Uranium: "The Atomic Gold"

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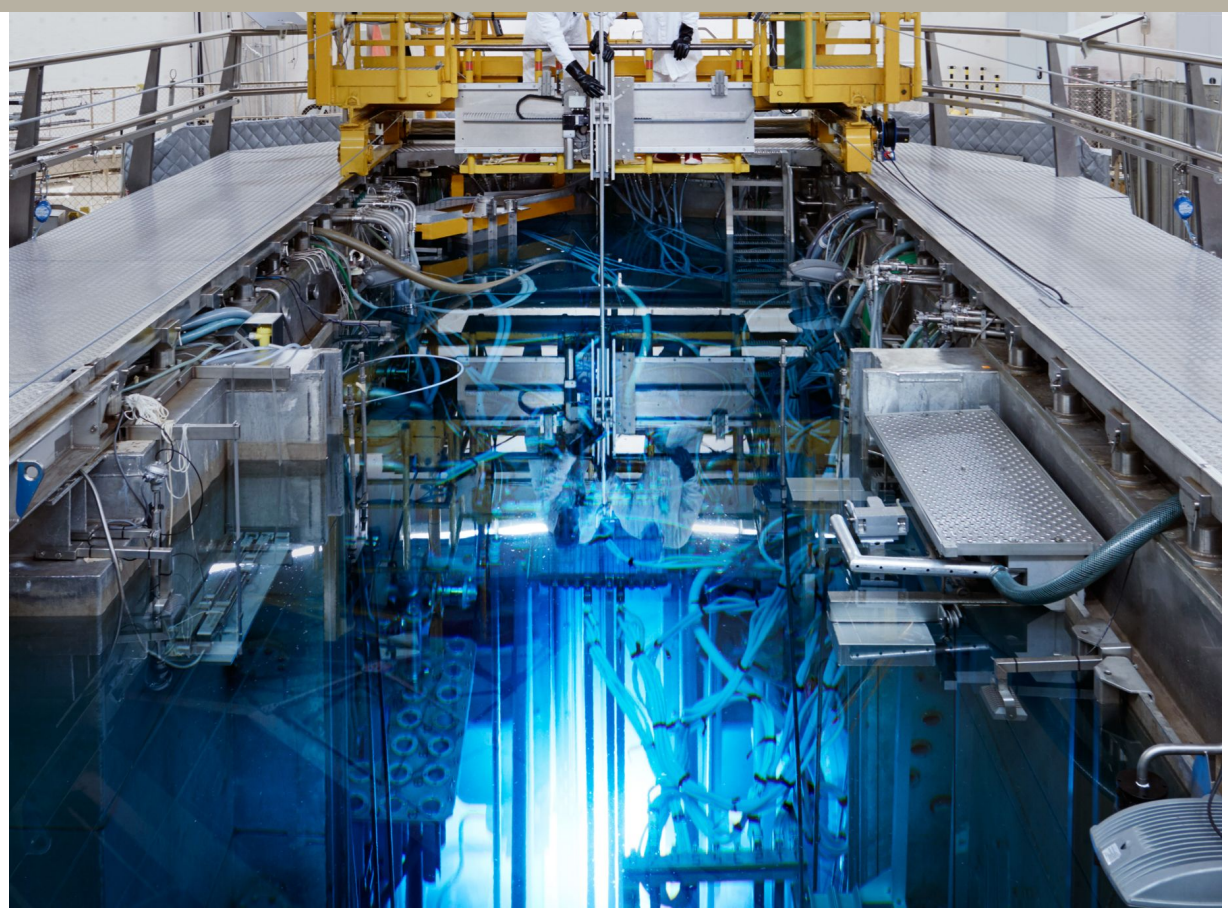
Governments all over the world seek to control the supply of uranium for its ability to generate near-limitless amounts of energy. In this blog, we will take a closer look at the various aspects of this metal, including its unique chemical properties, its commercial applications and the geopolitical factors which influence its supply.

