to shutter a mine, for example, it essentially creates a new market because production is so concentrated and so limited. That severely limits the ability of one formula to describe the market, because we have been confronted with different markets at different times. So we are forced into using another approach.

We fall back on a Dutch auction methodology. That is, we look at a global cost of production per marginal tonne for each year. By looking up the marginal cost of production for the last tonne that needed mining in that year, we can determine a multiple between marginal cost related to spot price. It is actually possible to develop a meaningful equation for that multiple, based on factors like mine production or reactor consumption for the year, and we do so based on historical data. Then, we project those variables forward, postulate what the likely marginal cost of the last mined tonne will be in a given year in the future and apply our calculated multiple to provide a spot price projection.

Note that our historical data spans the period 2010 to 2021, but we were forced to drop two years as data points from those years against our relevant variables were several standard deviations away from what was expected. You need a good reason to discard data. You shouldn't throw away data simply because it is a headache, but in this case we think we have a good reason. We dropped data points from both 2011 and 2015.

For those who follow the industry, the reasons will be obvious, but for others the explanation revolves around Japan. 2011 was the year that the Tōhoku Earthquake occurred with the subsequent Fukushima reactor catastrophe overshadowing the destruction from the earthquake, itself. The market reacted in entirely unpredictable ways when a significant portion of global demand was suddenly removed from the ledger owing to the political decision made by the Japanese government of the time to shutter all nuclear reactors. 2015 gave us the opposite. Japan announced reactor restarts and then proceeded to actually restart one of its shuttered reactors, after realizing that the continued operation of these reactors was necessary. Again, the effect on spot prices was, for a time, radically different from the normal uranium market cycle.

What we have done is derive a formula for the multiple to be applied to marginal cost for uranium in any given year, moving forward to 2030. Full disclosure, this necessarily means that the formula will be extrapolating, that is we will derive multiples of this marginal cost that are likely higher than for any year in the uranium market to date, except perhaps for 2007 and the historic price spike that occurred. This means we have a good deal less confidence in our projections than if we were interpolating results, within ranges we have seen before. But that's the nature of an extraordinary market condition, that we are a lot more likely to see extraordinary pricing. Our results are:

Figure 10 – Uranium Price Forecasts

Year	Actual 2020	Actual 2021	Est. 2022	Proj. 2023	Proj. 2024	Proj. 2025	Proj. 2026	Proj. 2027	Proj. 2028	Proj. 2029	Proj. 2030
Spot Price (USD/lb.)	$ 29	$ 32	$ 56	$ 62	$ 56	$ 68	$ 112	$ 141	$ 139	$ 140	$ 129
Reactor Use (tonnes U)	68,240	69,513	75,316	81,980	79,239	77,718	87,132	89,898	87,868	88,087	88,982
Investment and Stockpiles (tU)	8,000	10,000	13,000	19,000	9,000	18,000	22,000	20,000	15,000	15,000	25,000
Effective Consumption (tU)	76,240	79,513	88,316	100,980	88,239	95,718	109,132	109,898	102,868	103,087	113,982
Mine Prodn (tU)	68,240	69,513	75,316	81,980	79,239	77,718	87,132	89,898	87,868	88,087	88,982
Weapons Downblend (tU)	-	-	-	-	-	-	-	-	-	-	-
Re-Processed Fuel (tU equiv.)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Re-Enrichment Tailings (tU)	2,000	1,800	1,599	1,399	1,198	998	949	901	852	804	755
Underfeeding (tU)	6,000	5,399	4,798	4,197	3,595	2,994	2,848	2,702	2,557	2,411	2,265
Effective Production (tU)	78,240	78,711	83,713	89,575	86,033	83,710	92,930	95,501	93,277	93,301	94,001
Marginal All-In Cost (USD/lb.)	$ 40	$ 40	$ 45	$ 45	$ 45	$ 45	$ 55	$ 84	$ 84	$ 84	$ 84

Source: Stormcrow (2022)

We have assumed that Cameco and Kazatomprom, both, will open their floodgates and try to get maximum production from all their mines, old and new, at appropriate times. We assume other producers will do the same. This will have the effect of reducing marginal cost, and therefore our predicted spot price, in coming years. None of this will be enough. Spot prices will rise to levels, as yearly averages, that we have never seen before amid growing annual shortages of uranium. We believe spot prices will seriously rise beginning in 2026, with global average spot price for the year lurching above USD$100 for the first time, then move even higher in 2027 and beyond.

Conclusions – It's Time to Act

So why are we bothering to say this now? Financial investors, let's be blunt, don't care about much happening beyond this quarter unless a longer-term thematic can incent motion in a company's stock price today. What we are describing is still years away, so who cares? Well, utilities that rely on uranium certainly do. If more entities that use uranium see the same inevitability in this market, they may well hasten what will happen in 2026 and beyond by buying up more material into stockpiles and creating scarcity ahead of what would be driven by reactor demand, alone.

National governments, or at least a few experts within them who study matters like energy security, certainly worry about things like this. If a significant portion of electricity production in the US or China or Canada is about to get squeezed by a global shortage of the relevant fuel, then maybe it is time for these governments to make sure that doesn't happen, at least to their nation. That could well pull forward a shortage, as well.

And mining companies definitely care. Those uranium miners who can credibly compete at the future prices we suggest should be doing their best to do whatever low-cost things can be done to push their project closer to construction, right now. The days of all of us in the uranium sector talking about how this project or that project is a really great project in a great jurisdiction with a great management team, but nothing can be done until uranium hits $70 or $80 dollars, will soon be gone, precisely because the prices WILL be $70 or $80 per pound!

What will happen in this market is as inevitable as the price increases that we knew were coming by 2016 in the battery materials sector, and for many of the same reasons: the market is small, it takes a lot of time to bring new production to market, small increases in demand can have outsize effect on pricing in a small market, etc. etc. It is time for the existing producers, the juniors, the few educated investors today who can see the trend and the end-users of uranium to act.

Important Disclosures

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