Chemical Properties

Named after the icy planet Uranus by German chemist Martin Klaproth in 1789, uranium is one of the most famous and powerful metals known to humanity. Its radioactive properties has been harnessed to kill thousands during the second world war, but has also saved lives by being used in medical treatment. Uranium occurs naturally in most rocks, as well as in seawater (in lower concentrations) and is about 500 times more abundant than gold. It is the heaviest naturally occurring element on earth and exists as a solid at room temperature with high melting and boiling points (1135°C and 4131°C respectively)

The distinguishing feature of uranium is its high energy density (24 GWh/kg), which makes 1 kg of commercially enriched uranium equivalent to 14 tons of coal or 63 barrels of oil. This means that the energy needs of the entire world could be satisfied by less than 2 Olympic sized swimming pools filled with uranium ! The dual use nature of this metal has necessitated the oversight of regulatory bodies such as the Nuclear Energy Agency (NEA) and the International Atomic Energy Agency (IAEA) in uranium processing and supply.



History

Uranium was used by the Romans in glassware and ceramics due to its fluorescent yellow/light green glow. Scientific research throughout the early twentieth century helped uncover the radioactive properties of uranium and radium, which led to many scientists being awarded Nobel prizes for their discoveries.

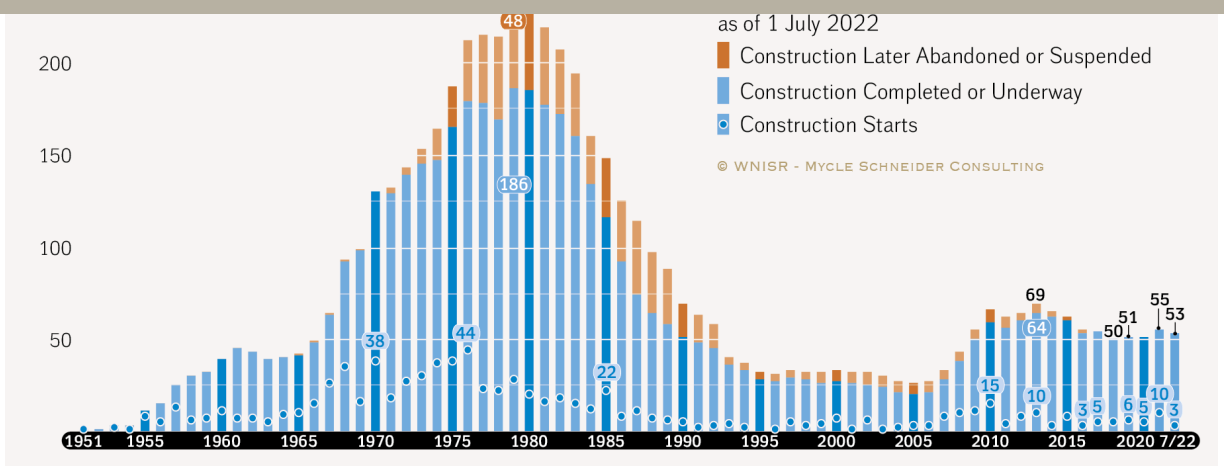
Uranium was a key component in the US efforts to develop atomic weapons in the 1940's. The success of the 'Manhattan project' helped the allied forces win the second world war and establish US as a global superpower. This ushered in the golden age of atomic energy during the 1960's, with the UN setting up international nuclear programs to encourage commercial development of nuclear energy for civilian use.

Nuclear power started losing popular support, as accidents like the 1979 Three Mile island incident (US) and the 1986 Chernobyl disaster (Soviet Russia) heightened public fears of nuclear radiation. The nuclear contamination from the Fukushima Daichi plant caused by the 2011 tsunami convinced the Japanese and German governments to phase out their nuclear programs.

Commercial Applications

The primary use of uranium is as a fuel for energy generation in nuclear reactors. A nuclear power plant works in a similar fashion as a traditional thermal power plant, with the heat released from the splitting of unstable uranium atoms used to generate steam, which moves a turbine and generates electricity. Many EU countries (France, Sweden, Finland) meet their energy needs using nuclear power, since it is a clean and reliable form of baseload energy, which does not rely on weather conditions.

The high density of uranium (1.67 times more than lead) makes it suitable for shielding people from gamma radiation and is used extensively in the medical, research and transport sectors. It is also used as a counterbalance weight in equipment such as boats and satellites for the same reason.



Mining and processing

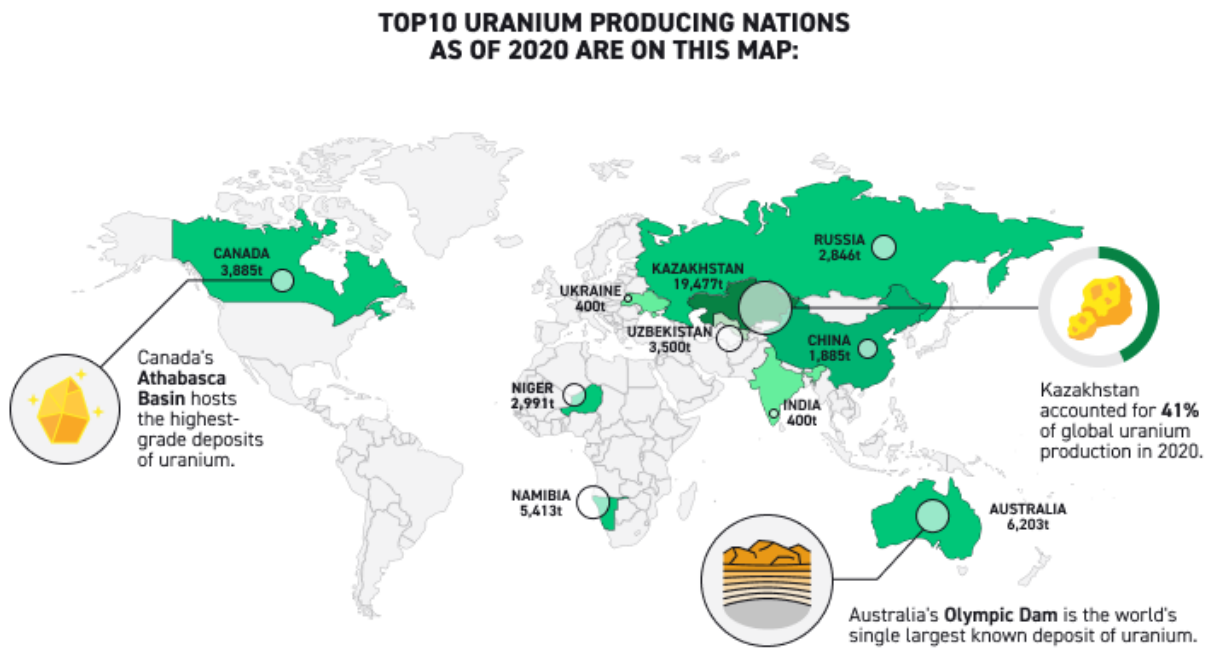
Uranium ore, similar to other metals, is obtained either by underground/open pit mining (43% of world production) or in situ leaching (57% of world production). In situ leaching consists of pumping a chemical solution down drill holes into the deposit, which is then pumped back to the surface to extract the ores from the solution. Both processes recover uranium ore concentrates in a yellow powdered form (called 'yellowcake'), which is then sent for enrichment.

Naturally occurring uranium is a combination of the U-235 isotope (0.7%) and the U-238 isotope (99.3%) which differ in their physical properties, notably their mass. This difference is exploited in the enrichment process of the ore, which increases the concentration of the fissile U-235 isotope from 0.7% to 3.5%, to be used as fuel for nuclear power plants.

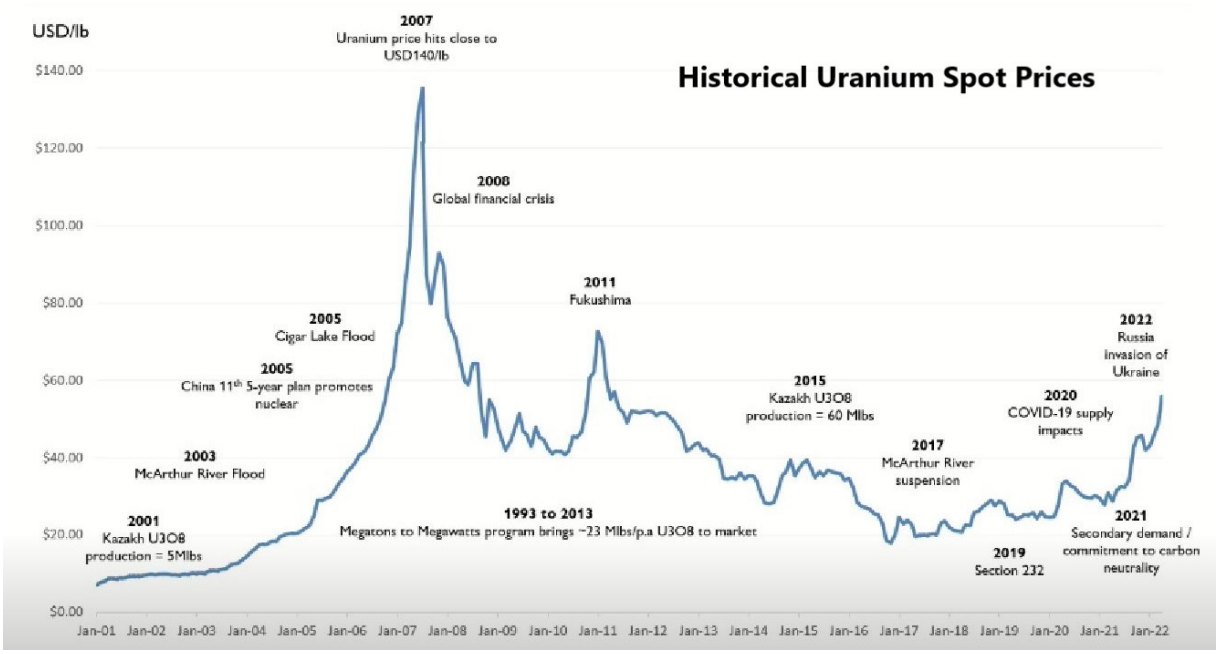
Uranium enrichment is strategically sensitive and capital intensive, hence, there are relatively few commercial enrichment suppliers operating a limited number of facilities worldwide. The three major producers currently are: Orano, Rosatom, and Urenco operating large commercial enrichment plants in France, Germany, Netherlands, UK, USA, and Russia.

Mineral Reserves & Production

The total amount of uranium reserves worldwide, based on profitable recovery, is estimated at 6 million tons. Australia leads with 28% of the world's identified recoverable resources, with 80% of it originating from a single site: the Olympic Dam deposit. The next largest reserves are found in Kazakhstan, Canada, Russia and Namibia. The world's known uranium resources has increased by 25% in the last decade due to increased exploration efforts led by Canada, China, India, Russia and Kazakhstan. Searching for uranium deposits is easier than other mineral resources because of its radiation signature which allows them to be mapped from the air. A significant share of mine production (53%) is controlled by state-owned companies like Kazatomprom (Kazakhstan), Orano (France), CGN (China) and Uranium One (Russia) with the aim to secure supplies for their national reserves.



yearJ with the vast majority consumed by the power sector and a small amount being used for medical and research purposes. 440 reactors across the world use uranium as fuel and generate 10% of the world's electricity. 75% of the current world reserves of uranium are economically recoverable at an average mining cost of 50 dollar/lb, which will cover the world's demand for the next 100 years.



The Chicago Mercantile Exchange (CME) offers a standard unit contract for 250 pounds of triuranium octoxide, the most commonly occurring form of uranium ore. Low market prices due to an oversupplied uranium market led to significant reductions in uranium production and delays in some mine development projects from 2017-2020. However, prices have risen sharply in 2022, due to a supply squeeze brought about by pandemic disruptions along with logistical concerns from the Russian invasion of Ukraine.

Future Opportunities

Despite all the various challenges, there are a number of factors that suggest that the uranium market is poised for a rebound in the coming years.

First, the perception of nuclear energy as an energy source with low carbon/land footprint has started to emerge in many countries, as reflected by recent EU policy changes to recognize nuclear energy as a green fuel (report). Second, technological advancements in nuclear waste treatment and fuel efficiency has made operations more safer and reliable. Third, many developing countries like India and China are actively constructing new nuclear plants to meet the energy needs of their growing populations. For instance, 60 power reactors are being constructed in 15 countries, and even Japan has restarted their nuclear program (Economist article). The need to gain energy self-sufficiency among nations and the decline of the petrodollar system has started a 'nuclear renaissance' from which investors can profit immensely.

Conclusion

The discovery of the radioactive properties of uranium could be considered as humanity's greatest scientific achievement. As a potential source of affordable clean energy, the role of uranium in our society is likely to become even more important in the coming years.

We at the Commodity Discovery Fund, see the demand for good uranium projects growing in the coming years. We have invested in exploration companies with significant uranium discoveries globally like Extract Resources (Namibia) and Hathor Exploration (Canada). For more information regarding our portfolio and fund, please visit the the Portfolio page and download our brochure.

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